



Upper Colorado River Endangered Fish Recovery Program

RECOVERY IMPLEMENTATION PROGRAM
SECTION 7 CONSULTATION, SUFFICIENT PROGRESS,
AND HISTORIC PROJECTS AGREEMENT
October 15, 1993 (Revised March 8, 2000)

AND

RECOVERY IMPLEMENTATION PROGRAM
RECOVERY ACTION PLAN
(RIPRAP)

March 27, 2017

PREFACE

This document was originally finalized on October 15, 1993. Part One received a minor revision on March 8, 2000, to accommodate programmatic biological opinions. Part Two has been revised to accommodate annual updates, designation of critical habitat for the endangered fishes, and development of specific recovery goals for each of the species.

PART ONE: Section 7 Consultation, Sufficient Progress, and Historic Projects Agreement

Sections 4.1.5, 4.1.6, and 5.3.4 of the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) outline procedures for consultation pursuant to Section 7 of the Endangered Species Act on water projects in the Upper Colorado River Basin. The Section 7 Agreement (including Section 7 Consultation, Sufficient Progress, and Historic Projects Agreement) was developed by Recovery Program participants to clarify how Section 7 consultations will be conducted on water depletion impacts related to new projects and impacts associated with historic projects (existing projects requiring a new Federal action) in the Upper Basin.

PART TWO: Recovery Implementation Program Recovery Action Plan

The Recovery Implementation Program Recovery Action Plan (RIPRAP) was developed by the Recovery Program participants in support of the Section 7 Agreement using the best, most current information available and the recovery goals for the four endangered fish species. It identifies specific actions and time frames currently believed to be required to recover the endangered fishes in the most expeditious manner in the Upper Basin. The RIPRAP is the Recovery Program's long range plan. It contains dates for accomplishing specific actions over the next 5 years and beyond. The RIPRAP is a measure of accomplishment the U.S. Fish and Wildlife Service uses to determine if the Recovery Program can continue to serve as a reasonable and prudent alternative for projects undergoing Section 7 consultation to avoid the likelihood of jeopardy to the continued existence of the endangered fishes as well as to avoid the likely destruction or adverse modification of critical habitat.

PART ONE:

RECOVERY IMPLEMENTATION PROGRAM
SECTION 7 CONSULTATION, SUFFICIENT PROGRESS,
AND HISTORIC PROJECTS AGREEMENT

Agreement

Section 7 Consultation, Sufficient Progress, and Historic Projects

Recovery Implementation Program for the Endangered Fish Species in the Upper Colorado River Basin

October 15, 1993

Revised March 8, 2000

I. Background

The Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (RIP) is intended to go considerably beyond offsetting water depletion impacts by providing for the full recovery of the four endangered fishes. The RIP participants recognize that timely progress toward recovery in accordance with a well-defined action plan is essential to the purposes of the RIP, including both the recovery of the endangered fishes and providing for water development to proceed in compliance with State law, Interstate Compacts, and the Endangered Species Act (ESA). Recovery activities which result in significant protection and improvement of the endangered fish populations and their habitat need to receive high priority in future planning, budgeting, and decision making. The RIP participants accept that certain positive population responses to RIP initiatives are not likely to be measurable for many years due to the time required for the endangered fishes to reach reproductive maturity, limited knowledge about their life history and habitat requirements, sampling difficulties and limitations, and other factors. The RIP participants also recognize that further degradation of endangered fish habitats and populations will make recovery increasingly difficult.

II. RIP Recovery Action Plan (RIPRAP)

The Recovery Action Plan (RIPRAP) identifies actions currently believed to be required to recover the endangered fishes in the most expeditious manner possible in the upper basin. It has been developed using the best information available and the recovery goals established for the four endangered fish species. By reference, the RIPRAP is incorporated and considered part of this agreement. The RIPRAP will be an adaptive management plan because additional information, changing priorities, and the development of the States' entitlement may require modifications to the RIPRAP. The RIPRAP will be reviewed annually and modified or updated, if necessary, by September 30 of each year or prior to adoption of the annual work plan, whichever comes first. The RIPRAP will serve as a guide for all future planning, research, and recovery efforts, including the annual work-planning and budget decision process.

The RIP is intended to provide the reasonable and prudent alternatives for projects undergoing Section 7 consultation in the upper basin. While some recovery actions in the RIPRAP are expected to have more direct or immediate benefits for the endangered fishes than others, all are considered necessary to accomplish the objectives of the RIP. Recovery actions which protect or improve habitat conditions and result in more immediate, positive population responses will be most important in determining the extent to which the RIP provides the reasonable and prudent alternatives for projects undergoing Section 7 consultation. In general, these actions will be given highest priority in the RIPRAP.

The Fish and Wildlife Service (FWS) will determine whether progress by the RIP provides a reasonable and prudent alternative based on the following factors:

- a. Actions which result in a measurable population response, a measurable improvement in habitat for the fishes, legal protection of flows needed for recovery, or a reduction in the threat of immediate extinction.
- b. Status of fish population.
- c. Adequacy of flows.
- d. Magnitude of the impact of projects.

Therefore, these factors were considered in the development and prioritization of the recovery actions in the RIPRAP.

III. Framework for Agreement

The following describes the agreement among RIP participants on a framework for conducting Section 7 consultations on depletion impacts related to new projects (as defined in Section 4.1.5 a. of the RIP) and impacts¹ associated with historic projects in the Upper Colorado River Basin. This agreement is meant to supplement and clarify the process outlined in Sections 4.1.5, 4.1.6 and 5.3.4 of the RIP. This agreement applies only to the four Colorado River endangered fishes in the Upper Colorado River Basin, excluding the San Juan River, and is not a precedent for other endangered species or locations.

1. Activities and accomplishments under the RIP are intended to provide the reasonable and prudent alternatives which avoid the likelihood of jeopardy to the continued existence of the endangered Colorado River fishes (hereinafter the "reasonable and prudent alternative") resulting from depletion impacts of new projects and all existing or past impacts related to historic projects with the exception of the discharge by historic projects of pollutants such as trace elements, heavy metals, and pesticides. However, where a programmatic biological opinion applies, the appropriate provisions of such an opinion will apply to future individual consultations.

The RIP participants intend the RIP also to provide the reasonable and prudent alternatives which avoid the likely destruction or adverse modification of critical habitat, to the same extent as it does to avoid the likelihood of jeopardy. Once critical habitat for the endangered fishes is formally designated, the RIP participants will make any necessary amendments to the RIPRAP to fulfill such intent.

2. The RIP is intended to offset both the direct and depletion impacts of historic projects occurring prior to January 22, 1988 (the date when the Cooperative Agreement for the RIP was executed) if such offsets are needed to recover the fishes. Under certain circumstances, historic projects may be subject to consultation under Section 7 of the ESA. An increase in depletions from a historic project occurring after January 22, 1988, will be subject to the depletion charge. Except for the circumstances described in item 11 below, depletion charges or other measures will

¹ All impacts except the discharge of pollutants such as trace elements, heavy metals, and pesticides.

not be required from historic projects which undergo Section 7 consultation in the future.

3. The Bureau of Reclamation (BR) and the Western Area Power Administration will operate projects authorized and funded pursuant to Federal reclamation law consistent with its responsibilities under Section 7 of the ESA and with any existing contracts. No depletion charge will be required on depletions from BR projects as long as BR continues its contributions to the RIP's annual budget.
4. The FWS will assess the impacts of projects that require Section 7 consultation and determine if progress toward recovery has been sufficient for the RIP to serve as a reasonable and prudent alternative. The FWS will use accomplishments under the RIP as its measure of sufficient progress. The FWS will also consider whether the probable success of the RIP is compromised as a result of a specific depletion or the cumulative effect of depletions. Support activities (funding, research, information and education, etc.) in the RIP contribute to sufficient progress to the extent that they help achieve a measurable population response, a measurable improvement in habitat for the fishes, legal protection of flows needed for recovery, or a reduction in the threat of immediate extinction. Generally, sufficient progress will be evaluated separately for the Colorado and Green River subbasins (but not individual tributaries within each subbasin). However, the FWS will give due consideration to progress throughout the upper basin in evaluating sufficient progress.
5. If sufficient progress is being achieved, biological opinions will identify the activities and accomplishments of the RIP that support it serving as a reasonable and prudent alternative.
6. If sufficient progress is not being achieved, biological opinions for new and historic projects will be written to identify which action(s) in the RIPRAP must be completed to avoid jeopardy. Specific recovery actions will be implemented according to the schedule identified in the RIPRAP. The FWS will confer with the Management Committee on the identification of these actions within established timeframes for the Section 7 consultation. For historic projects, these actions will serve as the reasonable and prudent alternative as long as they are completed according to the schedule identified in the RIPRAP. For new projects, these actions will serve as a reasonable and prudent alternative so long as they are completed before the impact of the project occurs. The FWS has ultimate authority and responsibility for determining whether progress is sufficient to enable it to rely upon the RIP as a reasonable and prudent alternative and identifying actions necessary to avoid jeopardy.
7. Certain situations may result in the FWS determining that the recovery action in previously rendered biological opinions are no longer serving as a reasonable and prudent alternative. These situations may include, but are not limited, to:
 - a. Critical deadlines for specified recovery actions are missed;
 - b. Specified recovery actions are determined to be infeasible; and
 - c. Significant new information about the needs or population status of the fishes becomes available;
8. The FWS will notify the Implementation and Management Committees when a situation may result in the RIP not serving as a reasonable and prudent alternative.

The Management Committee will work with the FWS to evaluate the situation and develop the most appropriate response to restore the RIP as a reasonable and prudent alternative (such as adjusting a recovery action so it can be achieved, developing a supplemental recovery action, shortening the timeframe on other recovery actions, etc.).

9. The RIP is responsible for providing flows which the FWS determines are essential to recovery of the endangered fishes. Whether or not a Section 7 review is required, the RIP will work cooperatively with the owners/operators of historic projects on a voluntary basis to implement recovery actions needed to recover the endangered fishes.
10. The responsibility for the efficiency and effectiveness of the RIP, and for its viability as a reasonable and prudent alternative, rests upon RIP participants, not with individual project proponents. RIP participants fully share that responsibility.
11. If the RIP cannot be restored to provide the reasonable and prudent alternative per item 8, above, as a last resort the FWS will develop a reasonable and prudent alternative, if available, with the lead Federal Agency and the project proponent. (RIP participants recognize that such actions would be inconsistent with the intended operation of the RIP). The option of requesting a depletion charge on historic projects or other measures on new or historic projects will only be used in the event that the RIPRAP does not or can not be amended to serve as a reasonable and prudent alternative. In this situation, the reasonable and prudent alternative will be consistent with the intended purpose of the action, within the Federal Agency's legal authority and jurisdiction to implement, and will be economically and technologically feasible.
12. This agreement becomes effective upon adoption of the RIPRAP by the Implementation Committee. Until the RIPRAP is adopted, the FWS will use the procedures in this agreement and the January 1993, draft RIPRAP as the basis for identifying reasonable and prudent alternatives.
13. Experience may dictate a need to modify this agreement in the future. This agreement may be modified or amended by consensus of all the RIP participants. A review of the agreement may be initiated by any voting member of the Implementation Committee.

PART TWO:

RECOVERY IMPLEMENTATION PROGRAM
RECOVERY ACTION PLAN
(RIPRAP)

**RECOVERY IMPLEMENTATION PROGRAM
RECOVERY ACTION PLAN
(RIPRAP)**

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1.0 INTRODUCTION

1.1 RECOVERY PROGRAM PURPOSE

The purpose of the Recovery Implementation Program for Endangered Fishes in the Upper Colorado River Basin (Recovery Program) is to recover the humpback chub (*Gila cypha*), bonytail (*G. elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), and razorback sucker (*Xyrauchen texanus*) while existing and new water development proceeds in the Upper Basin (i.e., Upper Colorado River Basin upstream of Glen Canyon Dam, excluding the San Juan River; Cooperative Agreement, 1988) in compliance with the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et. seq.*), state water and wildlife law, interstate compacts, and authorized purposes of Bureau of Reclamation projects. Further, the Recovery Program is intended to serve as a reasonable and prudent alternative to avoid the likelihood of jeopardy to the continued existence of the endangered fishes and to avoid the likely destruction or adverse modification of critical habitat in Section 7 consultations on depletion impacts¹ related to new projects and all impacts, except the discharge of pollutants such as trace elements, heavy metals, and pesticides, associated with historic water projects in the Upper Basin.

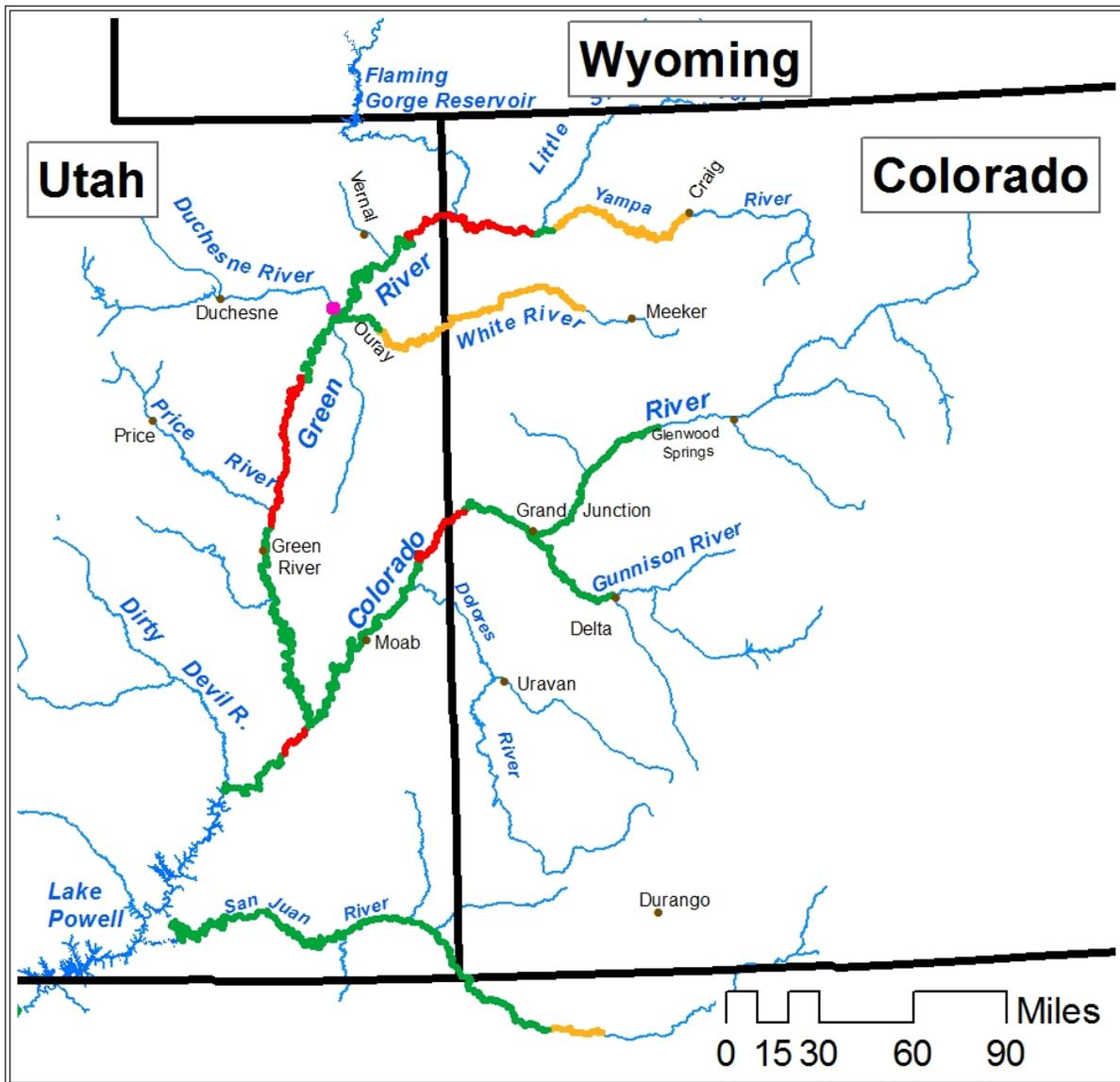
1.2 SPECIES RECOVERY GOALS/PLANS

The overall goal for recovery of the four endangered fishes is to achieve naturally self-sustaining populations and to protect the habitat on which those populations depend. Recovery plans for these species have been developed under Section 4(f) of the Endangered Species Act (ESA; U.S. Fish and Wildlife Service 1990a, 1990b, 1991, 1998), and the final rule determining critical habitat was published in the *Federal Register* on March 21, 1994 (59 FR 13374; Appendix). Once critical habitat was designated (see map on next page), the RIPRAP was reviewed by the Service and modified in coordination with the Management Committee. Final recovery goals for the four endangered fish, which amend and supplement the former recovery plans, were approved in August 2002 (U.S. Fish and Wildlife Service 2002a, 2002b, 2002c, 2002d).

The recovery goals describe what is necessary for downlisting and delisting each of the species by identifying site-specific management actions/tasks necessary to minimize or remove threats; establishing objective, measurable criteria that consider demographic and genetic needs for self-sustaining, viable populations; and providing estimates of the time to achieve recovery. In a lawsuit by Grand Canyon Trust over the humpback chub recovery goals, U.S. District Court 9th Circuit ruled that review of the substance of Service recovery plans is inappropriate under the Administrative Procedure Act and the ESA, but ordered the goals vacated until time and cost estimates are updated. The Service is in the process of reviewing and updating the species recovery plans.

¹Prior to 2009, the Service concluded that the impacts associated with any amount of water depletion in the Upper Colorado River resulted in a Section 7 jeopardy opinion. Since 2009, the Service requires action agencies to incorporate the Recovery Program and its associated recovery actions as applicant-committed Conservation Measures, which results in non-jeopardy biological opinions.

Designated Critical Habitat in the Upper Colorado River Basin for Federally Listed Colorado River Fish



Upper Colorado River



**Endangered Fish
Recovery Program**

Legend

Critical Habitat

- Colorado Pikeminnow
- Razorback Sucker
- Razorback Sucker, Colorado Pikeminnow
- Razorback Sucker, Colorado Pikeminnow, Bonytail Chub, Humpback Chub

State Boundaries

Created by Kevin McAbee
using FWS & USGS data.
March 11, 2016.



In the context of the recovery goals/plans, recovery of humpback chub, bonytail, and razorback sucker will occur in the Upper and Lower basins (each basin is treated as a “recovery unit”), with separate recovery criteria developed for each of the two recovery units. Based on the Colorado pikeminnow recovery plan, recovery of Colorado pikeminnow will occur in the Upper Colorado River Basin, including the San Juan River subbasin. The Recovery Program and the San Juan River Basin Recovery Implementation Program provide for the coordinated implementation of management actions/tasks to achieve recovery in the Upper Basin recovery unit.

Five-year status reviews were completed for Colorado pikeminnow and humpback chub in 2011 (USFWS 2011 a & b) and for bonytail and razorback sucker in 2012 (USFWS 2012 a & b). The reviews found that the species remain “endangered.” Progress was indicated on whether a recovery factor criterion was “met”, “partially met”, or “not met.”

In light of expanding numbers and distribution of razorback sucker, a species status assessment (SSA), was initiated for the razorback sucker in late 2015 with completion anticipated by early 2017. The Service uses SSA’s to characterize species needs, species current condition and species viability,.

In 2012, The Service convened a Colorado Pikeminnow Recovery Team to revise that species’ recovery plan to incorporate new information; the Recovery Team was expanded to include state partners in 2013 . A draft Recovery Plan was reviewed by stakeholders in 2015. The stakeholders asked the Service to defer further revision of the plan until a population viability analysis (PVA) and species status assessment (SSA) can be prepared. The Service initiated the PVA and SSA in early 2016.

The Service also convened a humpback chub Recovery Team and is updating that recovery plan, beginning with an SSA for this species, as well.

The Program Director’s office has recommended deferring update of the bonytail recovery plan until new information warrants.

1.3 RECOVERY ACTION PLAN PURPOSE

This Recovery Implementation Program Recovery Action Plan (RIPRAP) has been developed and updated using the best, most current information available on the species’ status and the recovery goals for the four endangered fish species. The RIPRAP is intended to provide an operational plan and schedule for implementing recovery actions by the Recovery Program, including development of the Recovery Program’s annual work plan and future budget needs. Specifically, the RIPRAP identifies the actions that are necessary to recover the endangered fishes, including schedules and budgets for implementing those actions. Accomplishment of these recovery actions allows the Recovery Program to provide ESA compliance for depletion impacts of new projects and all existing or past impacts related to water projects in place when the Recovery Program was initiated (January 21, 1988) (historic water projects), except impacts from contaminants, in accordance with the October 15, 1993

Section 7 Agreement (Revised March 8, 2000). The RIPRAP was incorporated and is considered part of that Agreement.

1.4 ESTIMATED COST OF RECOVERY ACTIONS

The estimated total budget for the Recovery Program from FY 2017–FY 2023 is approximately \$74.69 million². Funding for the Recovery Program is expected to come from the following sources:

- a. An annual operating budget of approximately \$7 million, adjusted annually for inflation. As per passage of PL 112-270, which reauthorized PL 106-392, annual funding will be applied to the full suite of the Recovery Program's actions through FY2019, with the exception of capital projects. The sources of these funds are: hydropower revenues from the Colorado River Storage Project; the U.S. Fish and Wildlife Service; and the States of Colorado, Utah, and Wyoming. Additional annual funding will come from one-time water development depletion fees on new projects (post-January 21, 1988). Under the Recovery Program, proponents of new water projects which undergo Section 7 Endangered Species Act consultation pay a one-time depletion fee based on a project's average annual depletion. The rate is adjusted annually for inflation. As of October 1, 2016, the fee was \$20.89 per acre foot; the rate increases to \$21.17 per acre foot as of October 1, 2017. The actual rate of water development has not been projected therefore it is difficult to predict the amount of this funding source on an annual basis. Through FY2016, depletion fees and interest earned on these fees totaled \$2,343,900. These funds may be accumulated and are used to fund recovery actions pursuant to decisions made by the Recovery Program on an annual basis.
- b. Approximately \$20.91 million will be spent between FY 2017 and FY 2023 for remaining capital projects. P.L. 106-392 authorized capital funding in October 2000; P.L. 107-375 extended construction authority from 2005 to 2008; and P.L. 109-183 authorized Federal appropriations through 2010, increased authorized Federal appropriations from \$46 million to \$61 million, and increased the capital funding total from \$62 million to \$77 million plus adjustments for inflation to the Federal portion. In March 2009, Section 9107 of P.L. 111-11 authorized an additional \$15 million in federal funds and extended the capital construction period through 2023.

² Expenditures to date may be found in the pie charts of the most recent [Program Highlights briefing document](#).

1.5 MEASURING PROGRESS TOWARD RECOVERY AND SCHEDULING RIPRAP ACTIVITIES

To achieve recovery in the Upper Basin, it is essential to fully implement all of the actions in the RIPRAP. This can be accomplished only through cooperation by all Recovery Program participants. In general, actions will be scheduled such that recovery will be achieved in the most expeditious and cost-effective manner possible. However, the schedule may require some adjustment based on sequence and impacts of water development and management actions to ensure recovery of the endangered fishes while water development continues.

Recovery actions likely to result in a measurable population response, a measurable improvement in habitat for the fishes, legal protection of flows needed for recovery, or a reduction in the threat of immediate extinction have been determined by the Service to be most important in determining the extent to which the Recovery Program provides the reasonable and prudent alternatives to avoid jeopardy for projects undergoing Section 7 consultation. These actions are identified by the caret ">" in the Recovery Action Plan. Actions that the Service believes are most important to the Recovery Program serving as a reasonable and prudent alternative to adverse modification of critical habitat are identified by an asterisk (*). These caretted and (or) asterisked actions will generally be given highest priority for implementation in scheduling and budgeting.

The Recovery Program continually evaluates the outcome of completed RIPRAP actions to determine their effectiveness in contributing to recovery. Ultimately, success of recovery actions will be measured by species response (change in population size, distribution, composition, etc.). However, it may be many years before such responses are evident. In the interim, the Recovery Program also will gage its progress towards recovery by accomplishment of the actions identified in the RIPRAP. Toward that end, Program participants assess progress and update the RIPRAP annually.

1.6 RECOVERY ACTION PLAN STRUCTURE

The substance of the RIPRAP is in Section 4.0, where the specific recovery actions are listed in the RIPRAP tables. In addition, significant accomplishments and shortcomings of the past year are identified in the RIPRAP tables, developed as part of the Recovery Program's annual assessment and update of the RIPRAP.

The RIPRAP tables schedule activities through 2023 (the Recovery Program's Cooperative Agreement is effective through September 30, 2023). Activities that have led to recovery of the endangered fishes will need to be continued after these species are delisted. Therefore, the RIPRAP tables identify the activities that Program participants anticipate will continue post-Program.

The first section of the Recovery Action Plan tables identifies general support activities important to the success of the Recovery Program. The subsequent sections that follow

the General Recovery Action Plan are for the Green and Colorado rivers and their subbasins in the Upper Basin. Each subbasin table includes recovery actions arranged by the "recovery elements" listed below:

- I. Identify and protect instream flows;
- II. Restore and protect habitat;
- III. Reduce negative impacts of nonnative fishes and sportfish management activities;
- IV. Conserve genetic integrity and augment or restore populations;
- V. Monitor populations and habitat and conduct research to support recovery actions;
- VI. Increase public awareness and support for the endangered fishes and the Recovery Program (in the General Recovery Program Support table only); and
- VII. Provide program planning and support (in the General Recovery Program Support table only).

Section 4.0 is provided in table format for ease of scheduling and tracking activities. A general discussion of activities under each recovery element and of recovery priorities in each subbasin is found in Sections 2.0 and 3.0, respectively.

2.0 DESCRIPTION OF RECOVERY ACTION PLAN ELEMENTS

The Recovery Action Plan tables contain brief descriptions of specific recovery actions in each subbasin. This section provides a general description of each recovery element. Specific recovery actions being carried out in each subbasin are discussed in Section 3.0.

2.1 I. IDENTIFY AND PROTECT INSTREAM FLOWS

Recovery cannot be accomplished without securing, protecting, and managing sufficient flows to provide habitat to support self-sustaining endangered fish populations. Identification and protection of instream flows are key elements in this process. The first step in instream flow protection is to identify flow regimes needed by the fish, typically characterized in terms of peak and base flow needs over a range of hydrologic conditions. In the Recovery Program, determining flow needs is primarily the responsibility of the Service (in cooperation with other participants). Factors considered in determining flow needs include: flow effects on reproduction and recruitment; flow effects on food supplies and nonnative fishes; and interrelationships between flow and other habitat parameters believed to be important for the fish, such as channel structure, sediment transport, substrate characteristics, vegetative encroachment, and water temperature. Flow recommendations often are made in stages, with initial flow recommendations based on the best available scientific information, historic conditions, and extrapolation from similar reaches. Recommendations then are refined following

additional field research. The contribution of tributaries to recovery was ranked by Tyus and Saunders (2001).

Flow recommendations have been approved for reaches of the Colorado (Osmundson and Kaeding 1991; McAda 2003), Yampa (Modde and Smith 1995; Modde et al. 1999), Green (Muth et al. 2000), Gunnison (McAda 2003), and Duchesne (Modde and Keleher 2003) rivers. Flows in the Little Snake and Yampa rivers after estimated future depletions were identified in the Yampa River Management Plan and Environmental Assessment (Roehm 2004). Interim flow recommendations for the White River were completed in 2004 (Irving et al. 2004), and are currently under revision. A White River management plan will be drafted in 2016-17, which will ultimately serve as the basis for a White River programmatic biological opinion. This management plan will include flow recommendations. Under the Gunnison River Basin Programmatic Biological Opinion and Aspinall Unit Study Plan (2011), the Recovery Program is conducting monitoring to assess how well the operation of the Aspinall Unit contributes to meeting target flows in the Gunnison and Colorado Rivers and to help determine if managed flows from the Gunnison and the Colorado rivers are sufficient for recovery on the Colorado River from the Gunnison River to the confluence of the Green and Colorado rivers. After this monitoring is conducted, the Service will assess if the resulting flows on the Colorado River below its confluence with the Green River are adequate for recovery. Flow recommendations for other rivers or river reaches will be developed as deemed necessary to achieve recovery. Flow and temperature recommendations for the Green River below Flaming Gorge Dam (Muth et al. 2000) are being evaluated.

A strategic plan was completed in 2003 that identified geomorphology research priorities to refine the flow recommendations and address the Recovery Goals (LaGory et al. 2003). In 2012, USGS finalized results of a sediment transport study on three rivers in the upper Colorado River basin. Samples were collected on the Colorado River at Cameo, Stateline and Cisco; on the Gunnison River at Grand Junction; and on the Green River at Jensen and the town of Green River (Williams et al. 2013). These results provide a methodology that will help the Recovery Program understand how flow recommendations may be benefitting recovery of the endangered fishes. A team of experts convened in 2013 and 2014 to review the findings and to recommend methodologies to determine whether the current peak flow recommendations are achieving objectives. The resulting Peak Flow Technical Supplement (LaGory et al., 2015) offers a range of study approaches and prioritizes river reaches to evaluate the peak flow aspects of the Program's flow recommendations. A high priority is placed on collecting suspended sediment data within ongoing programs of NPS and USGS. Studies and monitoring recommended in the Supplement to address high priority information needs have been incorporated into the RIPRAP.

In 2011 and 2012, the Service and The Nature Conservancy formatted the Recovery Program's flow recommendations and three National Wildlife Refuge water rights for inclusion as non-consumptive water needs in the [Colorado River Basin Water Supply and Demand Study](#) (Basin Study) conducted by the Bureau of Reclamation. The study encompasses all seven Colorado River Basin States. It looks at current and future

imbalances in water supply and demand in the basin and adjacent areas through 2060 including projected effects associated with climate change and attempts to develop and analyze options and strategies to resolve imbalances. The final report was published in December 2012 (available at: <http://www.usbr.gov/lc/region/programs/crbstudy.html>); updates of this effort are planned every 5 years. As per recommendation from the Basin Study and under the WaterSMART Grants program a review of alternative decision support platforms and tools for incorporating ecological and recreational flows into water management for the Colorado River Basin was completed in 2013. (Alexander et al. 2013).

In 2014 the Service participated in the workgroup for Environmental and Recreational flows of the Colorado Basin Water Supply. The White River from Kenny Reservoir to the Green River and the Colorado River from the Gunnison River to the confluence of the Green River were chosen as two of the four focus reaches. The next phase will be to identify scientific uncertainties and opportunities to address those uncertainties, document mechanisms or programs that have been successful protecting environmental and river-based recreational resources, and explore and document opportunities and potential solutions that might be applied at a scale larger than the focus reaches.

Colorado

In Colorado, the appropriation of an instream water right follows a structured process developed by the Colorado Water Conservation Board (CWCB) in 1997. The process begins with a Service flow recommendation, which is reviewed by CWCB and Colorado Parks and Wildlife (CPW). Then CWCB issues a notice of intent to appropriate, followed by Board approval to appropriate. Finally, the Attorney General must make a water court filing to confirm the appropriation and to establish the appropriation's priority date. It may take 3 to 4 years from the notice of intent to appropriate to obtain a decree from the water court, depending on the nature of any litigation over the filing. In appropriation, the water right will have a relatively junior priority date (the date CWCB issued the notice of intent to appropriate), and only flow conditions as of that date can be protected. In some cases, the appropriation process has lacked support and thus proven to have limited use in the Recovery Program. Therefore, the Recovery Program adopted alternative means of legally providing and protecting flows in some reaches by combining water project re-operations and contracts for the delivery of storage water (e.g., Grand Valley Water Management Plan and deliveries from the Historic Users Pool at Green Mountain Reservoir), and has put programmatic biological opinions (PBOs) in place to monitor new depletions of existing flows on the Yampa, Little Snake, Gunnison, and Colorado Rivers. Under these PBOs, the Recovery Program and the CWCB will periodically evaluate the need to appropriate new instream flow water rights in Colorado to legally protect such flows. Recovery Program participants anticipate that these methods will prove effective in ensuring instream flows for the endangered fishes. Where flows are provided through the physical alteration of flow conditions by re-operating a reservoir or other component of an existing or new water project, various

contracts with reservoir owners may be needed to legally protect the deliveries from storage from re-diversion. Contracts for the delivery and protection of storage releases may be combined with purchase of water rights in Colorado and their physical or legal transfer to supplement storage releases (e.g. Redtop Ditch). Water rights historically used for other purposes may also be purchased or leased in Colorado and temporarily or permanently transferred to instream use to increase and legally protect flows needed for recovery, but this method has not been used to date.

Utah

Utah officials believe that flows to the Lower Colorado River Basin under the Colorado River Compact have and will continue to ensure sufficient quantities of water remain in the Green River to satisfy the recommended flow requirements. Additional methodologies to protect stream flows exist in Utah but are limited. Current approaches include: 1) acquiring existing water rights and filing change applications to provide for instream flow purposes; 2) withdrawing unappropriated waters by governor's proclamation; 3) approving future applications subject to minimum flow levels; and 4) with proper compensation, preparing and executing contracts and subordinating diversions associated with approved and perfected rights. Although current Utah water law may not fully provide for all aspects of instream-flow protection, Utah can provide an increased level of protection.

This RIPRAP originally contemplated that the Utah State Engineer would establish, by policy, legal protection for endangered fish recommended flows. In 1994, the State Engineer adopted a policy to subordinate future water right application approvals to required fish flows during the summer and autumn periods from Flaming Gorge Reservoir to the confluence of the Duchesne River. There was little resistance to this initial policy adoption and few policy disputes ensued in subsequent years even though the State Engineer's statutory authority to approve vested instream flow rights is limited to certain entities and circumstances. In 2006, the Utah State Engineer began a public process to extend the policy to protect recommended flows for endangered fish to all seasons and over the entire length of the Green River in Utah, pursuant to RIPRAP objectives. Public concern over the practical distribution implications associated with subordinating to recommended flows led to questions about the State Engineer's authority to establish instream flow water rights. Ultimately, in 2009, the State Engineer concluded that other means to legally protect flows should be explored to avoid a contest over the extent of his statutory authority. The Recovery Program's Water Acquisition Committee formed a task force to develop additional options for protecting fish flows on the Green River. In 2010, Utah identified a legal and technical process and schedule to protect recommended year-round flows for the endangered fishes on the Green River in Utah (Utah Department of Natural Resources 2010). This schedule was updated as follows in 2013 and 2017:

- 1) Identify issues, concerns and timeframe, 2007-2010
- 2) Prioritize potential methods and criteria for flow protection, 2009-2011
- 3) Amalgamate technical information needed to model and resolve issues, 2010-2011

- 4) Develop model for analysis of historic and future scenarios, 2010-2011
- 5) Analyze model results, 2017
- 6) Establish internal policy committee to work with Program partners to explore flow protection options, 2016-2018.
- 7) Obtain additional authority to protect flows, 2018
- 8) Implement legal protection, 2016-2019.

With the modeling complete and the report in preparation, Utah continues to make progress evaluating the most appropriate means to protect fish flows with the framework of State water law. An internal policy committee working on flow protection has been receiving input from other Program partners and continues to evaluate a variety of options being proposed.

2.2 II. RESTORE AND PROTECT HABITAT

Important elements of habitat protection include restoring and managing in-channel habitat and historically flooded bottomland areas, restoring passage to historically occupied river reaches, preventing fish entrainment at diversion structures (if warranted), enhancing water temperatures, and reducing or eliminating the impacts of contaminants.

Historically, Upper Colorado River Basin floodplains were frequently inundated by spring runoff, but today many of the rivers are channelized by levees, dikes, rip-rap, and tamarisk. Fish access to flooded bottomlands has been further reduced by decreased peak spring flows due to upstream impoundments. Numerous studies have suggested the importance of seasonal flooding to river productivity, and flooded bottomlands have been shown to contain large numbers of zooplankton and benthic organisms. Floodplain areas inundated and temporarily connected to the main channel by spring flows appear to be important habitats for all life stages of razorback sucker and bonytail, and the seasonal timing of razorback sucker reproduction suggests an adaptation for utilizing these habitats. Restoring access to these warm and productive habitats is intended to provide the growth and conditioning environments that appear crucial for recovery of self-sustaining razorback sucker populations. In addition, juvenile Colorado pikeminnow also use these areas for feeding and adults stage in these habitats prior to migrating to spawning areas. Inundation of floodplain habitats, although most important for razorback sucker, will benefit bonytail and other native fishes by providing growth and conditioning environments and by restoring ecological processes dependent on periodic river-floodplain connections. Restoration of floodplain habitats is achieved through a combination of increased peak flows, prolonged peak-flow duration, lower bank or levee heights, levee removal, and constructed inlets. Studies have shown that a full benefit of these floodplain habitats has been reduced by the presence of large numbers of predacious and competing nonnative fish (Christopherson et al. 2004; Modde and Haines 2005).

The Recovery Action Plan tables contain tasks to identify and restore important flooded bottomland habitats. During 1994, the Recovery Program completed an inventory of floodplain habitats for 870 miles of the Colorado, Green, Gunnison, Yampa, and White

ivers. From the list of inventoried habitats, high-priority sites were evaluated for restoration potential. Site acquisition began in 1994 and continued through 2003. Since 2003, the Recovery Program has completed the razorback sucker floodplain habitat model and floodplain management plans for the Green and Colorado River sub-basins (subject to revision as new information is gathered). Based on the model and these management plans, the Recovery Program has shifted from restoration/acquisition of additional floodplain sites to better management of sites already acquired or otherwise available. Success will be measured by the response of the endangered fish populations.

The General Recovery Program Support Action Plan table includes tasks to develop an issue paper on floodplain restoration and protection. This paper identified legal, institutional, and political strategies to enhance and protect floodplain habitats for the endangered fishes and ameliorate the effects of levees, diking, rip-rap, gravel mining, and other forms of floodplain development. Phase 1 of the issue paper identified what floodplain restoration and protection is needed for the endangered fishes (Nelson 1998); Phase 2 determined how to accomplish that restoration and protection (Tetra Tech 2000). The issue paper evaluated responsibilities of the Recovery Program, Recovery Program participants, and other agencies involved in floodplain development, regulation, and management, and their roles and responsibilities with respect to endangered species. Speas et al. (2017) reviewed the Recovery Program's state of knowledge relative to floodplain management. They recommended that successful rearing of razorback sucker larvae to the YOY stage will require: 1) the ability to exclude large-bodied nonnative fish from the wetland during the larval entrainment period; 2) maintenance of water levels using water control structures and external water sources; and 3) capture, enumeration and release of YOY fish into the main channel Green River as the wetland is drained in the fall months.

Passage barriers have fragmented endangered fish populations and their habitats, resulting in confinement of the fishes to 20 percent of their former range in the Upper Basin. Blockage of Colorado pikeminnow movement by dams and water-diversion structures has been suggested as an important cause of the decline of this species in the Upper Basin (Tyus 1984; U.S. Fish and Wildlife Service 1991). Restoring access to historically occupied habitats via fish passage ways was identified in the Colorado Squawfish [Pikeminnow] Recovery Plan (U.S. Fish and Wildlife Service 1991) and in the recovery goals (U.S. Fish and Wildlife Service 2002c) as one of several means to aid in Colorado pikeminnow recovery.

The Recovery Action Plan tables contain tasks to assess and make recommendations for fish passage at various dams and diversion structures. The need for passage was determined at four sites: Redlands, Grand Valley Irrigation Company (GVIC), Price Stubb, and the Grand Valley Project (GVP). Passage has been restored at all four locations. A fish passage was completed in 2012 on the Hartland Diversion on the Gunnison River near Delta by NRCS and local interests that benefits both endangered and native fishes. A newly rebuilt Tusher Diversion on the Green River near Green River, Utah includes a fish passage component, designed similar to the Price Stubb fish

passage, and was completed in 2016. Long term effectiveness of these fish passages will require upstream sediment management (GVP and Redlands passages); in-passage debris removal (Price Stubb and Tusher Diversion passages); and continued operation of selective fish passage structures (GVP and Redlands passages).

Diversion canals have been found to entrain native and endangered fishes. The Recovery Program has constructed fish screens on major diversion on the Colorado and Gunnison rivers. Construction of fish screens was completed at the Grand Valley Project and Redlands Water and Power Company diversion during 2005. Construction of a screen at the Grand Valley Irrigation Company diversion canal was completed in 2002 and additional improvements to this screen are anticipated. The Grand Valley screens on the Colorado and Gunnison rivers are operated as much as feasible through the irrigation season, though debris and other concerns sometimes interrupt operation. Evaluation of potential entrainment into irrigation canals is an important part of the Recovery Program's decision making process for screening canals. Studies of Colorado pikeminnow entrainment into diversion structures on the Yampa River began in 2007 (Hawkins 2009), and continued at the Maybell Ditch in 2011-2012 (Speas et al. 2014). During a two year study, only one endangered fish, a Colorado pikeminnow, was detected in the Maybell Ditch (in 2012). Evaluation of potential entrainment of endangered fishes at the Green River Canal near Green River, Utah has been considered by the Recovery Program for many years, first being undertaken by Kitcheyan et al in 2001. Stationary PIT antennas have been deployed in the canal since 2013, documenting high levels of entrainment. All four endangered species continue to be documented in the canal through 2016. Based on these findings, the Program is pursuing a vertical weir wall in the Green River Canal below the Thayn Hydro facility to reduce entrainment at this site (instead of the wedge wire screens used in Grand Valley fish screens).

A number of potentially harmful contaminants (including selenium, petroleum derivatives, heavy metals, ammonia, and uranium) and suspected contaminant "hot spots" have been identified in the Upper Basin. It is the intent of the Recovery Program to support and encourage the activities of entities outside the Recovery Program (e.g. Reclamation's participation in the Gunnison River Basin Selenium Management Program) that are working to identify problem sites, evaluate contaminant impacts, and reduce or eliminate those impacts. Specifically, the Service will identify actions needed to reduce selenium contamination to levels that will not impede recovery and identify existing pipeline river crossings that need to have spill-control devices installed. New petroleum pipelines with a Federal nexus are required by the Service through the Section 7 process to have shutoff valves. Not all pipelines have a Federal nexus; therefore, the Program Director's office discussed concerns with existing and future pipelines with the States' oil and gas divisions. The Service also is working with EPA, BLM, and USDOT to identify existing pipeline crossings that may need shutoff valves. Additionally, the Service and UDWR have worked with EPA on spill response contingency planning.

2.3 III. REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES

The introduction, establishment, and proliferation of nonnative fishes are considered the primary threat to the recovery of four Colorado River endangered fishes. Unfortunately, in the upper Colorado River basin, despite years of significant effort, the nonnative threat remains largely uncontrolled. Only 13 of more than 50 fish species that now occur in the Upper Basin are native (Bezzlerides and Bestgen 2002). Over the last 100 years, native fishes have decreased in range and abundance, while introduced fishes have concurrently become more widespread and abundant (Carlson & Muth 1989, Martinez et al. 1994; Bezzlerides & Bestgen 2002; Francis & Ryden 2014). An increasing body of evidence characterizes the negative interactions of nonnative fishes with the endangered fishes (Hawkins & Nesler 1991; Minckley 1991; Lentsch et al. 1998; Bezzlerides & Bestgen 2002; Francis & Ryden 2014), including predation and competition. Direct evidence of predation includes native fishes obtained from stomach contents of nonnative fishes (Francis and Ryden 2014) and by visual observation of predation. Other means by which nonnative fishes may adversely affect native fishes are by competition for food and niche space.

Warm water game fish, primarily stocked in reservoirs for recreational purposes, are thought to have the greatest adverse effect on endangered native fishes. Of those species, large-bodied predators are considered the most problematic – specifically centrarchids (smallmouth bass), esocids (northern pike), and percids (walleye). For example, during the 1990s, the Yampa River experienced a dramatic increase in northern pike and smallmouth bass numbers. Predation by these two piscivorous species wreaked havoc on the native fish community. Biologists documented significant declines of native fish densities in the Yampa River since that time (Bestgen et al. 2015).

In studies on the Green River, researchers documented that young Colorado pikeminnow constituted 5% of the diet of northern pike, even though young Colorado pikeminnow made up a much smaller portion of the available food base in the river (Crowl and Lentsch 1996). Researchers estimated that a single northern pike could consume 100 or more young Colorado pikeminnow per year. In addition, northern pike are known to prey on large-bodied native fishes (Martinez 2001, Hawkins et al. 2005, Martin and Wright 2010) including adult Colorado pikeminnow, native roundtail chub (*Gila robusta*), flannelmouth and bluehead suckers, and may feed on humpback chubs in the Yampa River. More recently, Francis and Ryden documented juvenile Colorado pikeminnow in the guts of nonnative walleye and reported a simultaneous decline in Colorado pikeminnow abundance in the lower Colorado River between 2010 and 2014, while walleye populations were increasing (Francis and Ryden 2014). Recently, numbers of walleye have increased in the Green and lower Colorado rivers and burbot have been discovered in the Green River below Flaming Gorge Dam. Both of these species also pose a significant predatory and competitive threat to native and endangered fishes (Francis and Ryden 2014, Gardunio et al. 2011).

Recovery Program activities related to nonnative fishes initially focused on identifying impacts/interactions and developing nonnative fish stocking procedures. Nonnative fish control strategies were developed to identify and prioritize options for controlling or removing nonnative fishes from river reaches occupied by the endangered fishes as well as other reaches that serve as production areas for nonnatives that subsequently disperse into occupied habitat (Tyus and Saunders 1996; Lentsch et al. 1996; Hawkins and Nesler 1991). In February 2004, the Recovery Program adopted a nonnative fish management policy that addresses the process of identifying and implementing nonnative fish management actions needed to recover the endangered fishes (Upper Colorado River Endangered Fish Recovery Program 2004). Through 2009, emphasis was focused on the control activities identified in these strategies. Development of a new basinwide strategy for the management of nonnative aquatic species began in 2009, and was finalized in early 2014 (Nonnative Fish *ad hoc* Committee 2014). This strategy emphasizes prevention as a major component in efforts to control existing invasive impacts and to avoid similar impacts arising from existing or new species in additional locations within the Upper Basin.

All nonnative fish control activities are evaluated for effectiveness annually. By thoroughly evaluating the smallmouth bass and northern pike control strategies in the Yampa River basin, the Larval Fish Lab at CSU provided the Program with guiding principles for nonnative removal in the entire basin. Specifically, both of these comprehensive evaluations indicate that the Recovery Program should focus on disrupting reproduction in the river and preventing immigration into river habitats, such as by limiting the escapement of these species from reservoirs.

Disrupting in-river reproduction and preventing reservoir escapement are now the two key tenets of nonnative fish management. Limiting reproduction is accomplished through targeted removal of smallmouth bass during the spawn (the Surge) and by netting northern pike in backwaters in the Yampa River. Landscape scale spawning disruptions of smallmouth bass via water management are also being considered (Bestgen and Hill 2016). Reservoir escapement is primarily prevented through installation of physical screens on outlets or channels and nets on spillways. Currently Elkhead and Rifle Gap Reservoirs, and Highline Lake, all have screened releases, while Ridgway, Red Fleet and Starvation Reservoirs, and Lake Catamount, are planned for screening in the future.

The States and the Service also have developed procedures for stocking of nonnative fishes in the Upper Basin (USFWS 1996a, 1996b). The procedures are designed to reduce the impact on native fishes from stocking of nonnative fishes in the Upper Basin and clarify the role of the States, the Service, and others in the review of stocking proposals. A cooperative agreement has been signed by the States and the Service implementing the Stocking Procedures. The Stocking Procedures were revised in 2009 (USFWS 2009) and the cooperative agreement was updated. In 2013, the Colorado

Wildlife Commission updated changes to Colorado's Wildlife Regulations that apply the provisions of the revised Stocking Procedures to the private aquaculture industry, in waters of both the Upper Colorado and San Juan River. The provisions of the revised Stocking Procedures also are part of Utah's stocking policy (including private aquaculture, which can only stock sterile salmonids without specific State review and approval). All private fish stocking in Wyoming also is subject to State review. Harvest regulations also play a key role in nonnative fish management. The Upper Basin States have liberalized bag and possession limits for the 'worst of the worse' predators (northern pike, smallmouth bass, walleye, and burbot). Utah and Wyoming have implemented must kill regulations for these species where appropriate. Colorado Parks and Wildlife has developed a "catch and keep" outreach strategy, paired with unlimited harvest and harvest incentives in regulation, as opposed to must kill regulations. The Colorado Wildlife Commission ratified unlimited harvest regulations for smallmouth bass and northern pike on the western slope which took effect on April 1, 2016.

The Recovery Program now implements a comprehensive strategy for nonnative fish management, focusing on in-river removal, reservoir escapement, and policy and outreach components. Over the past decade, the Recovery Program has committed millions of dollars and thousands of hours to removing these problematic predators from hundreds of miles of rivers in the upper Colorado River basin. What began over fifteen years ago as a pilot removal effort in 6 miles of the Yampa River now constitutes a basin-wide removal effort in more than 600 river miles, with some river reaches receiving up to 10 to 15 passes to disrupt spawning. In addition to this labor intensive effort, Recovery Program stakeholders are now preventing individuals from escaping reservoirs, implementing appropriate stocking and harvest policies, and conducting outreach on the problems of nonnative fish.

2.4 IV. CONSERVE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS

Species recovery depends on protecting and managing species genetic resources. This is a complex activity that includes: determining the genetic diversity of the endangered fishes; protecting species in refugia; planning, developing, and operating propagation facilities; propagating fish for augmentation or restoration, research, and information and education; and planning, implementing, and evaluating augmentation or restoration of species. Stocking is only an interim tool in the Recovery Program because recovery, by definition, implies that the populations will be self-sustaining in the wild. The success of augmentation and restoration stocking is dependent on prior or concurrent implementation of other recovery actions such as flow protection, habitat restoration, and management of nonnative fishes. This dependency is reflected in the schedule of subbasin-specific actions in Section 4.0.

Studies to confirm genetic diversity have been vital to genetics management of the endangered fishes. Species are being protected in refugia to develop broodstocks and

guard against catastrophe. Representatives of species thought to be in immediate danger of extinction are brought into refugia immediately. Refugia populations of species are developed using paired breeding matrices to maximize genetic variability and maintain genetic integrity.

Most of this work is included under the General Recovery Program Support Action Plan because it applies to the entire Upper Basin. Subbasin-specific activities of augmenting or restoring species are placed under the subbasin Action Plans. Augmentation or restoration plans are being implemented, fish produced, and river reaches restored and augmented with those fish. The effects of these augmentation efforts need to be monitored and evaluated.

Four basic documents are used to plan, implement, and coordinate genetics management and artificial propagation for the endangered fishes. These are the Genetics Management Guidelines (Williamson and Wydowski 1994), Genetics Management Plan (Czapla 1999), Coordinated Hatchery Facility Plan (Wydowski 1994), and the Revised Integrated Stocking Plan (Integrated Stocking Plan Revision Committee 2015). All four of these plans have been developed and will be revised or updated as needed.

The Genetics Management Guidelines document provides the rationale, genetics concepts, and genetic risks to be considered in genetics-management planning and implementation. For example, it indicates that a fish population is the fundamental unit of genetics management and that its definition and characterization, relative to other populations, are important. Genetic surveys have been part of the identification and characterization process. Further, the prioritization and genetics management required for each population is determined by its relative population status, demographic trends, and genetics data derived from the surveys.

The Genetics Management Plan is the operational document. It tells the "what, who, when, where" of implementation. It identifies specific objectives, tasks, activities, and type of facilities necessary to accomplish Recovery Program goals, i.e., protect population genetic integrity or restore a self-sustaining population in the wild. It is the action plan developed for implementation, directed by the Recovery Program goals, and structured along the format presented in the Genetics Management Planning Guidelines document.

Facilities are required to meet long-term (5 years or more) augmentation and restoration stocking needs. The plans for these facilities are the Coordinated Hatchery Facility Plan and the Facilities Plan. These plans, in accordance with the Genetics Management Plan, define facilities required to meet propagation needs, identify fish needs that can be met by existing facilities, and recommend expansion or modification of existing facilities. Genetics management requires a great deal of operational activity. Refugia and propagation facilities have been planned, built, and are now operated in a coordinated fashion. The State of Colorado operates the J. W. Mumma Native Aquatic Species Restoration Facility in Alamosa, Colorado. The State of Utah raises bonytail at

the Wahweap State Fish Hatchery in Big Water, Utah. The U.S. Fish and Wildlife Service operates the Ouray National Fish Hatchery with units near Grand Junction, Colorado (Grand Valley Unit) and Vernal, Utah (Randlett Unit). With a few exceptions, these facilities have achieved their stocking targets for the past six years

The Integrated Stocking Plan (Nesler et al. 2003) provided specific annual numbers of fish and their sizes to be produced at Recovery Program hatcheries and stocked into Upper Colorado River Basin river reaches. This plan has been implemented for over 10 years and has been revised based on recent estimates of survival of the stocked fish. The revised stocking plan (Integrated Stocking Plan Revision Committee 2015) recommends stocking larger bonytail and razorback suckers and releasing bonytail in floodplain habitats instead of canyon-bound reaches, since new information suggests floodplains may be more suitable habitat. Revisions to augmentation and restoration stocking (primarily for razorback sucker and bonytail) are intended to directly aid in recovery of the species and to establish fish in the system to be able to demonstrate that habitat and instream flow activities are having an effect on endangered fish recovery.

Humpback chub are not currently being stocked; however, augmentation of existing small populations is being considered and additional brood fish from wild populations are being brought into hatcheries. An ad hoc group reviewed the population and known genetics information from all the humpback populations and concluded that the Recovery Program should: 1) use a decision tree to guide choices in creating a refuge population and potentially stocking fish into the wild; and 2) genetically test, and if appropriate, use humpback chub collected from Westwater Canyon and Black Rocks and potentially Desolation Canyon to develop a refugia for Upper Colorado River Basin genetics. Those populations have been shown to genetically represent most populations in the upper basin (Douglas and Douglas 2007, W. Wilson, Southwestern Native Aquatic Resources & Recovery Center, personal communication).

2.5 V. MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS

This category consists primarily of research and monitoring activities that have application to more than one of the foregoing elements. In the General Recovery Program Support Action Plan, this element includes: monitoring populations and habitat and annually assessing changes in habitat and population parameters (i.e., population estimates); determining gaps in existing life-history information and recommending and conducting research to fill those gaps; and improving scientific research and sampling techniques. Research activities are identified for each subbasin only to the extent that such activities are related to another recovery action in that subbasin. Such identification does not preclude further research in that subbasin that may be identified later or that is identified in the General Recovery Program Support Action Plan.

The Recovery Program is updating data management to track individual fish via passive integrated transponder tags implanted in endangered fish handled by Recovery

Program hatchery and research personnel. In recent years, tag and re-sight events have greatly increased, primarily from increased number and survival of stocked fish, increased sampling associated with nonnative fish activities, and detections from several remote antennas installed in locations throughout the Upper Basin. Antennas have significantly increased tag detections and researchers have now begun to incorporate these data into demographic analyses. The Recovery Program has contracted with Colorado Natural Heritage Program to design and implement a web-based database that will store and query the large amount of tag data the Recovery Program now manages. The database will allow Recovery Program partners to input data more easily and effectively, and will allow outside researchers and the general public to interact with the data under various permission levels. In 2014, Colorado Natural Heritage Program performed initial design of the database using examples of Recovery Program data. The database is planned for phased implementation that began in 2015. As of 2016, the STReaMS (www.streamsystem.org) has launched and is available to all Program partners. Improvements and full implementation will occur in FY 2017.

2.6 VI. INCREASE PUBLIC AWARENESS AND SUPPORT FOR THE ENDANGERED FISHES AND THE RECOVERY PROGRAM

Public information and education is crucial to the Recovery Program's success. A strategic, multi-faceted information and education program is being implemented to:

- develop public involvement strategies at the beginning of projects as warranted;
- educate target audiences (including media, the public and elected officials) about endangered fish and increase their understanding of and support for the recovery of these fish at local, state and national levels;
- provide opportunities for the public to participate in activities that support recovery; and
- improve communication and cooperation among members of the Recovery Program and their constituents.

Numerous site-specific activities are undertaken to promote understanding of, and support for, Recovery Program actions and to involve the public in decisions which may impact specific locations in the Upper Basin. These include public meetings, presentations, communications (e-mails, newsletters, etc.), exhibits and distribution of Recovery Program publications.

In recent years, the Program has begun to place additional emphasis on educating the public regarding the gravity of illegal stocking. CPW and UDWR have placed signs warning the public not to transplant fish at various fisheries in western Colorado. Colorado, Wyoming, and Utah fishing regulations call special attention to the problem of and penalties for illegal stocking. Colorado's Nonnative Fish Management Work Group will consider illicit introductions as a component of a strategy to respond to Service's sufficient progress assessment.

The information and education element continues to develop a number of products including an annual *Field Report* (print and digital editions); up-to-date fact sheets; interpretive signs and displays; bookmarks; annual *Program Highlights* and other briefing documents; and a website. In addition, the Recovery Program actively seeks news media coverage of its activities. Special educational publications are produced as needed. The Recovery Program also integrates social media into outreach strategies as appropriate.

Because funding for capital construction and ongoing operation and maintenance (O&M) for the Upper Colorado River and San Juan River Basin Recovery Programs is tied together in Federal legislation (Public Laws 106-392, 107-375, 109-183, 111-11 and 112-270), an annual publication is produced that highlights accomplishments of both recovery programs. The *Program Highlights* publication serves as a briefing document for use by the non-Federal partners' annual visit to Washington, D.C., and is used for numerous other purposes throughout the year.

In addition to the *Program Highlights* document, the *Swimming Upstream* field report and freestanding exhibits (in both small and large formats) promote both the Upper Colorado and San Juan recovery programs. Shared outreach efforts help ensure accurate, consistent information about the endangered fish species and efforts to recover them. They have also proved more cost-effective by sharing publication production costs and exhibit fees.

The Upper Colorado and San Juan recovery programs will continue to work with other organizations throughout the Colorado River Basin to ensure that information about the endangered fishes is consistent, current, and accurate.

2.7 VII. PROVIDE PROGRAM PLANNING AND SUPPORT

This work also is placed entirely under the General Recovery Program Support Action Plan. Recovery Program planning and support includes planning and tracking recovery activities, participation in Recovery Program committees, and managing, directing, and coordinating the overall Recovery Program. Another important program support activity involves securing the funding necessary to implement the Recovery Program.

3.0 DISCUSSION OF SUBBASIN RECOVERY ACTIONS

Following is a summary of the importance of the various subbasins in the Upper Colorado River Basin to the endangered fishes and a brief discussion of the major actions directed at recovering the endangered fishes in these subbasins. Critical habitat in each of these subbasins is shown on the map on page 2. A more detailed accounting of the activities is found in Section 4.0.

3.1 GREEN RIVER

3.1.1 Importance

The Green River system supports wild populations of humpback chub and Colorado pikeminnow and historically supported populations of bonytail and razorback sucker. Colorado pikeminnow abundance in the Green River has declined over the past decade, but wild spawning and recruitment are still occurring. Humpback chub are found in Desolation and Gray Canyons in the Green River; populations are apparently stable and continuing to reproduce and recruit in this location. Razorback sucker became functionally extirpated in the Green River in the late 1990's, but have been reestablished through augmentation stocking. Spawning aggregations are now found in the middle and lower Green river. Collections of wild produced larval razorback have been on the increase in the Middle Green since 2007; wild produced Age 1+ juveniles were collected in the lower Green and Colorado rivers in 2013 and in the middle Green River in 2015. Bonytail are stocked in large numbers in the Green River, but are not surviving at high rates, although wild bonytail reproduction was confirmed in middle Green River wetlands (Stewart Lake and Johnson Bottom) in 2015 and 2016.

The importance of the Green River to the endangered fishes has been established in Recovery Program planning. The Colorado Squawfish [Pikeminnow] Recovery Plan (U.S. Fish and Wildlife Service 1991) listed the Green River as the highest priority area for recovery of the species, and the recovery goals (U.S. Fish and Wildlife Service 2002c) consider the Green River subbasin as the center of the Upper Basin Colorado pikeminnow metapopulation. Habitat in Desolation and Gray canyons supports a self-sustaining humpback chub population, and the last known riverine concentration of wild bonytail was in the Green River within Dinosaur National Monument (U.S. Fish and Wildlife Service 1990a, 1990b, 2002a, 2002b). Recovery plans for humpback chub (U.S. Fish and Wildlife Service 1990a) and bonytail (U.S. Fish and Wildlife Service 1990b) identified the Green River in Desolation and Gray canyons and in Dinosaur National Monument as important to recovery. Until recently, the Green River supported the last known riverine concentration of wild razorback sucker (Lanigan and Tyus 1989; U.S. Fish and Wildlife Service 1998, 2002d).

3.1.2 Recovery Actions

Recovery actions in the Green River have focused on refining the operation of Flaming

Gorge dam to enhance habitat conditions for the endangered fishes, acquiring and restoring floodplain habitats for endangered fish use, and managing populations of nonnative fish species. Flows in the Green River are influenced by tributary inputs, especially the Yampa River, as well as Flaming Gorge dam releases. A biological opinion was issued on the operation of Flaming Gorge Dam in 1992. This opinion contained seasonal flow recommendations for the Green River at Jensen, Utah, and called for additional research under a specific set of research flows to collect information needed to refine the flow recommendations (particularly flow recommendations for spring and winter) and to develop flow recommendations for other areas of the Green River. The effects of the test flows on the endangered fishes and their habitat were evaluated through a variety of studies through 1997, and a final report including revised flow recommendations was completed (Muth et al. 2000). National Environmental Policy Act (NEPA) compliance on reoperation of Flaming Gorge Dam and a Record of Decision were completed in 2006. A new biological opinion was completed in 2005. A study plan for the implementation and evaluation of flow and temperature recommendations for endangered fishes in the Green River downstream of Flaming Gorge Dam was completed in 2007 (Green River Study Plan ad hoc Committee 2007). Following the 2006 Record of Decision, Reclamation provided peak flows that met or exceeded the Muth et al (2000) recommendations. Reclamation achieved these peak flow magnitudes and durations by timing Flaming Gorge releases to match peak Yampa River flow, thus minimizing releases needed to achieve the targets. A 2011 synthesis by Bestgen et al. showed that after 1993, releases to match the Yampa peak occurred prior to larval razorback sucker drift and suggested that this approach may not be providing for successful razorback sucker recruitment. In response, the Recovery Program proposed that Reclamation use the occurrence of razorback sucker larvae in channel margin habitats (an indication that larval drift is occurring in the river) as the “trigger” to determine when peak releases should occur from Flaming Gorge Dam (rather than trying to match the Yampa peak). A Larval Trigger Study Plan (LTSP; Larval Trigger Study Plan ad hoc Committee. 2012), consistent with the Muth et al. (2000) flow recommendations, is being implemented for an experimental period of about six years beginning in 2012. To date, LTSP operations have proven hugely successful, resulting in an autumn release of wild-produced Age-0 razorback sucker from floodplains to the Green River main channel; 2013-2015. In spring 2015, the Green River Evaluation and Assessment Team (GREAT) was convened to evaluate: 1) the Program's performance meeting the Muth et al. flow and temperature since the 2006 ROD; 2) the results of studies identified in the Green River Study Plan (e.g. Floodplain Synth; BW-Synth; and Nonnative studies); and 3) the need for revision of the recommendations.

Flow recommendations also have been developed for some tributaries to the Green River, such as the Yampa, White (interim flow recommendations; currently under revision), and Duchesne rivers. In 2012, the PDO developed a position paper on minimum flow management in the Price River (Chart and Mohrman 2012). Tributary and mainstem flow recommendations will be carefully coordinated to address recovery needs from an Upper Basin wide perspective.

An element of the 1992 Flaming Gorge Dam biological opinion identified the need to protect dam releases from possible diversion in the occupied habitat of the endangered fishes. The initial focus of this effort was to legally protect Flaming Gorge releases in the Green River down to the confluence of the Duchesne River for the months of July through October. In 2010, Utah identified a legal and technical process and schedule to protect recommended year-round flows for the endangered fishes on the Green River in Utah, which is scheduled to culminate with legal streamflow protection in 2019 (Utah Department of Natural Resources 2010; Mike Styler and Henry Maddux, UDNR, personal communication).

Other Green River activities involve restoration of bottomlands adjacent to the Green River that flood in the spring and provide important habitat for razorback sucker and Colorado pikeminnow. Levees have been breached to restore 9 sites (574 acres) and six perpetual easements were acquired (1008 acres). Speas et al. (2017) reviewed the Recovery Program's floodplain management activities and provided recommendations for how to proceed (see Section 2.2. above)

Projects to identify nonnative fish management strategies for the Green River have been implemented. Active management of northern pike (*Esox lucius*) began in 2001. Active management of smallmouth bass began in 2004. Walleye also are emerging as a threat in the Green River and active management began in 2013. White sucker removal also is occurring to reduce hybridization with native suckers (Skorupski et al. 2012). Gizzard shad, green sunfish, and burbot are other species of concern, but active management of these species has not been proposed by the Recovery Program.

Increased catches of walleye in the middle Green River are likely linked to escapement of individuals from Starvation Reservoir and an illegally introduced population in Red Fleet Reservoir (Johnson et al. 2014). UDWR completed a rotenone treatment of Red Fleet Reservoir in the fall of 2015 to eliminate this source population. The treatment was followed by stocking of compatible sport fish under an approved lake management plan, with plans for a downstream screening structure. UDWR is also planning an escapement solution for Starvation Reservoir (see Duchesne River); a temporary solution has been in place the last three years. Lake Powell may be a source of walleye in the lower Green River; however, a solution to prevent their escapement has not yet been developed.

Refuge (captive) populations of razorback sucker collected from the Green River are being maintained at the Ouray National Fish Hatchery, Ouray, Utah, with backup broodstock being maintained at Wahweap State Fish hatchery, Big Water, Utah. A plan for augmenting razorback sucker in the Green River using hatchery propagated fish is being implemented. Stocking of bonytail at Echo Park was initiated in 2000 in accordance with a stocking plan developed by the State of Colorado. The Revised Integrated Stocking Plan requires stocking of bonytail and razorback sucker in the Green River near Jensen and Green River, Utah. Bonytail stocking sites were

evaluated as part of revision of the integrated stocking plan (Integrated Stocking Plan Revision Committee 2015).

Population estimates are conducted in the Green River subbasin for Colorado pikeminnow, humpback chub, and most recently for razorback sucker, but not for bonytail. Population estimates for Colorado pikeminnow in the entire Green River subbasin began in 2001 (Bestgen et al. 2005). These estimates are conducted on a 3-year on, 2-year off cycle, with the first three-year sampling period having occurred from 2001 to 2003. The second 3-year “on” period was completed during 2006–2008 and showed an increase in the numbers of adult fish in the Green River population (Bestgen et al. 2010). A third 3-year sampling period was completed in 2013. Preliminary analyses of the most recent data indicates that population has declined throughout the sub-basin, especially in the Yampa River basin. Population estimates for humpback chub in Desolation and Gray canyons were conducted in 2001 and 2002, and expanded in 2003 (Jackson and Hudson 2005). In the mid-2000’s, this population appeared to decline and recommendations were made to secure the genetics by bringing fish into captivity (Badame 2012). In 2009, twenty-five adult humpback chub were captured and taken to the Ouray National Fish Hatchery, Randlett Unit; of these 25, 11 remain. UDWR resumed humpback chub population estimation in Desolation and Gray Canyons in 2014; specific site estimates were extrapolated to canyon(s)-wide estimate of 1,863 adult humpback chub (Howard 2014). There are no significant trends in site-specific population estimates between 2006 and 2015.

Selenium contamination of water and soil in Stewart Lake and Ashley Creek near Jensen, Utah, may adversely affect endangered fishes. The Bureau of Reclamation and Utah Division of Wildlife Resources manages ongoing remediation of Stewart Lake, in the form of fill, drain, and dry. Historic selenium levels in bottom sediments exceeded 15 ppm but the goal is 4 ppm or less (USGS 2003). The most recent sediment samples, taken in 2012, average less than 9 ppm and indicate that selenium concentrations decline substantially following high flow years on the Green River. Despite elevated selenium levels, UDWR has documented rapid growth of razorback sucker larvae entrained into Stewart Lake under the LTSP suggesting it can play an important role in recovery of razorback sucker (Breen and Skorupski 2012, 2013, Schelly et al. 2014). Continued coordination with the selenium remediation team is necessary to maximize secondary benefits (periods of inundation) to endangered fish.

3.2 YAMPA RIVER AND LITTLE SNAKE RIVER

3.2.1 Importance

The Yampa River is the largest remaining substantially unregulated river in the Upper Colorado River Basin, and its inflow into the Green River, 65 miles downstream of Flaming Gorge Dam, ameliorates some effects of dam operation on river flow, sediment load, and temperature (Muth et al. 2000). Holden (1980) concluded that flows from the Yampa River, especially spring peak flows, were crucial to the maintenance of the Green River’s “large-river” characteristics and, therefore, very important to maintaining

suitable conditions in the Green River downstream of the confluence. The Yampa River supports resident subadult and adult Colorado pikeminnow, contains one of the primary Colorado pikeminnow spawning areas in the Upper Basin, and was a major producer of endangered fishes for the entire Green River subbasin (Tyus and Karp 1989). A small population of humpback chub historically existed in the Yampa River in Dinosaur National Monument (Tyus and Karp 1989; U.S. Fish and Wildlife Service 1990a, 2002a), but is now believed to be extirpated. . Historically, spawning aggregations of adult razorback sucker were observed near the mouth of the Yampa River, and adult razorback sucker were captured upstream to the mouth of the Little Snake River (Tyus and Karp 1989). The lower portion of the Yampa River was part of the historic range of bonytail and was associated with some of the last captures of wild fish. The Bonytail Recovery Plan (U.S. Fish and Wildlife Service 1990b) identified the Yampa River within Dinosaur National Monument as a high priority recovery and/or restoration site. As discussed earlier, the number of adult Colorado pikeminnow residing in the Yampa River has been greatly reduced, largely because of persistent high densities of nonnative predators, and perhaps also because of extended drought.

The Little Snake River provides approximately 28% of the Yampa River's flow and 60% of the Yampa River's sediment supply. The sediment supply of the Little Snake River is believed to be important to the maintenance of backwater nursery areas utilized by young Colorado pikeminnow in the Green River (Smith and Green 1991). Adult Colorado pikeminnow have been captured in the Little Snake River upstream to near Baggs, Wyoming, and humpback chub have been captured in the lower 10 miles of the Little Snake River (U.S. Fish and Wildlife Service 2002a, 2002c).

3.2.2 Recovery Actions

Recovery actions in the Yampa River are focused on control of nonnative fishes and maintaining and legally protecting the flow regime required to recover the endangered fishes.

Colorado filed for a junior instream-flow water right for the Yampa River between the confluences of the Williams Fork and Little Snake rivers in December 1995. Forty-eight statements of opposition were filed against these filings in State water court.

As a result of concerns expressed by the Service and other Recovery Program participants, CWCB withdrew the baseflow and recovery flow instream-flow filings on the Yampa and Colorado rivers. With the approval of the PBO for the upper Colorado River upstream of the Gunnison River confluence, CDOW staff was instructed by CWCB to develop new methodologies and flow recommendations.

To achieve flow protection objectives, the Recovery Program developed the Yampa River Management Plan with extensive local input. The Plan identifies management actions necessary to provide and protect the needs of the endangered fishes while existing depletions for human use continue and water resources are developed to serve foreseeable future human needs in the Yampa River basin (Roehm 2004). A

cooperative agreement implementing the Yampa River Management Plan and a PBO were completed for the Yampa River in 2005.

The Yampa River Management Plan proposed to augment Yampa River base flows in accordance with the Yampa River flow recommendations (Modde et al. 1999). Of thirteen alternatives identified and evaluated in the Plan, enlargement of Elkhead Reservoir provided the most reliable water supply at a moderate cost. Construction of enlargement for human and endangered fish water supplies is complete and water releases for the endangered fish began in 2007. The Recovery Program funded a 5,000 af pool of permanent storage out of the 12,000 af of Elkhead enlargement and has the option to lease up to an additional 2,000 af on an as-needed basis from the Colorado River Water Conservation District. In 2016, the Recovery Program agreed to partner with the Colorado River Water Conservation District, Maybell Irrigation District, and the Yampa-White River Roundtable to install an automated gate in the Maybell Canal to return Elkhead fish releases, enhancing flows to ten mile reach of the Yampa River.

The Recovery Program and CWCB reevaluate the need for instream-flow filings or other protective mechanisms at least every 5 years and document their findings. The Recovery Program determined in November 2011 that additional permanent protection in the form of instream flow filings was not deemed necessary at that time. As part of the pending Yampa River depletion accounting report, CWCB will make an estimate of current and projected future depletions and will recommend whether or not additional instream flow filings or other flow protection mechanisms should be considered.

Flow contributions from the Little Snake River, as they assist in recovery in the Yampa River, were identified after estimated future depletions were accounted for in the Yampa River Management Plan and Environmental Assessment (Roehm 2004).

The Recovery Program has evaluated several low-head agricultural-water diversion dams on the Yampa River for Colorado pikeminnow passage. A variety of existing diversions between Craig, Colorado, and Dinosaur National Monument were inventoried in 1994–1995. Disturbance of fish habitat related to maintenance of diversion structures was evaluated and found to be minimal based on the limited area and duration of the disturbance. Several diversions were identified as possible barriers to fish migration under certain conditions (Hydrosphere 1995a). However, due to uncertainties about whether these diversions were in fact barriers to Colorado pikeminnow movement during the migration period, a study was conducted to determine threshold flows for adult Colorado pikeminnow passage on the Yampa River between Craig and Dinosaur National Monument (Masslich 1993). It was determined that these barriers present little if any problem to fish movement during the periods when Colorado pikeminnow migrate to and from spawning habitats downstream. Evaluation of entrainment of Colorado pikeminnow in the larger Maybell diversion began in 2007 and continued in 2011 and 2012. Only one endangered fish, a Colorado pikeminnow, was detected in 2012 (Speas et al. 2014). The Service's 2014 Sufficient Progress memo concluded that due to

relatively low rates of entrainment, an exclusion device would not be cost effective. The Service recommended that the Recovery Program should strive to offset impacts at the Maybell Canal by completing the Yampa River nonnative fish control actions identified in the RIPRAP addendum included in their 2013 memo.

The Recovery Program began removing nonnative sportfish from certain reaches of the Yampa River and, where feasible, relocating them to more acceptable waters in 1999. Active management of channel catfish in Yampa Canyon began in 2001, but the Recovery Program discontinued this work in 2007 (except for incidental removal of very large fish) to focus on the control of smallmouth bass, whose population expanded dramatically in the early 2000s coincident with the abrupt decline in small-bodied and juvenile native fishes and a rapid increase in virile crayfish (*Orconectes virilis*) (Martinez 2012). Active removal of northern pike downstream of Hayden began in 2003. The Recovery Program now removes smallmouth bass and northern pike at some level of intensity from Steamboat Springs downstream to the confluence with the Green River.

Northern pike distribution in the Yampa River extends from reservoirs in the upper reaches downstream to the Green River, but pike numbers are highest in the cooler upstream reaches. CPW has undertaken remediation projects to reduce northern pike spawning habitat in the upper Yampa River. Active removal of northern pike downstream of Hayden began in 2003. In 2004, the Recovery Program began tagging northern pike in the Yampa River upstream of the Hayden Bridge to determine if it is a significant upstream source of northern pike moving downstream into critical habitat. In 2005, CPW began work to determine sources of northern pike that may gain access to endangered fish critical habitat in the Yampa River. Prior to the 2011 sampling season, the Recovery Program recommended and CPW agreed to discontinuing the pike marking pass in the Yampa River buffer zone between Hayden and Craig. Translocation of pike to off-channel waters was discontinued in 2014. In 2015, Colorado State University completed an investigation of northern pike abundance and population dynamics in the Yampa River during the removal period of 2004 to 2010 (Zelasko et al., 2015). Northern pike abundance was highest in upstream reaches, but survival was highest in downstream reaches. Combined immigration and recruitment from river and reservoir sources were determined to offset northern pike removal rates; therefore northern pike removal rates in the Yampa River were deemed insufficient to reach removal targets without reducing reproduction and escapement.

Northern pike were illegally introduced into Stagecoach Reservoir and subsequently spread downstream into the privately owned Catamount Reservoir. Catamount is known to contribute northern pike downstream into the Yampa River, including in critical habitat (Orabutt 2006; Finney and Haines 2008; Martin and Wright 2010). CPW conducts intensive mechanical removal of northern pike from Catamount Reservoir and is working with the Catamount Ranch and Club (CRC) to restore the trout fishery there. CRC has implemented must-kill for northern pike in the reservoir. Pike numbers and the size of captured pike have been reduced, but individuals can reinvade the reservoir from Stagecoach Reservoir upstream; however, only one pike confirmed to have

escaped from Stagecoach Reservoir has been captured in Catamount Reservoir in the last 5 years.

Unlike northern pike, smallmouth bass densities in the Yampa River are higher in the lower, warmer portions of the river. Active removal of smallmouth bass in a 12-mile treatment reach in Little Yampa Canyon, a 5-mile treatment reach in Lily Park, and in the lower Yampa River in Yampa Canyon began in 2004. The 12-mile treatment was expanded to 24 miles in 2006 in order to geographically include a greater portion of the targeted population. Removal was also expanded in 2006 to include the South Beach reach immediately upstream of the Little Yampa Canyon treatment reach in order to focus control on concentration areas. In 2009, smallmouth bass removal was expanded throughout critical habitat on the Yampa River. Prior to the 2011 sampling season, the Recovery Program recommended and CDOW agreed to cease translocation of adult smallmouth bass from the Yampa River into Elkhead Reservoir due to concerns about the rate of escapement of translocated and resident smallmouth bass from the reservoir and the propagule pressure and proliferative capacity of these escapees within critical habitat. The Recovery Program's multi-year assessment of smallmouth bass escapement from Elkhead Reservoir is complete (Breton et al. 2013) and demonstrated that a solution for nonnative fish escapement was needed. In 2016, Program partners completed installation of a net across the spillway to eliminate further escapement. The net is supported by an updated lake management plan that describes in-reservoir actions to disadvantage the existing populations of northern pike and smallmouth bass.

The programmatic synthesis of smallmouth bass (Breton et al. 2014) populations in the upper Colorado River basin is also completed. In general, abundant year classes of young smallmouth bass produced in low flow and warm years such as 2007 have potential to overwhelm removal efforts, and the year class persists for one or more years. Nonetheless, it appears that increased electrofishing removal efforts from 2007 to 2011 resulted in sustained reductions in density of smallmouth bass sub-adults and adults throughout the upper basin despite environmental conditions that favored smallmouth bass reproduction in some years (e.g. 2007 and 2009) (Breton et al. 2014).

The Recovery Program's Integrated Stocking Plan (Nesler et al. 2003) outlines plans for stocking bonytail in the middle Green River which includes the confluence of the Yampa River. Stocking bonytail at the confluence of the Yampa and Green rivers was initiated in 2000. The Integrated Stocking Plan was revised (Integrated Stocking Plan Revision Committee 2015) and more and larger bonytail are currently being stocked at Echo Park and/or Deerlodge.

3.3 DUCHESNE RIVER

3.3.1 Importance

Colorado pikeminnow and razorback sucker regularly utilize the mouth of the Duchesne River especially during spring runoff. Fishery surveys conducted in 1993 documented the use of the lower 15 miles of the Duchesne River by Colorado pikeminnow and

razorback sucker (Cranney 1994). More recently, limited fish surveys have been conducted in the lower 33 miles of the Duchesne River and have documented presence of razorback sucker and bonytail (Groves and Fuller 2009). And most recently, in 2010 one Colorado pikeminnow was found near the town of Randlett by the Ute Indian Tribe (Fuller and Groves 2010).

3.3.2 Recovery Actions

Initial flow recommendations were developed for the Duchesne River in 1995 to address immediate concerns of several proposed water projects being considered in the Duchesne River basin. A follow-up study to evaluate and refine these flow recommendations began in 1997 and was completed in 2003 (Modde and Keleher 2003). A water availability study was completed that identified sources of water to meet the flow recommendations. A coordinated reservoir operations study was completed in 2004. The Duchesne Biological Opinion issued in 1998 was updated in 2005. The 2005 update set targets for maintaining 50 cfs of baseflows year-round and 115 cfs of baseflows during periods of fish migration. It also formalized high flow recommendations based on an evaluation of the high flows that occurred during the 1977-2002 period of record and the response of sediment and other channel characteristics to these flows. Agreements were developed to provide flows in the Duchesne River for the endangered fishes, primarily based on voluntary cooperation between water managers, water users, and government agencies. Since 2005, the local Duchesne River Workgroup has improved water operations and provides baseflows for native fish at increasingly better frequencies (Central Utah Water Conservancy District, 2013).

The Recovery Program participated in rehabilitation of the Myton Townsite Diversion Dam on the Duchesne River (completed in 2009) to help implement the flow recommendations for the endangered fish. More recently, the Ute Tribe, Utah Division of Wildlife Resources, Bureau of Reclamation, and the U.S. Fish and Wildlife Service funded and constructed a selective fish passage structure on this diversion to allow fish passage and to increase available habitat for endangered and other native fishes. In addition, a Candidate Conservation Agreement with Assurances (CCAA) and Safe Harbor Agreement (SHA) were finalized for the portions of the Duchesne River between the Myton and Knight diversions and the Strawberry River below Starvation Reservoir. These agreements between the State of Utah, U.S. Fish and Wildlife Service, and the Associated Water Users of the Strawberry and Duchesne Rivers, formalizes the agreement to allow water from Starvation Reservoir to reach the Myton Diversion without being claimed by irrigators in return for guarantees for no future Endangered Species Act requirements from the Service. UDWR operated the Myton Fish Passage in 2016 but did not document any endangered species. Nonnative fish management has occurred intermittently in the Duchesne River since the mid-2000s, but is not currently being conducted. Nonnative fish escapement from reservoirs in the Duchesne River basin is considered a priority and solutions are being developed. In 2011, isotopic analyses indicated that Starvation Reservoir and/or Lake

Powell are a source of walleye entering the Green River; therefore, preventative escapement measures were re-evaluated. UDWR has funded the design of a permanent screening solution for the Starvation Reservoir spillway stilling basin. A temporary barrier has been in place and operated the last three years. A working group of Program partners and stakeholders met in January 2017 and plan to construct the permanent barrier in fall of 2017.

3.4 WHITE RIVER

3.4.1 Importance

Construction of Taylor Draw Dam in 1984 blocked native fish passage in the White River, including Colorado pikeminnow migration. However, adult Colorado pikeminnow occupy the White River downstream of Taylor Draw Dam near Rangely, Colorado, in relatively high numbers. Adult Colorado pikeminnow residing in the White River are known to spawn in the Green and Yampa rivers. However, in 2011, researchers documented for the first time razorback suckers and Colorado pikeminnow spawning in the White River (Webber et al. 2013). Juvenile and subadult Colorado pikeminnow also utilize the White River on a year-round basis. Incidental captures of razorback sucker have been recorded in the lower White River. A passive integrated antenna array near the Bonanza Bridge (installed September 2012) demonstrated that razorback sucker and Colorado pikeminnow use the Utah portion of the White River in higher numbers than previously thought. The White River within Utah appears to be a stronghold for native fishes and management efforts in this basin should strive to preserve this feature of the river (Breen and Hedrick 2009, 2010). However, a recent expansion of smallmouth bass in the White River is a cause for concern for this native fish stronghold.

3.4.2 Recovery Actions

A work plan for the White River (Lentsch et al., 2000) was developed to synthesize current information about the endangered fish and provide recommendations for specific recovery actions, including the merits of providing fish passage at Taylor Draw Dam. Interim flow recommendations for the White River were completed in 2004 (Irving et al. 2004) and a review began in 2009. A White River management plan is being drafted in 2017, will ultimately serve as the basis for a White River programmatic biological opinion (expected completion date of 2018). This management plan will include flow recommendations. Instream-flow filings are on hold pending reevaluation of how flows will be legally protected in Colorado.

In 2011, researchers reported increasing abundance of smallmouth bass and evidence of reproduction. The Recovery Program began intensive removal of smallmouth bass from the White River in 2012 and has increased effort in this subbasin in subsequent years. The clear, warm water below Taylor Draw Dam provides ideal spawning habitat for smallmouth bass, even in years in which other basins see reduced reproduction. The population is apparently increasing in distribution downstream into Utah, with multiple

age-classes present. Further efforts need to investigate how to sufficiently disadvantage this emerging population in a native fish stronghold.

3.5 COLORADO RIVER

3.5.1 Importance

The mainstem Colorado River from Rifle, Colorado, to Lake Powell, Utah, supports populations of humpback chub and Colorado pikeminnow, and is recognized as important to the recovery of all four endangered fishes (U.S. Fish and Wildlife Service 1990a, 1990b, 1991, 1998, 2002a, 2002b, 2002c, 2002d). Relatively large populations of humpback chub occur at Black Rocks and Westwater canyons near the Utah-Colorado state line. However, both populations appear to have experienced a decline around the year 2000 and have remained low since that time (Elverud 2012; Francis and McAda 2011). Population estimates began again in 2011 and the Recovery Program will consider results and recommendations from Francis et al. and Hines et al. 2016 in deciding what steps need to be taken. A smaller humpback chub population occurs in Cataract Canyon where some of the last wild bonytail in the Colorado River were collected. All life stages of Colorado pikeminnow occur in the section of river from Palisade, Colorado, downstream to Lake Powell. Numbers of adult Colorado pikeminnow have remained stable since 1992 (Osmundson and White 2009). However, the most recent (preliminary) population estimates (collected in 2013 - 2015) indicate the adult population has declined to about 400 individuals, among the lowest estimates on record. However, researchers report strong numbers of subadults and record high catch of age-0 Colorado pikeminnow in 2015. Since 2008, with the completion of the Price-Stubbs fish passage structure (the third of three such capital projects), the endangered fish have regained access to historically occupied reaches of the Colorado River upstream of Palisade, Colorado. Wild razorback sucker populations in the mainstem Colorado River declined precipitously in the early years of the Recovery Program, but stocked individuals have been accumulating over the past decade. Wild-produced Age 1+ and 2+ juveniles were collected in the lower Colorado River in 2013.

3.5.2 Recovery Actions

A variety of recovery actions are planned, ongoing, or completed for the Colorado River. Numerous approaches are being taken to restore flows in the 15-mile reach immediately upstream from the confluence of the Gunnison River to levels recommended by the Service. Reclamation has made available 5,000 acre-feet of water annually plus an additional 5,000 acre-feet in four of every five years from Ruedi Reservoir to augment flows in the 15-mile reach during July, August, and September. In addition, water is available from the permanent commitment of 10,825 acre-feet/year from East and West slope water users. East and West slope 10-year commitments were secured in 2000 by Memoranda of Agreement (MOA) with the Colorado River Water Conservation District (CRWCD) and Denver Water for delivery of 5,412 acre-feet of water from Wolford Mountain Reservoir and 5,412 acre-feet from Williams Fork Reservoir, respectively (extended through 2013). To replace these interim sources of

water and meet their obligations to provide 10,825 af of water to the 15-mile reach on a permanent basis, East and West slope water users cooperatively analyzed a wide range of alternatives, reaching consensus on the "Lake Granby-Ruedi" option. A contract to provide Ruedi Reservoir water by water user agreement to provide a permanent source of water was completed in 2012. The Lake Granby contracts/agreements were completed in 2013. Implementation of the permanent sources occurred during the 2013 irrigation season. The Service's average monthly summer base flow recommendation of 810cfs continues to be difficult to achieve / maintain during dry years. However, the summer base flow augmentation program often increases instantaneous flows in the 15-mile reach by 200 cfs or more. The Program is working to improve the overall strategy for flow augmentation in the 15 mile reach to be considered each spring and adjusted as the year progresses, addressing all possible sources of water, priorities, antecedent conditions, projected flows and supplies, including OMID, Grand Valley Project, CFOPS, etc. In August 2015, the CWCB entered into a one-year lease agreement with Ute Water Conservancy District for water stored in Ruedi Reservoir to supplement flows for existing instream water rights on the Colorado. That agreement allowed CWCB to lease between 6,000 acre-feet and 12,000 acre-feet of water from Ruedi for instream flow use in the 15-Mile Reach. 9,000 acre-feet were leased in 2015. In 2016, another lease (yield = 12,000 acre-feet) was signed with future options.

In April 2013, below average snowpack, low runoff conditions, and early onset of the irrigation season resulted in predictions of flows less than 200 cfs in the 15 Mile Reach. In light of potential extreme low flows in the summer of 2013, consensus was reached to conserve upstream storage for late summer flow augmentation. Subsequently, cold temperatures further curtailed runoff, resulting in flows in the range of 50 cfs or less in the 15 Mile Reach. In the future, water users and the Service will address the potential for this situation to recur as part of the normal HUP calls regarding water management for the 15 Mile Reach and determine what measures if any should be taken based on current conditions. This should avoid a repeat of the extreme low flows in the spring. The Service and water users will formalize and implement more specific recommendations to deal with the situation should it recur in the future.

In 1992, Colorado filed an application in State water court for a 581 cubic feet per second (cfs) instream-flow right in the 15-mile reach for the months of July, August, and September. In 1994, Colorado filed for a 300 cubic feet per second instream flow right on the return flows available in the 15-mile reach during the same months. Final decrees for both of these water rights were issued in 1997. Colorado filed for junior instream-flow rights on additional base flows and recovery goals in the 15-mile reach in December 1995, which was opposed in State water court.

As a result of concerns expressed by the Service and other Recovery Program participants, CWCB withdrew the baseflow and recovery flow instream-flow filings on the Colorado and Yampa rivers. With the approval of the PBO for the upper Colorado River upstream of the Gunnison River confluence, CDOW staff was instructed by CWCB to develop new methodologies and flow recommendations. The Recovery

Program and CWCB will reevaluate the need for instream-flow filings or other protective mechanisms at least every 5 years and document their findings.

Water is being provided to the 15-mile reach through an MOA with CRWCD for delivery of up to 6,000 acre-feet of water from Wolford Mountain Reservoir. Other sources of water for the 15-mile reach include construction of the Grand Valley Water Management Project and operation of Federal and private projects. A study of options for providing additional water primarily to augment spring peak flows was completed in 2003. Water users are exploring ways to increase participation in expanded coordinated reservoir operations as recommended in the study report. Earlier coordinated reservoir operations for the 15-mile reach began in 1997. From 1997 to 2015, 1,742,037 acre-feet of water has been released from reservoirs in the upper reaches of the mainstem (including Green Mountain, Ruedi, Wolford Mountain Williams Fork, Granby Windy Gap, Willow Creek, and the Palisade Bypass) to enhance spring and summer flows to improve habitat in the 15-mile reach near Grand Junction. Reclamation and the municipalities of Grand Junction, Palisade, and Fruita have signed municipal-recreation agreements to deliver additional Orchard Mesa Check Settlement water and Grand Valley Water Management Plan water to benefit endangered fish. In 2000, Reclamation entered a 5-year contract to deliver Green Mountain surplus water to the city of Grand Junction for municipal/recreational purposes and that contract was renewed on 8/29/2007 through 12/31/2012. In 2015, Reclamation and the municipalities signed a 40-year agreement that can accommodate as much as 66,000 af – the entire Green Mountain Historic Users Pool. Under the previous agreements, Reclamation has delivered as much as 61,000 af/year.

The Service completed their Gunnison River Basin Programmatic Biological Opinion (PBO) in December, 2009. In April 2012, Reclamation signed their Record of Decision on an EIS to re-operate the Aspinall Unit to provide flows for endangered fish in the Gunnison and Colorado rivers. The Recovery Program will conduct monitoring under the PBO and the Aspinall Unit Study Plan (2011) to assess how well the operation of the Aspinall Unit contributes to meeting target flows in the Gunnison and Colorado rivers and to help determine if managed flows from the Gunnison and the Colorado rivers are sufficient for recovery in the Colorado River from the Gunnison River to the confluence of the Green and Colorado rivers. After this monitoring and assessment are completed, the Service's flow recommendations for the Colorado River at the Utah-Colorado state line (McAda 2003) may be revised, or others may be developed, as necessary.

Reclamation has constructed fish passage at the GVIC and GVP diversion dams on the upper Colorado River. Construction of passage at the Price-Stubb diversion dam was completed in 2008. The Price-Stubb passage was retrofitted with PIT tag antennas in 2010 and has detected bonytail, razorback sucker, Colorado pikeminnow and other native fish. Fish passage at these diversion dams benefits all four species of endangered fish (as well as other non-listed, native species) by providing access to approximately 50 miles of the river that was used historically by these fishes.

To prevent entrainment of endangered fishes into diversion canals, fish screens have been constructed at GVIC and at the Grand Valley Project. The Recovery Program also salvages fish from these canals when the screens cannot be operated full-time throughout the irrigation season. Salvage has been necessary every year since screens were completed. From 2009-2013, the GVIC screen was operating, on average, 60% of the days during the irrigation season; during 2015, it was operational 84% of the season. During 2012 and 2013, the GVP screen was operating 77% of the days during the irrigation season; during 2015 it was operational approximately 95% of the season.

To restore floodplain habitats, levees have been breached at 3 sites (46 acres) and ten properties acquired in perpetual easement or fee title to protect 394 acres. Other off-channel ponds are managed to reduce the threat of nonnative inputs. In 2015, Colorado Parks and Wildlife installed a Merwin trap net at a connected pond near Rifle, CO to prevent northern pike from reaching the Colorado River.

Nonnative fish are also a threat to recovery in the Colorado River drainage. Active removal of smallmouth bass began in 2004, and largemouth bass, northern pike, white sucker, and walleye also are targeted. A CSU/CDOW study to determine the source of centrarchid fishes suggested that floodplain pond contributions to riverine nonnative fish populations fluctuate with the interannual variations in flow regime and river-pond connectivity (Whitledge et al. 2007). Recovery Program projects remove nonnative fish from selected streamside ponds in order to limit the escape of these individuals into the river when they connect. Recovery Program concerns about increasing collections of northern pike in the Colorado River near Rifle led to increased removal efforts beginning in 2011. In 2013, CPW installed a fish screen to prevent nonnative fish escapement from Rifle Gap Reservoir in 2013. Expansion of walleye numbers in the lower reaches observed in 2013 has raised concerns (these fish may be coming from Lake Powell) (Francis and Ryden 2014). Specifically, walleye catches have greatly increased in the lower reaches of the Colorado River, overlapping with nursery habitat for Colorado pikeminnow. Documented predation on juvenile Colorado pikeminnow (~250mm) in this reach demonstrates the impact that predatory walleye can have on recruitment of the long-lived pikeminnow.

Operation of the fish barrier net at Highline Reservoir has been ongoing since 1999; the net was replaced in March 2006 and again in March 2014. Annual maintenance at Highline Reservoir to flush sediment requires unscreened releases from the outlet works. These releases are carefully timed in late summer when released waters are anoxic so as to minimize escapement of smallmouth bass and largemouth bass which occur in Highline Reservoir.

Razorback sucker and bonytail are being stocked in the Colorado River in accordance with the revised Integrated Stocking Plan (Integrated Stocking Plan Revision Committee 2015).

Razorback sucker spawning activity was documented in the Colorado River inflow of Lake Powell in 2014-2016 (near Trachyte Creek and Castle Butte). Biologists collected 954 adult razorback sucker between 2 and 14 years old from 2014-2016; 8% were without a PIT tag. In 2014, 811 larvae were collected and in 2015 biologists identified 3 spawning areas in the Lake Powell inflow area.

3.6 GUNNISON RIVER

3.6.1 Importance

The Gunnison River is currently occupied by Colorado pikeminnow and is historic habitat for razorback sucker and presumably bonytail. Several adult Colorado pikeminnow were captured in the Gunnison River in fishery surveys conducted in 1992 and 1993. Unrestricted upstream migration of fish had been limited by the 10-foot high Redlands diversion dam located 2 miles upstream from the mouth of the Gunnison River. Several Colorado pikeminnow larvae have been collected in the Gunnison River upstream and downstream of the Redlands diversion dam. Kidd (1977) reported that adult razorback sucker were collected frequently by commercial anglers near Delta, Colorado, between 1930 and 1950. Razorback sucker larvae were collected in the Gunnison River (Osmundson and Seal 2009), and the reach near Delta is considered a priority razorback sucker restoration site. The native fish assemblage in the Gunnison River is presently less impacted, compared to other rivers, by nonnative fishes (particularly piscivorous species). CPW management efforts are emphasizing preserving this feature of the river.

3.6.2 Recovery Actions

Recovery activities on the Gunnison River are focused on operating and evaluating a fish ladder at the Redlands diversion dam, re-operating the Aspinall Unit to improve flow/habitat conditions in the Gunnison River, and restoring flooded bottomland habitats near Delta. Perpetual easements have been acquired on three properties (198 acres) for bottomland habitat. Construction of a fish ladder at the Redlands diversion dam was completed in 1996 and has provided for passage of all four endangered fishes and other native fishes (as well as allowing exclusion of nonnative fishes). In 2016, a record annual catch of 33 Colorado pikeminnow and 17 bonytail used the Redlands fish ladder and were transported upstream to Delta at river mile 57.1 to help encourage retention of these fish in the Gunnison River. One of these fish was detected on a PIT antenna at Roubideau Creek in summer 2016. In 2010, the first humpback chub (previously captured in Westwater Canyon, Utah) used the ladder. To prevent entrainment of adult and subadult endangered fish into diversion canals, a fish screen was installed at Redlands in 2005. In 2016, the Redlands screen was in operation 96% of the days during the irrigation season.

A 5-year research plan to evaluate the effects of reoperation of the Aspinall Unit on the endangered fishes and their habitat was completed in 1997. During this research period, Reclamation and Western Area Power Administration provided test flows. The

research culminated with the Service's flow recommendations in 2003 (McAda 2003). The Service completed their Gunnison River Basin Programmatic Biological Opinion (PBO) in December, 2009. In April 2012, Reclamation signed their Record of Decision on an EIS to re-operate the Aspinall Unit to provide flows for endangered fish in the Gunnison and Colorado rivers. A study plan to evaluate effects of Aspinall Unit operations to benefit habitat and recovery of endangered fishes in the Gunnison and Colorado rivers was completed in 2011 (Aspinall Unit Study Plan *ad hoc* Committee 2011). A Gunnison River fish community monitoring study was initiated in 2011 to evaluate Aspinall reoperation. A team of geomorphology experts convened in 2013 and 2014 to review the findings of the USGS sediment transport study (Williams et al., 2013) and recommend methodologies the Recovery Program should consider to further evaluate the physical habitat expectations of the peak flow recommendations for the Gunnison and Colorado rivers. Recommendations from the resulting Peak Flow Technical Supplement (LaGory et al. 2015) were incorporated into the RIPRAP. The supplement offers a range of study approaches and prioritizes river reaches to evaluate the peak flow aspects of the Program's flow recommendations. High priority is placed on collecting suspended sediment data and investigating bed load transport within ongoing programs of NPS and USGS. The Service's flow recommendations for the Gunnison River (McAda 2003) may be revised and then legal protection of Aspinall releases and State protection of instream flows in the Gunnison River will be addressed.

The 2009 Gunnison Basin PBO included a requirement for Reclamation to "develop and implement a Selenium Management Program (SMP), in cooperation with the State of Colorado and Gunnison River basin water users to reduce adverse effects of selenium on endangered fish species in the Gunnison and Colorado rivers..." An SMP Action Plan was developed and is updated regularly to reduce the existing selenium load from existing sources and prevent, minimize, or mitigate potential new selenium loading from new activities. Muscle plugs have been collected from endangered and surrogate species to determine baseline selenium concentrations and evaluate effectiveness of selenium remediation.

Beginning in 1995, the Service experimentally stocked razorback sucker in the Gunnison River near Delta. The State of Colorado stocking plan for razorback sucker was revised in 2003 to stock fewer but larger fish (as was the Program's Integrated Stocking Plan, Integrated Stocking Plan Revision Committee 2015). Stocking of razorback sucker continues in the Gunnison River, in accordance with the revised integrated stocking plan.

In 2012, CPW treated Paonia Reservoir to remove a source population of nonnative northern pike. Actions like this are consistent with the Basinwide Strategy. CPW has reported that illegally introduced smallmouth bass in Ridgway Reservoir on the Uncompahgre River (a tributary to the Gunnison) are increasing and occupying habitats near the spillway. CPW, the reservoir owners, and the Recovery Program are working together to develop short and long-term solutions to prevent these fish from escaping the reservoir. CPW implemented an unlimited harvest of smallmouth bass beginning

April 1, 2015 and conducted a harvest tournament at the reservoir in summer of 2015 and 2016, removing an estimated 35% and 24% of the reservoir's smallmouth bass population, respectively. Tri-County Water has avoided using the spillway since 2014, when the problem of smallmouth bass escapement was recognized. Stakeholders are working together to design and install a net, like the Elkhead Reservoir net, at Ridgway.

3.7 DOLORES RIVER

3.7.1 Importance

The Dolores River is historic habitat for Colorado pikeminnow; both adult and young-of-the-year fish were captured in the 1950's and 1960's. Valdez et al. (1991) documented the use of the lower 1 mile of river by Colorado pikeminnow. Uranium processing facilities operated during the late 1940's through the 1960's severely impacted the river and may have contributed to the decline of Colorado pikeminnow in the Dolores River drainage (Valdez et al., 1982).

3.7.2 Recovery Actions

Recovery actions for the Dolores River drainage have been limited to efforts independent of the Recovery Program to try to prevent/limit escapement of nonnative sport fish (e.g., smallmouth bass, yellow perch, and kokanee salmon) from McPhee Reservoir. However, smallmouth bass have become established in the Dolores River and may be an additional source for this invasive species in the Colorado River. Walleye also are in the reservoir, but have not been captured downstream. Therefore, the Recovery Program needs to determine if nonnative fishes in the Dolores River basin pose a threat to endangered fishes and determine appropriate response. In 2013, CPW treated Miramonte Reservoir to remove a source population of nonnative smallmouth bass. Actions like this are consistent with the Basinwide Strategy.

Environmental contaminant clean-up is being pursued by State and Federal agencies independent of the Recovery Program. It is unknown if stocked bonytail are using the Dolores River. Utah conducted surveys on the Dolores in 2005 and 2013 and detected bluehead suckers, roundtail chub, and flannelmouth sucker (no bonytail were captured). The Recovery Program will consider the need for additional recovery actions in the Dolores River as new information becomes available. The Bureau of Reclamation funded the installation of PIT antenna in the lower Dolores River in 2013 and 2014. The Dolores River Working Group is exploring opportunities for improving the viability of native fishes in the Dolores River below McPhee Dam. The [Lower Dolores River Monitoring, Implementation & Evaluation Plan](#) contains objectives for nonnative fish monitoring and removal.

In efforts to determine better locations to stock bonytail such as quiet still waters, flooded bottom lands, and tributaries, bonytail were stocked 8 miles above the confluence with the Colorado River in 2014. This stocking location is upstream of the PIT-tag antenna arrays.

4.0 RECOVERY ACTION PLANS

The tasks in these Recovery Action Plans are prioritized by their schedules. Schedules are shown where they have been identified (if all the year columns for an activity are blank, then the activity has not yet been scheduled). If a completion date has been identified, it is shown under the appropriate fiscal year. Where specific dates have not been identified, but an action is ongoing, beginning, or ending in a year, an "X" appears in that year's column. The "who" column identifies the lead responsible agency (listed first) and any cooperating agencies. The status column is used where additional narrative is needed to explain the duration, status, etc. of an activity. The caret ">" identifies those recovery actions which are expected to result in a measurable population response, a measurable improvement in habitat for the fishes, legal protection of flows needed for recovery, or a reduction in the threat of immediate extinction. An asterisk (*) identifies those activities which will contribute to the RIPRAP serving as a reasonable and prudent alternative to the likely destruction or adverse modification of critical habitat.

The Recovery Action Plans are formatted in stepdown-outline tables. This is reflected in the numbering system and indenting. Some actions which assess options or the feasibility of a recovery action are followed by a subsequent implementation step, and others are not, depending on how feasible the implementation step is considered to be at this time.

The following abbreviations are used to identify lead/cooperating agencies:

ANL	Argonne National Laboratory
BR	U.S. Bureau of Reclamation
CO	State of Colorado
CDA	Colorado Department of Agriculture
CDOPR	Colorado Division of Parks and Outdoor Recreation (See also CPW)
CDOW	Colorado Division of Wildlife (See also CPW)
CPW	Colorado Parks and Wildlife (CDOPR & CDOW merged in 2011)
CRWCD	Colorado River Water Conservation District
CWCB	Colorado Water Conservation Board
FWS	U.S. Fish and Wildlife Service
	-ES Ecological Services
	-FAC Fish and Aquatic Conservation
	-RW Refuges and Wildlife
	-WR Water Resources
LFL	Larval Fish Laboratory
NWCD	Northern Water Conservancy District
PD/PDO	Recovery Program Director
TBD	To be determined
UT	State of Utah
UDWR	Utah Division of Wildlife Resources

UTWR Utah Division of Water Resources
WAC Water Acquisition Committee
WYGF Wyoming Game and Fish Department

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	ACTIVITY	WHO	STATUS	FY 17 10/16-9/17	FY 18 10/17-9/18	FY 19 10/18-9/19	FY20 10/19- 9/20	FY21 10/20- 9/21	FY22 10/21- 9/22	FY23 10/22- 9/23	Post- Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X), (Focused on February 1, 2016 - January 31, 2017)
I.	PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)												
I.A.	Evaluate methods for defining habitat-flow needs and select methods most appropriate to specific stream reaches.												
I.A.1.	Review instream flow methodologies and assess the technical adequacy of current flow recommendations.	PD	Complete										
I.A.2.	Develop recommendations for integrating geomorphology and food web studies into Recovery Program.	PD	Complete										
I.A.3.	Evaluate CDOW's instream flow methodologies and flow recommendations for warmwater native fishes (Anderson) as they relate to flows needed for endangered fish recovery.	FWS/PD	Complete										
I.A.4.	Develop strategic plan for geomorphic research and monitoring.	Program	Complete										
I.A.4.a.	Develop strategy and design for studies to address geomorphic research priorities. Peak Flow Technical Supplement (LaGory et al. 2015) approved in January 2016.	Geo. Work Group	Complete									We anticipate that endangered fish flow recommendations will be in final form by 2023. Ongoing geomorphic research is anticipated, but needs to be identified.	A Peak Flow Technical Supplement (LaGory et al. 2015) was approved in January 2016. Implementing a high priority recommendation from that report, the Recovery Program approved a SOW in late 2016 establishing a collaborative effort with USGS-GCMRC to expand the Colorado River Basin suspended sediment monitoring network to include sediment transport gaging at the Jensen and Ouray streamflow gage sites on the Green River. These sampling sites will complement ongoing sediment monitoring in Dinosaur National Monument funded by NPS. The Recovery Program's current funding commitment to this sediment transport monitoring is for 5 years. The Recovery Program recognizes that to understand the habitat implications of sediment transport it may be necessary to augment existing Green River channel transects information (currently conducted outside the Recovery Program) as well as procure periodic aerial photography, etc. In 2016, the Recovery Program also collaborated with USGS to explore the utility of using hydrophones to determine flow-triggered bed load transport on the Gunnison River (Mohrman 2016). The BC and WAC will need to determine how to interpret the existing hydrophone data and determine if the Recovery Program should pursue this technology further. Results of Toby Minear's hydrophone work in the San Joaquin River can be accessed at https://acwi.gov/sos/pubs/3rdJFIC/Contents/4B-Marineau.pdf .
I.A.4.b.	Conduct needed geomorphic research and monitoring. See Williams et al. 2013 and I.A.4.a, above.												
I.A.4.b.(1)	Periodically monitor future channel narrowing and compare to historic rates using aerial or satellite imagery in the Green River (between Yampa and White rivers), Gunnison River (Hartland Dam to Colorado River), and the Colorado River downstream of the Gunnison River (Peak Flow Tech Supplement priority).	Program	Ongoing	X	X	X	X	X	X	X	X		
I.A.4.b.(2)	Monitor sediment mass balance in the middle Green River at Jensen and Ouray gages, Gunnison River downstream of Hartland Dam at Delta and Whitewater gages, and the Colorado River at Cameo and State Line gages above and below the confluence with the Gunnison River (Peak Flow Tech Supplement priority).	Program	Ongoing	X	X	X	X	X	X	X	X		
I.B.	Develop and select methods for modifiable protection of instream flows in Colorado.												
I.B.1.	Develop, evaluate and select, as appropriate, options for interim protection of instream flows until uncertainty concerning habitat needs and water availability can be resolved.												PDO drafted a spreadsheet identifying current and needed protections for instream flow needs defined for critical habitat. Flow Protection work group reviewing.
I.B.1.a.	Colorado Attorney General review.	CO	Complete										
I.B.1.b.	CWCB approval/recommended action.	CWCB	Complete										
I.B.1.c.	Adopt legislation or regulation, if necessary.	CWCB	Complete										
I.B.2.	Evaluate options for allocating Colorado's compact entitlement among the five subbasins, the implications for water available to recover the endangered fishes, and implications of full protection of recovery flow recommendations on development of Colorado's compact entitlement.	CWCB	Complete										
I.B.3.	Assess need for retirement of senior conditional water rights.	CWCB/FWS	Dropped										
I.C.	Develop an enforcement agreement between the Service and appropriate State agencies to protect instream flows acquired under the Recovery Program for the endangered fishes.												
>*	I.C.1. Colorado.	FWS/CWCB	Complete										
I.D.	Develop tributary management plans (based in part on the tributary report, see V.F., pg. 23).												
I.D.1.	Assess need for tributary management plans on a site specific basis.	PD	Complete										
I.E.	Develop strategies for long-term flow protection	States/PD/Env. Groups	In progress	X	X	X	X	X	X	X		Implement strategies via cooperative agreement. See General, VII.A.6.	Flow protection work group began review and developed matrix of long-term flow protection in 2016; ongoing.
II.	RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)												
II.A.	Restore flooded bottomland habitats.												
II.A.1.	Conduct inventory of flooded bottomland habitat for potential restoration.	FWS-FR	Complete										

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II.A.2.	Screen high-priority sites for potential restoration/acquisition.	PD	Complete															
II.B.	Support actions to reduce or eliminate contaminant impacts. [NOTE: Contaminants remediation (in all reaches) will be conducted independently of and funded outside of the Recovery Program]																	ColoWyo is funding a mercury deposition modeling analysis which will aid in recovery planning for endangered fish and other species potentially affected by mercury contamination in the Yampa and White rivers. See also FWS environmental contaminants 2016 annual report at http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2016/hab/ContaminantFY16.pdf
II.B.1.	Evaluate effects of selenium.	FWS-ES	Ongoing	X	X	X	X	X	X	X	X	X						The Recovery Program, UDWR, FWS, and Texas A&M University are currently researching Selenium uptake in age-0 razorback sucker at Stewart Lake and Johnson Bottom wetlands (including riverine larval fish). Samples have been collected opportunistically since 2013. Results are currently being analyzed and are expected to be released in 2017, in support of a revised Stewart Lake management plan. BR continues to fund (Salinity Control Program) a significant selenium remediation effort in the Gunnison and Uncompahgre river drainages as per the Gunnison PBO.
II.B.1.a.	Identify actions to reduce selenium contamination to levels that will not impede recovery.	FWS-ES	Ongoing	X	X	X	X	X	X	X	X	X						USBR is considering re-initiating the Biological Opinion at Stewart Lake to ensure alignment of operations for both razorback sucker rearing and selenium remediation. The new proposed action at Stewart Lake will evaluate selenium concentrations in sediment, water, and biota. FWS modification of Sheppard Bottom under a razorback sucker recovery initiative will consider selenium remediation for a portion of the wetland.
II.B.2.	Identify locations of petroleum-product pipelines and assess need for emergency shut-off valves.																	EPA has developed a GIS-based map of existing pipelines (contact Guy.Kerry@epa.gov. for access to this map). The EPA has developed a Sub-Area Spill Contingency Plan for the Green River and is now developing the same for the Colorado River drainage.
>*	II.B.2.a.	Ensure that all new petroleum product pipelines have emergency shutoff valves.	FWS-ES	Ongoing	X	X	X	X	X	X	X	X						This should be a requirement of all Upper Basin State energy permitting offices and identified in post-Program cooperative agreements. USFWS Ecological Services addresses this through Section 7 consultation, though not all pipeline approvals have a federal nexus resulting in consultation. On April 7, 2016, the Deputy Program Director and I&E Coordinator presented a Recovery Program overview and provided outreach materials to the Northwest Colorado Oil and Gas Forum in Rifle, CO. The PDO will seek more opportunities to communicate with this and other energy development groups in the future.
>*	II.B.2.b.	Identify locations of existing petroleum-product pipelines potentially affecting critical habitat and determine if they have emergency shutoff valves.	FWS-ES, States	Ongoing	X	X	X	X	X	X	X	X						See II.B.2.
II.B.3.	Review and recommend modifications to State and Federal hazardous materials spills emergency response programs.	FWS-ES	Ongoing	X	X	X	X	X	X	X	X	X						Green River Sub-Area Contingency Plan (SACP) was circulated by the EPA on 1/1/16. This plan provides tactical response to guide actions during a major discharges of oil in the Green River Basin. It is designed to support state, local, and facility response plans and was developed in a collaborative effort. The PDO worked with program biologists to provide information on critical spawning areas. but that information has yet to be included in the document. EPA is now working on a SACP for the Colorado River.
II.C.	Develop an issue paper on the desirability and practicality of restoring and protecting certain portions of the floodplain for endangered fishes and evaluate the floodplain restoration program.																	
II.C.1.	Identify what restoration and protection are needed by addressing: 1) biological merits of restoring the floodplain with emphasis on endangered fish recovery; 2) priority geographic areas; and 3) integration of a broader floodplain restoration initiative into the current Recovery Program floodplain restoration program.	PROGRAM	Complete															
II.C.2.	Identify how to conduct restoration and protection by addressing: 1) restoration and protection tools/approaches; 2) institutional options for floodplain restoration; 3) costs/funding strategy; and 4) implementation steps and schedule.	PD/CO/UT	Complete															
II.C.3.	Identify viable options and develop specific restoration strategies for selected geographic areas (e.g., Grand Valley, Green River).	PD	Complete															
III.	REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)																	
III.A.	Reduce negative interactions between nonnative and endangered fishes.																	
III.A.1.	Where not already generally known, identify negative impacts (e.g., predation, competition, hybridization) of problem species.																	
III.A.1.a.	Determine role of nonnative fishes as potential competitors with bonytails and determine size-specific vulnerability of bonytails to nonnative fish predators.	UDWR	Complete															
III.A.1.b.	Assess impact of northern pike predation on Colorado pikeminnow in the Green River.	UDWR	Complete															

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	III.A.1.c.	Re-evaluate levels of hybridization with white sucker and assess effects on razorback sucker populations. (Program will monitor for evidence of hybridization as razorbacks increase in the system.)	FWS/UDWR/CSU	Ongoing	X	X	X	X	X	X	X	X	Continue to monitor hybridization as a threat to native fishes.	Hybridization between white sucker and native suckers is widespread, but apparently more problematic for flannelmouth sucker than other species. Preferred habitats of white sucker create increased opportunity for hybridization, such as the cooler water below Flaming Gorge dam (Kluender et al., 2017 Researchers Meeting presentation). X Investigators raise concern that the level of white sucker hybridization in the White River is increasing, thus presenting a direct threat to the genetic integrity of the robust native catostomid community (see Project 167 report at http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2016/nna/167.pdf). White suckers are still a dominant catch in the Yampa and Colorado rivers, but catch rates of hybrids remain lower (projects 125, 98b, and 126). Correct field ID of hybrids remain vital to understanding this issue.
>*	III.A.1.c.(1)	If necessary, implement actions to minimize hybridization between white sucker and razorback sucker.	FWS/UDWR/CSU	As needed	X	X	X	X	X	X	X	X	Continue to remove hybrids to minimize threat to native fishes.	See above. White sucker and their hybrids are removed where encountered in Yampa, Green, White, Colorado, and Gunnison rivers. ! UDWR pursuing modifications to Browns Park WMA to eliminate white sucker source population there.
	III.A.2.	Identify and implement viable active control measures.												
	III.A.2.a.	Identify options (including selective removal) to reduce negative impacts of problem species and assess regulations and options (including harvest) to reduce negative impacts on native fishes from nonnative sportfish.	PD	Complete										
	III.A.2.b.	Review options and develop agreement with appropriate States on strategies and locations for implementing control options. Develop Nonnative Fish Management Policy.	FWS/STATES	Complete										
>*	III.A.2.c.	Evaluate the effectiveness (e.g., nonnative and native fish response) and develop and implement an integrated, viable active control program.	PD/FWS/STATES	Ongoing	X	X	X	X	X	X	X	X	Maintain an active, robust nonnative fish removal program to suppress nonnative fish to levels sufficient to support native fish populations.	! The Program continues to adjust nonnative fish actions to those deemed most effective and efficient. The Program judged removal efforts appropriately planned and implemented, with no need for large-scale changes and did not hold a nonnative fish workshop in 2016. Stakeholders have increased focus on reservoir escapement based on results of smallmouth bass (Breton et al. 2014) and northern pike syntheses (Zelasko et al. 2015), and increased walleye catches. Reservoirs of interest are guided by provenance study (Johnson et al. 2014). In-river removal continues to focus on disrupting spawning and removing adults. Smallmouth bass removal during spawning (the 'Surge') and northern pike backwater netting are primary efforts to reduce reproduction of these species. Walleye are removed during times of lower water temperature in the spring and fall, and have not yet demonstrated recruitment in the river. In-river removal efforts generally occur as long as conditions are safe for crews and catch rates are productive. X Current low densities of Colorado pikeminnow throughout the upper basin are linked to the persistence of nonnative predators. Large-bodied predatory species of concern appear to be expanding in other segments of critical habitat (e.g. walleye in Colorado pikeminnow nursery habitat).
	III.A.2.c.(1)	Project-level synthesis: synthesize data on each species/river nonnative fish control effort and concomitant native fish response (e.g., smallmouth bass in the Yampa River and native fish response in the Yampa River) (completed by PI's and identified as a task in individual scopes of work). (YS G-3) See Bestgen et al., 2007 for Yampa River native fish response report (2003-2006) and Skorupski et al 2012 for Middle Green River native fish response report (2005-2008).	PI's	Ongoing	X							X	Monitor native fish populations response to nonnative fish populations	CSU LFL will provide synthesis report on Yampa River native fish response and Lodore/Whirlpool Canyon fish community. Smallmouth bass early life history report (Bestgen and Hill 2016b) finalized in 2016 demonstrated that short duration increases in flow could disrupt smallmouth bass spawning on a landscape scale (see III.A.2.g.).
	III.A.2.c.(2)	Programmatic synthesis: assimilate project-level data into a basinwide and population scale analyses of effectiveness of nonnative fish management. (Breton et al. 2013, 2014, Zelasko et al. 2015),(YS G-3)	PD	Complete								X	May need to reanalyze the effectiveness of nonnative fish removal efforts in future.	CSU evaluation of smallmouth bass and northern pike control finalized. The Smallmouth Bass Projection Tool and the accompanying report are complete. Preliminary results have been vitally helpful in re-directing and intensifying removal efforts around the bass spawning period and have indicated that removal efforts are having a negative, population-level effect on smallmouth bass (though insufficient in themselves to cause recruitment failure). Northern pike and smallmouth bass syntheses demonstrated recruitment and immigration are offsetting removal efforts; therefore, Program must focus on reducing reproduction and reservoir escapement.

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III.A.2.c.(3)	Develop one or more standardized nonnative fish datasets to facilitate data analyses and information tracking (one dataset will incorporate all tagging data, others may incorporate all movement, mark-recapture, removal data, etc.) *YS G-1.) Relates to item V.A.1., Interagency Data Management.	Program	Ongoing	X	X	X	X	X	X	X	X	X	Store uniform data in a central location to further analysis of nonnative fish removal.	Ongoing. NNF PI's submit their standardized data sets to the PDO (formerly to CRFP-GJct) no later than March 15 each year. Nonnative fish collections are being considered in broader STReAMS database effort.
III.A.2.c.(4)	Evaluate additional techniques to improve data analysis (e.g., advanced software, exploitation models, ecosystem response models). (YS M-1,2). See, for example, Haines and Modde, 2007.	Program	Ongoing	X	X	X	X	X	X	X	X	X	Novel techniques for nonnative fish suppression will always be important to consider.	The programmatic smallmouth bass synthesis, III.A.2.c.(2) provided projection tool software that was made available in spring 2014. User Guide and final report are completed and available.
>*	III.A.2.d. Close river reaches to angling where and when angling mortality is determined to be significant. (See specific river reaches.)	STATES	Ongoing, as needed											
	III.A.2.e. Increase law enforcement activity to decrease angling mortality.	STATES	Ongoing											
>*	III.A.2.f. Develop control program for removal of small nonnative cyprinids in backwaters and other low velocity habitats. (Trammell et al. 2002 and 2005 complete, but development and implementation of a control program is on hold.)	STATES	On hold											X Awaiting 158 report; nonnative cyprinid management on hold until Project 158 report reviewed.
>*	III.A.2.g. Evaluate other methods for controlling nonnative fishes, including manipulation of flow and temperature, use of fish attractants, pathogens, genetic modification, and chemical piscicides. See Johnson et al. 2014 (YS N-1,2,3,4), Bestgen and Hill 2016.	Program	Ongoing	X	X	X	X	X	X	X	X	X	All methods of controlling nonnative fish should be investigated, including landscape scale control methods such as flow manipulations.	A study plan for implementation of Flaming Gorge flow manipulation for bass control is being developed in the evaluation of flow and temperature recommendations below Flaming Gorge Dam. Data collected in the Yampa River in 2015 during a natural flow spike (intense rain event) strongly supported the conclusions in Bestgen and Hill 2016bt. Increases in velocity, turbidity, and depth, and decreases in temperature are effective at removing male adult bass and sweeping away fry and eggs. Lower basin researchers used ammonia to remove green sunfish below Glen Canyon Dam, indicating potential for upper basin application. A working group is considering using USBR's Challenge Grant process to request novel actions for nonnative fish control.
III.B.	Reduce negative impacts to endangered fishes from sportfish management activities.													
III.B.1.	Implementation Committee approval of Interim Nonnative Fish Stocking Procedures.	PD	Complete											
III.B.2.	Implement Interim Nonnative Fish Stocking Procedures.													
III.B.2.a.	Develop scope of work for evaluation of Interim Procedures.	PD	Complete											
III.B.2.b.	Evaluate and revise Interim Procedures.	PD	Complete											
III.B.3.	Finalize revised Nonnative Fish Stocking Procedures.													
III.B.3.a.	Complete Biological Opinion/NEPA compliance.	FWS-ES/FR	Complete											
III.B.3.b.	Implementation Committee approval of revised Nonnative Fish Stocking Procedures.	PD	Complete											
III.B.3.c.	State wildlife commissions approval, as necessary.	STATES	Complete											
III.B.3.d.	Execute memoranda of agreement between Service and States.	FWS/STATES	Complete											
III.B.4.	Incorporate final Procedures into State aquaculture permitting process.													
>*	III.B.4.a. Colorado.	CDA/CDOW	Complete											
	III.B.4.a.(1) Evaluate effectiveness of Colorado's stocking regulation.	CDOW	Complete											
>*	III.B.4.b. Utah.	UDWR	Complete											
>*	III.B.4.c. Wyoming.	WYGF	Complete											
	III.B.5. Explore options for tribal acceptance of Nonnative Fish Stocking Procedures.	FWS-FR	Complete											
III.B.6.	Review, evaluate, and revise as needed, the Nonnative Fish Stocking Procedures.	PD/FWS/STATES	As needed (to be reviewed in 2019)			X						X	Nonnative Fish Stocking Procedures should be followed and updated as needed.	States continue implementing the Nonnative Fish Stocking Procedures. Recent lake management plans reviewed under the Procedures include Elkhead, Rifle Gap, Red Fleet, and Starvation Reservoirs, and Pelican Lake.
III.B.7.	Increase law enforcement activity to prevent illicit stocking.													BC recommends that the question of whether there will be specific plans (lines 77 and 78) should be posed to fish chiefs at FWS/States Coordination meeting in June for potential further discussion. A single plan for all three states is unlikely.
III.B.7.a.	Develop plan	STATES	Ongoing	X?	X?	X?	X?							Recovery Program needs to continue to squarely address the issue of illegal stocking by adopting strict and severe penalties for illegal introduction of nonnative aquatic species and facilitating education, enforcement, and incentives to promote compliance and prosecution as needed. This is described in the Basinwide Strategy (III.D).
>*	III.B.7.b. Implement plan	STATES	Ongoing	X?	X?	X?	X?						Illicit stocking is a major impediment to successful fisheries management and needs to be prevented as much as possible. Strict penalties for convictions are one way to deter such actions.	Wyoming, Colorado, and Utah annual fishing regulations brochures call attention to the problem of and penalties for illegal stocking.
III.B.8.	Evaluate designation of native fish conservation areas	STATES	Ongoing	X	X	X	X	X	X	X	X	X	Evaluate and propose native fish conservation areas where appropriate.	Native fish conservation area still under consideration for White River in Utah.

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III.C.	Evaluate sources of nonnative fishes into critical habitat using isotope technology. See Johnson et al. 2014.	CSU	Ongoing	X	X								Novel introductions (new species or new locations) of nonnative fishes should be evaluated (e.g. isotopic analysis) to determine provenance.	CSU investigations resulted in otolith markers for water chemistry for reservoirs throughout the basin (Johnson et al. 2014). Program continues to collect & retain otoliths under specific guidance to assure potential for future analysis, if needed. FWS Grand Junction received funding to work with USGS Lakewood to implement this technique to determine source of walleye in the lower Colorado and Green rivers (preliminary results expected fall 2016). This technique also has forensic potential for prosecuting cases of illegal fish transport or possession of live fishes in illegal stocking cases.	
III.D.	Finalize the UCR Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy (Basinwide Strategy), Martinez et al. 2014.	PD	Complete										X	Follow concepts in the Basinwide Strategy to prevent new introductions of nonnative species, respond to new introductions, and evaluate ways to reduce nonnative species.	Most recent version of the Basinwide Strategy on website at http://www.coloradoriverrecovery.org/general-information/program-elements/nna/Basinwide_%20strategy-2015.pdf
III.E.	Cease translocation of all nonnative predators to any fishery within the UCR.	States / Program	Complete											Translocations of nonnative fish have consistently been determined to be detrimental to native fish management and should not be employed.	All translocation ceased as of FY14.
III.F.	The States will commit to remove northern pike and / or replace them with a Compatible (compatible with recovery) species (as identified in the Basinwide Strategy) throughout the UCR Basin. Specific waters will be targeted based on risk of escapement, opportunity and available resources.	States / Program	Complete in UT & WY; under review in CO	X	X	X	X	X	X	X	X	X		Continue to remove northern pike populations in the upper basin and replace them with compatible species.P89	States continue to remove and replace northern pike at specific reservoirs. CPW is removing northern pike at Lake Catamount, holding harvest tournaments that target northern pike at Elkhead and Stagecoach Reservoirs (see Yampa River), using Merwin trap at Mamm Creek gravel pit (see Colorado River), and has revised the Rifle Gap and Elkhead Reservoir LMPs to replace northern pike with other species.
III.F.1.	Implement 'must kill' regulations for northern pike throughout the UCR basin (exceptions may include waters where northern pike are being replaced by tiger muskie).	WY & UT	Complete										X	Utah and Wyoming will continue to enforce must-kill regulations	Must-kill regulations continue to be enacted.
III.F.2.	Continue discussions concerning "must kill" regulations on northern pike throughout the UCR Basin to develop a proposal supported by law enforcement for regulatory consideration.	CO	Under review	X	X	X	X	X	X	X	X	X		CPW will continue to evaluate harvest regulations and enact appropriate regulations that appropriately respond to northern pike populations	CPW opposes implementation of a pilot must-kill program or must-kill regulations. Must-kill regulations may be reconsidered by CPW if angler engagement and other strategies are not effective, and/or data proving the effectiveness of such regulations become available. CPW has instead implemented regulation changes which removed special protections for northern pike in West Slope waters. These regulation changes went into effect April 1, 2016. CPW also is investing in harvest incentives at specific reservoir locations in lieu of must-kill, specifically Elkhead Reservoir for pike. A significant issue for the success of unlimited harvest regulations, the "catch and keep" strategy, and incentivized harvest is the ability of anglers to remove and keep fish they do not plan to consume. Therefore, a large portion of fish caught under unlimited harvest regulations and other incentive programs may be released back into the system by anglers, contrary to their intent. CPW will continue investigating modifications to fishing regulations to allow anglers to dispose of excess smallmouth bass and northern pike they don't plan to consume.
III.G.	Remove smallmouth bass and / or replace them with a Compatible species (as identified in the Basinwide Strategy) everywhere they occur throughout the UCRB (exceptions = McPhee Res., Lake Powell Res., and upstream of Flaming Gorge Dam; and 'containment' may prove to be a viable management option for smallmouth bass at Starvation Res.). Specific waters will be targeted based on risk of escapement, opportunity and available resources.	States / Program		X	X	X	X	X	X	X	X	X		Continue to remove smallmouth bass populations where appropriate in the upper basin and replace them with compatible species.	! Utah pursuing containment at Starvation Reservoir. Downstream screen in the stilling basin has been 90% designed and is planned for construction in fall of 2017. ! Elkhead Reservoir stocked with largemouth bass to replace smallmouth bass. Harvest tournament held in 2016 to remove smallmouth. Net installed in September 2016 and will be tested during spring 2017 runoff. ! Ridgway Reservoir smallmouth bass tournament held in 2015 and 2016. New stakeholders planning for a net installation at Ridgway Reservoir for fall 2018. As part of net install, a new LMP will be drafted and possibly include replacement species.
III.G.1.	Implement 'must kill' regulations for smallmouth bass throughout the UCR basin (see exceptions above).	UT	Complete											Utah and Wyoming will continue to enforce must-kill regulations	Must-kill regulations continue to be enacted.
III.G.2.	Continue discussions concerning "must kill" regulations on smallmouth bass throughout the UCR Basin to develop a proposal supported by law enforcement for regulatory consideration.	CO	Under review	X	X	X	X	X	X	X	X	X		CPW will continue to evaluate harvest regulations and enact appropriate regulations that appropriately respond to smallmouth bass populations	See also III.F.2. above regarding must-kill and angler fish disposal. CPW has instead implemented regulation changes which removed special protections for smallmouth bass in West Slope waters (excluding Navajo and McPhee reservoirs). These regulation changes went into effect April 1, 2016. CPW also is investing in harvest incentives at specific reservoir locations in lieu of must-kill, specifically Ridgway and Elkhead Reservoirs (and allows payment of harvest incentives at Wolford Mountain and Green Mountain reservoirs).

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III.H.	Reduce burbot numbers through all means practicable (including targeted removal) throughout the UCR Basin.	States / USFWS	Complete in UT & WY; under review in CO	X	X	X	X	X	X	X	X	Continue to work to prevent burbot establishment and will respond to any instance of burbot introduction.	Current harvest regulations (e.g., 'must kill' regulations; fishing derbies at Flaming Gorge) considered adequate. X One adult burbot was collected in the middle Green River in 2016. X Burbot Risk Assessment should be finalized. In light of burbot escapement and high runoff potential in 2017, burbot escapement risk should be fully understood.
III.H.1.	Implement 'must kill' regulations for burbot throughout the UCR basin.	WY & UT	Complete									Utah and Wyoming will continue to enforce must-kill regulations	Must-kill regulations continue to be enacted.
III.H.2.	Continue discussions concerning "must kill" regulations on burbot (as a preemptive measure) throughout the UCR Basin to develop a proposal supported by law enforcement for regulatory consideration.	CO	Under review	X	X	X	X	X	X	X	X	CPW will continue to manage burbot as a prohibited species, indicating it is illegal for that species to be in the state.	See also III.F.2. above regarding must-kill and angler fish disposal. Burbot is a "prohibited species" in Colorado; therefore, it is illegal to export, import, transport, stock, sell, or release burbot.
III.I.	Reduce walleye numbers through all means practicable (including targeted removal) throughout the UCR Basin.	States / USFWS	Ongoing	X	X	X	X	X	X	X	X	Continue to monitor and remove walleye as appropriate in the UCR basin.	Walleye-specific removal passes continue in the Green and Colorado rivers, focusing on specific times and locations where catches are highest. Walleye removal is an ancillary component of Colorado pikeminnow population estimate work because the two species share niche overlap.
III.J.	Promote increased production of sterile gamefish (e.g., hybrids, triploids), as Compatible sport fish.	Service / States / Program	Pending	X	X	X	X	X	X	X	X	Continue to investigate sterile gamefish (with appropriate containment) as an appropriate replacement for problematic nonnative species. Continue to investigate appropriate technology for triploidy induction and appropriate stocking strategies for triploidy populations.	Providing sterile gamefish is consistent with Basinwide Strategy and Nonnative Fish Stocking Procedures. The States and FWS are collaborating on this topic where appropriate and possible. ! Utah stocked 100% triploid walleye in Red Fleet Reservoir. Colorado stocked 98% triploid walleye in Rifle Gap Reservoir. Utah and Colorado have agreed to share production of 100% triploidy if the other state cannot meet that threshold. UDWR is evaluating stocking triploid walleye into a illicit fertile population at Big Sand Wash. UDWR is funding a research project to investigate many unknown aspects of walleye triploidy (spawning behavior, growth, survival, population dynamics, etc.). FWS considering adding triploidy testing at Bozeman FTC to assist states in expeditious testing. Utah is producing hybrid striped bass (wipers) for use in new LMPs and is researching the ability to produce sterile smallmouth bass.
III.K.	Work with State Wildlife agencies and water user groups to increase awareness among States' legislatures and the courts of the ecological and financial ramifications of illicit introductions.	States and PD via Implementation Committee	Ongoing	X	X	X	X	X	X	X	X	Continue to provide information to legislatures and courts concerning the ecological and financial ramifications of illicit introductions.P152	
IV.	MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)												
IV.A.	Genetics Management.												
IV.A.1.	Develop and approve Genetics Management Guidelines.	PD	Complete										
IV.A.2.	Develop and implement Genetics Management Plan for all species and update as needed. Czaplá 1999.	PD	Ongoing	X	X	X	X	X	X	X	X	Maintain genetic refugia for each of the species.	The genetics management is implemented via breeding protocols at the various hatcheries that maintain broodstock for razorback sucker (Ouray-Randlett and Grand Valley), bonytail (Dexter), Colorado pikeminnow (Dexter) and humpback chub (Ouray-Randlett and Grand Valley).
IV.A.3.	Conduct genetic diversity studies (includes Gila taxonomy studies) and confirm presumptive genetic stocks based on all available information.												
IV.A.3.a.	Razorback sucker.	BR	Complete										
IV.A.3.b.	Bonytail and humpback chub.												
IV.A.3.b.(1)	Morphological and allozyme analyses. (Draft 4/95)	PD	Complete										
IV.A.3.b.(2)	Mitochondrial DNA analysis.	BR	Complete										
IV.A.3.c.	Colorado pikeminnow.	PD	Complete										
> IV.A.4.	Secure and manage the following species in hatcheries (according to the Genetics Management Plan).												
IV.A.4.a.	Razorback sucker.												
IV.A.4.a.(1)	Middle Green	FWS-FR	Ongoing	X	X	X	X	X	X	X	X	Maintain genetic refugia for each of the species.	
IV.A.4.a.(2)	Upper Colorado River.	FWS-FR	Ongoing	X	X	X	X	X	X	X	X	Maintain genetic refugia for each of the species.	
IV.A.4.b.	Bonytail	UDWR/CPW	Ongoing	X	X	X	X	X	X	X	X	Maintain genetic refugia for each of the species.	
IV.A.4.c.	Humpback chub.												A draft report on the genetics of <i>Gila</i> spp., including humpback chub, indicates historical hybridization (not anthropogenic) occurred between humpback chub and roundtail chub in Black Rocks. The authors identified two management units in the upper basin: Deso-Cataract and Black Rocks-Westwater. Authors did not recommend separate broodstocks, rather both management units be represented in a single Upper Basin broodstock.
IV.A.4.c.(1)	Black Rocks Canyon.	FWS-FR	Ongoing	X	X	X	X	X	X	X	X	Maintain genetic refugia for each of the species.	Eighteen adult HBC from Black Rocks are being held at Horsethief Canyon Native Fish Facility. As was the case in 2015, these fish spawned in the hatchery ponds again in 2016. See IV.A.4.c.
IV.A.4.c.(2)	Westwater Canyon.	UDWR	Ongoing	X	X	X	X	X	X	X	X	Maintain genetic refugia for each of the species.	

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IV.A.4.c.(3)	Cataract Canyon. (Broodstock currently represented by wild fish in the river.)	UDWR	Ongoing	X	X	X	X	X	X	X			
IV.A.4.c.(4)	Yampa Canyon. (Broodstock had been considered represented by wild fish in the river; however, population appears to have declined and Recovery Program was unable to establish a refuge stock.)	FWS-FR	Discontinued										
IV.A.4.c.(5)	Desolation/Gray Canyons. (Broodstock currently represented by wild fish in the river; however, population appears to have declined and Recovery Program is establishing a refuge stock.)	UDWR	Ongoing	X	X	X	X	X	X	X	X	Maintain genetic refugia for each of the species.	25 humpback chub from Desolation Canyon were brought into Ouray NFH 2009. Eleven remain at Ouray NFH-Randlett. Program may consider bringing in additional fish in future years. See IV.A.4.c.
IV.A.4.d.	Colorado pikeminnow.												
IV.A.4.d.(1)	Upper Colorado River Basin. (Broodstock currently represented at Dexter NFH and by wild fish in the river.)	FWS	Ongoing	X	X	X	X	X	X	X			Additional collection of young of year Colorado pikeminnow has been requested by Dexter to replenish broodstock.
IV.B.	Conduct annual fish propagation activities.												
IV.B.1.	Identify species needs for refugia, research, augmentation, and information and education.	PD	Annual	X	X	X	X	X	X	X			
IV.B.2.	Implement revised integrated stocking plan (Integrated Stocking Plan Revision Committee 2015).	FWS, UDWR, CPW	Annual	X	X	X	X	X	X	X			This stocking plan has made a major shift to annually stocking 35,000 bonytail and 12,000 razorback sucker, along with increased sizes for both. See the Assmt-Gen Stocking worksheet.
IV.B.3.	Conduct NEPA compliance and develop biological opinion on disposal of excess captive-reared endangered fish.	FWS-ES/FR	Complete										
IV.C.	Operate and maintain facilities.												
IV.C.1.	Ouray NFH: Randlett Unit.	FWS-FR	Ongoing	X	X	X	X	X	X	X	X	Operate and maintain facilities for genetic refugia	Tiger salamanders depredated razorback sucker ponds and target stocking numbers were not met in 2016. See Assessment-Gen Stocking tab. Ouray production was at 39%. Measures have been taken to eliminate tiger salamanders from getting into ponds and, if they do, removing egg masses when they occur.
IV.C.2.	Ouray NFH: Grand Valley Unit.	FWS-FR	Ongoing	X	X	X	X	X	X	X	X	Operate and maintain facilities for genetic refugia	
IV.C.3.	Wahweap.	UDWR	Ongoing	X	X	X	X	X	X	X	X	Operate and maintain facilities for genetic refugia	
IV.C.4.	Mumma.	CPW	Ongoing	X	X	X	X	X	X	X	X	Operate and maintain facilities for genetic refugia	
IV.D.	Plan, design, and construct needed facilities.												
IV.D.1.	Develop Coordinated Hatchery Facility Plan based on revised State stocking plans.	PD	Complete										
IV.D.2.	Design and construct appropriate facilities.												
IV.D.2.a.	Ouray NFH: Randlett Unit.	FWS/BR	Complete										
IV.D.2.b.	Wahweap.	UDWR/BR	Complete										
IV.D.2.c.	Ouray NFH: Grand Valley Unit.	FWS/BR	Complete										
IV.D.2.c.(1)	Construct ponds at Grand Valley to maintain secondary bonytail broodstock, humpback chub from Black Rocks, Westwater and Cataract Canyons, and additional rearing space for razorback sucker (leased ponds being discontinued).	FWS/BR	Complete										
IV.D.2.d.	Acquire ponds for growout of endangered fishes.												
IV.D.2.d.(1)	23 acres of growout ponds in the Green River basin.	FWS/STATES	Complete										
IV.D.2.d.(2)	100 acres of growout ponds in the Colorado River basin.	FWS/STATES	Complete										
IV.E.	Conduct monitoring to evaluate effectiveness and continuation of endangered fish stocking.												! Razorback adults continue to accumulate in the Green and Colorado sub-basins (including Colorado inflow to Lake Powell) and the larval catch has increased considerably in recent years. Spawning activity observed in numerous locations in the Green River, Colorado River, White River and Lake Powell. Preliminary estimates of abundance in the Green River 2011-2013 had a mean of 25,019, with a range of 24,785-25,221, annually.
IV.E.1.	Assess the monitoring needed to evaluate the contribution to recovery of endangered fish stocking over relevant reaches, life stages, and generations. Assessment addressed in 2001 and 2004 workshops (Upper Colorado River Endangered Fish Recovery Program 2002, 2006); continued assessment ongoing.	LFL/STATES	Ongoing	X	X	X	X	X	X	X			
IV.E.2.	Evaluate endangered fish stocking and revise augmentation plans, as needed. Initial evaluation complete: Zelasko et al. 2009, 2011.	FWS/LFL/States/PD	Ongoing	X	X	X	X	X	X	X			
IV.E.3.	Modify stocking plans to ensure successful stocking.	Program	Ongoing	X	X	X	X	X	X	X			Recommendations by Zelasko et al. 2009; 2011 were incorporated into the Revised Integrated Stocking Plan. The plan was finalized and is being implemented (see Assessment-Gen Stocking worksheet).
V.	MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)												
V.A.	Measure and document population and habitat parameters to determine status and biological response to recovery actions.												In 2016, mark-recapture population estimates for adult and juvenile humpback chub resumed in Black Rocks and Westwater canyons of the Colorado River, and for juvenile and adult Colorado pikeminnow in the Green River Basin. Annual monitoring for Colorado pikeminnow YOY occurred throughout the Upper Basin.

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V.A.1.	Conduct interagency data management program to compile, manage, and maintain all research and monitoring data collected by the Recovery Program.	FWS-FR	Ongoing	X	X	X	X	X	X	X	X	X		!The program database STReaMS is online and available to the public. Data can be queried and downloaded without restriction by program participants and without detailed location information by the public. A number of improvements are planned for 2017, including: improved data structure, continued quality assessment and control, batch upload tools to facilitate data submission, advanced query building tools and tracking tools.
V.A.1.a.	Develop basinwide razorback monitoring program (implementation to be reflected in sub-basin worksheets). Bestgen et al. 2012.	LFL		X										In the Colorado River arm of Lake Powell, 241 adults were captured in 2014, 378 in 2015, 335 in 2016 (@8% untagged). Three spawning areas were identified, 811 collected in 2014; 1,292 in 2015 and razorback sucker larvae are the second most abundant species in 2015 collected in light traps.
V.A.1.a.(1)	Standardize light trap sampling	LFL/Grad. Student?	Pending											Program has not yet considered work to address recommendation by Bestgen et al. 2012 to: 1) conduct additional experimental early life stage sampling programs to assess capture efficiency with light traps, and dispersal and colonization of wetlands by larvae; and 2) use occupancy analyses to aid in determining colonization probabilities of larvae in wetlands, given that detection probabilities of larvae in wetlands may be less than perfect.
V.A.1.a.(2)	Investigate improving recapture rates through passive PIT tag monitoring, nets, etc. to improve population abundance estimates.	ALL	Ongoing	X	X	X	X	X	X	X	X	X	Continue to use all appropriate data to analyze the population dynamics for each population.	! Stationary and portable PIT tag antennas have been used throughout the basin to add detections to the database. Portable antennas used in HBC sampling have added more tags than are seen with the traditional gear used to make collections. A population estimates workshop with a review of the STReaMS database is scheduled for March 2017.
V.A.2.	Evaluate population estimates.	PD	Ongoing	X	X	X	X	X	X	X	X	X	Continue to evaluate population estimates.	
V.A.3.	Collect and submit data according to standard protocol (e.g., location, PIT tag #, length, weight, etc.) on endangered fish encountered in all field activities in order to provide annual information on population status outside of formal population estimates.	ALL	Ongoing	X	X	X	X	X	X	X	X	X	Continue collecting data in all field activities outside of formal population estimates.	For 2017, the Biology Committee has recommended not handling razorback sucker during Colorado pikeminnow population estimate sampling. However, crews will keep a sharp eye for small razorbacks and net razorbacks when they have the opportunity to gather other information about these fish. A report on razorback sucker abundance estimates is expected in early 2017 and will include recommendations for sampling options in 2018.
V.B.	Conduct research to acquire needed life history information.													
V.B.1.	Identify significant deficiencies in life history information and needed research.	PD	Ongoing	X	X	X	X	X	X	X	X			
V.B.1.a.	Develop Research Framework	PD	Complete											
V.B.1.a.(1)	Implement climate change initiative that outlines a strategy for dealing with the effects of drought.													
V.B.2.	Conduct appropriate studies to provide needed life history information.	FWS-FR/ STATES	Ongoing	X	X	X	X	X	X	X	X			
V.B.2.a.	Evaluate need for imprinting based on reintroduction plans.	FWS-FR	Complete											
V.B.2.b.	Investigate age-0 and age-1 humpback chub mortality (especially in Black Rocks/Westwater and Desolation canyons) as recommended in the Research Framework.	TBD	Ongoing	X	X	X	X	X	X	X	X			Baited hoop nets were deployed throughout the Black Rocks reach in 2016 which resulted in captures of 87 adult, 10 juveniles HBC; 12 age-1+ and 85 YOY <i>Gila</i> spp. UDWR researchers recommend an additional sampling pass in Westwater Canyon in 2017 to experiment with hoop nets instead of trammel nets, which may reduce handling stress. This recommendation would require the purchase of ~50 hoop nets
V.C.	Develop and enhance scientific techniques required to complete recovery actions.													
V.C.1.	Conduct marking study of young-of-the-year Colorado pikeminnow.	FWS-FR	Complete											
V.D.	Establish sampling procedures to minimize adverse impacts to endangered fishes.													
V.D.1.	Assess electrofishing injury impacts to endangered fishes.	LFL	Complete											
V.D.2.	Implement scientific sampling protocols to minimize mortality for all endangered fishes.	FWS-ES/ STATES	Ongoing	X	X	X	X	X	X	X	X	X	Continue to implement sampling protocols to minimize mortality.	Continue to fine-tune settings on electrofishing equipment based on water quality conditions at collection sites.
V.E.	Provide for long-term care, cataloging, and accessibility of preserved specimens.	PROGRAM	Ongoing	X	X	X	X	X	X	X	X	X	Continue to provide long-term care for preserved specimens.	! LFL has the third largest specimen collection of 27 other museums reviewed online (and yet is the second youngest).
V.F.	Assess relative biological importance of tributaries and their potential contributions to endangered fish recovery.	Contract	Complete											
V.G.	Reevaluate overutilization for commercial, recreational, scientific or educational purposes and identify actions to ensure adequate protection.	FWS-ES	Ongoing	X	X	X	X	X	X	X	X			
V.H.	Reevaluate effects of disease and parasites and identify actions to ensure adequate protection.	FWS-ES	Ongoing	X	X	X	X	X	X	X	X			
VI.	INCREASE PUBLIC AWARENESS AND SUPPORT FOR THE ENDANGERED FISHES AND THE RECOVERY PROGRAM. (Includes integration with San Juan River Recovery Implementation Program.)													
VI.A.	Conduct survey to measure public awareness of and attitudes toward endangered Colorado River fishes and the Recovery Program.	PD	Complete 1995.											

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VI.B.	Plan and implement information and education and public involvement activities for all significant Recovery Program actions (e.g. presentations, public meetings, public involvement training , etc.).	PROGRAM	Ongoing	X	X	X	X	X	X	X	X	X	Consider continuing some presence at water user trade shows to educate and inform partners and the public about post-Program endangered fish conservation.	<p>Attended various trade shows: Colorado Water Congress, Utah Water Users, Colorado Water Workshop, Rocky Mountain Coal Mining Institute Annual Conference and CRWUA</p> <p>Attended public meetings such as, Northwest Colorado Oil and Gas Forum and Elkhead Reservoir Net Installation.</p> <p>I&E Tour of the Western Slope, found multiple placements for native fish brochure and other publications.</p> <p>Photographed classroom razorback sucker release at Connected Lakes State Park, at Ouray NWR for a USFWS classroom event and the Elkhead Fishing Tournament.</p> <p>Attended Ute Water Children's Water Festival, and Denver Water Children's Water Festival. and Endangered Species Day, May 20, 2016 at the Denver Aquarium</p> <p>Chris Michaud, Fisheries Biologist, UDWR Moab, Utah: lecture on the Colorado pikeminnow at the Moab Information Center (co-sponsored by Canyonlands Natural History Association and The Museum of Moab), July 15, 2016.</p> <p>UDWR-Moab, Utah hosted an informational booth at the Moab Farmers' Market many Thursdays throughout summer 2016.</p> <p>Aurora Water Tour, August 10-11, 2016. This tour specifically targets policy makers.</p> <p>Had display at Grand Junction Farmer's Market, Palisade Farmer's Market and Palisade Peach Festival, Palisade, CO</p>
VI.C.	Promote technical publication of study results.	PD	Ongoing	X	X	X	X	X	X	X	X			The Program supports authors' publishing their technical reports in professional journals (may use Program funds for publishing costs).
VI.D.	Produce, distribute, and evaluate information and education products (such as <i>Field Report</i> , newsletter , brochures, public website, social media, etc.); manage media relations, including contacting reporters, producing news releases, fact sheets, etc.	PD	Ongoing	X	X	X	X	X	X	X	X	X	Consider continuing these kinds of outreach to educate and inform partners and the public about post-Program endangered fish conservation.	<p>Worked with FWS External Affairs to float on the Colorado River with a Denver Post reporter and photographer. Issued press release regarding discovery of wild-spawned bonytail in Stewart Lake in Jensen Utah. Program hydrologist, Jana Mohrman worked on a CROS article with the Post and the Aspen paper. The Aspen reporter participated on the HUP calls and covered issues in detail.</p> <p>"Swimming Upstream" newsletter is now an 8.5" x 11" booklet in full color.</p> <p>I&E Coordinator, Melanie Fischer delivered newsletters to the Craig Chamber of Commerce and spoke directly to them about distributing other publications to the public. Newsletters are well received and distributed widely.</p> <p>Produced a four-page brochure called "On the Path to Recovery" for distribution to Congressional aides to highlight progress made in the recovery of the endangered fishes.</p> <p>A new native fish brochure has been developed and will be available for distribution in 2017. They will be distributed to State Parks, fishing shops, and retail outdoor gear stores across the basin. A percentage of native fish brochures will be pocket laminated and given to field crews, river runners and angling guides for distribution to folks encountered on the river or for use in a boat to identify the thirteen native fish species of the upper Colorado River basin. A nonnative fish message is prominent on the front cover.</p> <p>Two new rack cards identifying why nonnative fish need to be removed from reservoirs produced in conjunction with CPW's fish tournaments.</p> <p>Nonnative fish removal artwork has been developed for the Lil' Suckers beverage holders. This product will be distributed to field crews, river runners and angling guides for distribution to people encountered on the river.</p> <p>Sets of 5x7 inch note cards have been developed with species pictures on the front one of the five elements of recovery highlighted on the back.</p> <p>Trading cards for students have been redesigned with species pictures to be distributed to classrooms.</p>
VI.E.	Participate in development and circulation of interpretive exhibits about the Recovery Program and the endangered fish.	PD	Ongoing	X	X	X	X	X	X	X	X	X	Consider continuing interpretive exhibits to educate the public about post-Program endangered fish conservation.	<p>Provided content and paid for interpretive sign at the Utah Field House of Natural History, in Vernal UT. Delivered content for signage at Stagecoach Reservoir highlighting the endangered fish and the importance of nonnative fish management. Providing support and supplies to two live endangered fish exhibits in Grand Junction, CO. and an aquaculture facility at Palisade High School. Provide aquarium supplies for the "Razorback in the Classroom" project in Colorado and Utah. Visited state parks in Colorado to determine potential locations for interpretive signage.</p>

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VI.F.	Maintain Recovery Program technical library and library web page.	PD	Ongoing	X	X	X	X	X	X	X	X	Partners will need to discuss whether CWCB Laserfiche site should become an archive for Recovery Program reports, or remain a living directory to which partners may continue to submit technical reports related to the endangered Colorado River fishes.	New reports are posted to Program website (much of this is behind schedule, but is being addressed in early 2017), PD's office discussing with San Juan Program adding San Juan reports to CWCB Laserfiche library and protocol/methods for adding new reports.
VII.	PROVIDE PROGRAM PLANNING AND SUPPORT (PROGRAM MANAGEMENT)												
VII.A.	Determine actions required for recovery.												
VII.A.1	Assure consistency of RIPRAP with currently approved recovery plans.	PD	Ongoing	X	X	X	X	X	X	X	X		
VII.A.2.	Recognize the role of the Upper Colorado River Recovery Program in revised recovery plans.	FWS	Ongoing	X	X	X	X	X	X	X	X		
VII.A.3.	Update, refine, and prioritize recovery actions (RIPRAP) annually.	PD	Ongoing	X	X	X	X	X	X	X	X		
VII.A.4.	Develop Interim Management Objectives (IMOs) for each species and presumptive stock and an index to population status.	PD	Complete										
VII.A.4.a.	Public and external peer review of IMOs.	FWS	Complete										
VII.A.4.b.	Implementation Committee review and approval of IMOs.	ALL	Complete										
VII.A.5.	Develop specific recovery goals.												
VII.A.5.a.	Convene Recovery Team.	FWS	Complete										
VII.A.5.b.	Develop recommended recovery goals.	PD/Contract	Complete										
VII.A.5.c.	Biology Committee review of recommended recovery goals.	Program	Complete										
VII.A.5.d.	Finalize recovery goals.	FWS/PD	Complete										
VII.A.5.d.(1)	Update recovery goals and then revise recovery plans.	PD/FWS	In progress	X									In progress. The Colorado pikeminnow plan is on hold while a Population Viability Analysis and species status assessment (SSA) are developed (to be completed in 2017). SSAs for humpback chub and razorback sucker also are scheduled for completion in 2017. When survival of stocked bonytail improves and they begin completing life cycle in wild, the Service will initiate an SSA for this species. The Service does not recommend revising the bonytail recovery plan at this time.
VII.A.5.e.	Conduct species status review every 5 years. See U.S. Fish and Wildlife Service 2011 a&b, 2012 a&b at http://www.coloradoriverrecovery.org/documents-publications/foundational-documents/recovery-goals.html .	FWS/Program	Every 5 years	X									Program contracted for a razorback sucker species status assessment in 2016 which will inform the Service on the status of the species and potential for reclassification.
VII.A.6.	Identify elements of conservation plans to ensure long-term management and protection post-Program.	Program	Ongoing	X	X	X	X	X	X	X	X		
VII.A.7.	Monitor and assess Recovery Program accomplishments annually.	PD	Ongoing	X	X	X	X	X	X	X	X		
VII.A.8.	Develop biennial work plan to address priority needs.	PD	Ongoing	X	X	X	X	X	X	X	X		
VII.B.	Actively participate in Recovery Program committees and secure funding for annual work plan and larger projects (e.g., water acquisition, capital construction, and long term operation and maintenance) in accordance with the recovery actions and milestones (Utah, Colorado, Wyoming, Bureau of Reclamation, Fish and Wildlife Service, Western Area Power Administration, Water Users, Environmental Groups, Colorado River Energy Distributors Association and the National Park Service).	PD	Ongoing	X	X	X	X	X	X	X	X		
VII.B.1.	As defined in PL 106-392, prepare joint report with San Juan River RIP on the utilization of power revenues for base funding, including recommendations regarding the need for continued base funding after 2011 that may be required to fulfill the goals of the Recovery Programs. Report was due to the committees of the U.S. Senate and House of Representatives 9/30/08 (submitted April 2010). Second, abbreviated report submitted December 2016 (Secretary of the Interior, 2016).	Program	Complete (2010); second report completed in 2016.										PDO and Program partners developed abbreviated report which was submitted to Congress December 19, 2016.
VII.C.	Manage, direct, and coordinate Recovery Program activities.	PD	Ongoing	X	X	X	X	X	X	X	X	Program partners will want to determine what post-Program coordination should look like.	Database Manager position advertised and filled in 2016.
VII.C.1.	Review Information and Education program (Management Committee).	PD	Complete										

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Fish produced and stocked by facility in 2016				
Facility	Species	Target	Stocked	Percent
Grand Valley	Razorback sucker	6,000	5,617	94%
	Bonytail	10,000	10,324	103%
Ouray ¹	Razorback sucker	6,000	2,322	39%
	Bonytail	10,000	11,202	112%
Wahweap	Bonytail	10,660	8,208	77%
Mumma	Bonytail	5,000	6,027	121%
¹ Mortalities due to tiger salamander.				
Razorback sucker stocked by river				
Facility	River	Stocked		
Grand Valley	Upper Colorado	3,932		
	Gunnison	1,685		
Ouray	Middle Green	2,322		
Bonytail stocked by river				
River	Grand Valley	Ouray	Wahweap	Mumma
Middle Green		11,202	4,227	2,796
Lower Green				
Colorado	10,324		3,981	3,231

Total Numbers of Fish Stocked in the Upper Colorado River Basin Since 1995							
Razorback Sucker Stocking in the Upper Colorado River Basin							
Year	Stocking Goal	Colorado and Gunnison Rivers		Middle Green River		Lower Green River	
		# Stocked	% Target	# Stocked	% Target	# Stocked	% Target
1995	Upper Colorado River experimental stocking plan (13,100 in various size ranges)	316	2.4%				
1996	13,100 in various size ranges	1,112	8.5%				
1997	13,100 in various size ranges	2,926	22.3%				
1998	26,200 in various size ranges	606	2.3%	387	No Plan		
1999	58,600 in various size ranges	6,155	10.5%	1,357	No Plan		
2000	104,800 in various size ranges	29,826	28.5%	224	No Plan		
2001	104,800 in various size ranges	6,199	5.9%				
2002	State Stocking Plans (CO = 16,440 300+ mm; UT = 18,500 >300 mm)	11,374	69.2%			274	1.5%
2003	Integrated Stocking Plan (9,930 per reach)	5,541	55.8%	8,446	85.1%	2,377	23.9%
2004	Integrated Stocking Plan (9,930 per reach)	6,153	62.0%	9,619	96.9%	5,957	60.0%
2005	Integrated Stocking Plan (9,930 per reach)	10,284	103.6%	4,850	48.8%	4,231	42.6%
2006	Integrated Stocking Plan (9,930 per reach)	10,726	108.0%	5,021	50.6%	15,188	153.0%
2007	Integrated Stocking Plan (9,930 per reach)	10,064	101.3%	7,749	78.0%	8,549	86.1%
2008	Integrated Stocking Plan (9,930 per reach)	12,949	130.4%	11,677	117.6%	10,161	102.3%
2009	Integrated Stocking Plan (9,930 per reach)	17,975	181.0%	14,983	150.9%	5,017	50.5%
2010	Integrated Stocking Plan (9,930 per reach)	9,926	100.0%	10,926	110.0%	10,040	101.1%
2011	Integrated Stocking Plan (9,930 per reach)	12,019	121.0%	9,036	91.0%	12,496	125.8%
2012	Integrated Stocking Plan (9,930 per reach)	10,506	105.8%	11,191	112.7%	10,193	102.6%
		164,657		95,466		84,483	
		Ouray		Grand Valley			
	Facility	# Stocked	% Target	Avg Size	# Stocked	% Target	Avg Size
2013	Draft Revised Integrated Stocking Plan (6,000 per facility)	10,606	176.8%		10,061	168%	
2014	Draft Revised Integrated Stocking Plan (6,000 per facility)	6,601	110.0%	367.5	6,062	101%	367
2015	Revised Integrated Stocking Plan (6,000 per facility)	5,892	98.2%	373.0	3,165	53%	427
2016	Revised Integrated Stocking Plan (6,000 per facility)	2,322	38.7%	329.0	5,617	94%	382
		25,421			24,905		
344,606							
Bonytail Stocking in the Upper Colorado River Basin*							
Year	Stocking Goal	Colorado and Gunnison Rivers		Middle Green River		Lower Green River	
		# Stocked	% Target	# Stocked	% Target	# Stocked	% Target
2000	State Stocking Plans (CO = 12,000 200+ mm; UT = 16,280 μ=200 mm)	36,274	223%			69,192	425%
2001	State Stocking Plans (CO = 12,000 200+ mm; UT = 16,280 μ=200 mm)	37,968	233%	-		45,522	280%
2002	State Stocking Plans (CO = 12,000 200+ mm; UT = 16,280 μ=200 mm)	16,464	101%	17,713	109%	8,000	49%
2003	Integrated Stocking Plan (5,330 200+ mm per reach)	6,303	118%	16,927	318%	3,043	57%
2004	Integrated Stocking Plan (5,330 200+ mm per reach)	3,985	75%	3,500	66%	3,100	58%
2005	Integrated Stocking Plan (5,330 200+ mm per reach)	6,067	114%	5,980	112%	3,100	58%
2006	Integrated Stocking Plan (5,330 200+ mm per reach)	5,554	104%	5,045	95%	3,270	61%
2007	Integrated Stocking Plan (5,330 200+ mm per reach)	5,570	105%	5,409	101%	5,404	101%
2008	Integrated Stocking Plan (5,330 200+ mm per reach)	5,896	111%	7,641	143%	5,336	100%
2009	Integrated Stocking Plan (5,330 200+ mm per reach)	5,085	95%	5,347	100%	5,403	101%
2010	Integrated Stocking Plan (5,330 200+ mm per reach)	2,450	46%	2,813	53%	5,347	100%
2011	Integrated Stocking Plan (5,330 200+ mm per reach)	5,454	102%	5,526	104%	-	0%
2012	Integrated Stocking Plan (5,330 200+ mm per reach)	5,452	102%	2,831	53%	2,695	51%
2013	Integrated Stocking Plan (5,330 200+ mm per reach)	2,934	55%	8,503	160%	0	0%
		145,456		87,235		159,412	
392,103							

* Some bonytail may have been stocked prior to 2000, but these numbers not yet included.

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Year	Facility	Ouray			Grand Valley			Wahweap			Mumma		
		# Stocked	% Target	Avg Size	# Stocked	% Target	Avg Size	# Stocked	% Target	Avg Size	# Stocked	% Target	Avg Size
2013	Draft Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; $\mu=250$ mm)	6,087	61%			0%			0%		5,400	108%	
2014	Draft Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; $\mu=250$ mm)	15,196	152%	280.4	9,529	95%	254	15,671	157%	235.5	5,441	109%	321.9
	untagged							40,238	CDOT Pond, Debeque, CO				
	untagged							5,923	Rio Mesa Res. Group Camp, Dolores River, Utah				
2015	Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; $\mu=250$ mm)	10,131	101%	267.0	11,594	116%	274	13,427	134%	241.3	5,493	110%	320.6
2016	Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; $\mu=250$ mm)	11,202	112%	269.2	10,324	103%	264	8,208	82%	252.5	6,027	121%	327.0
		42,616			31,447			37,306			22,361		133,730

Colorado pikeminnow Stocking in the Upper Colorado River Basin

Year	Stocking Goal	Colorado River		Gunnison River	
		# Stocked	% Target	# Stocked	% Target
2003	Integrated Stocking Plan (1,125 150+ mm per reach)	2,405	214%	1,051	93%
2004	Integrated Stocking Plan (1,125 150+ mm per reach)	1,809	161%	1,200	107%
		4,214		2,251	6,465

GREEN RIVER ACTION PLAN

	ACTIVITY	WHO	STATUS	FY 17 10/16-9/17	FY 18 10/17-9/18	FY 19 10/18-9/19	FY 20 10/19-9/20	FY21 10/20- 9/21	FY22 10/21- 9/22	FY23 10/22- 9/23	Post- Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X), (Focused on February 1, 2016 - January 31, 2017)
I.	PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)												
I.A.	<u>Green River above Duchesne River</u>												
I.A.1.	Initially identify year-round flows needed for recovery while providing experimental flows.												
I.A.1.a.	Summer/fall.	FWS-ES	Complete										
I.A.1.b.	Winter/spring.	FWS-ES	Complete										
I.A.1.c.	Review summer/fall flow recommendation.	FWS-ES	Complete										
I.A.2.	State acceptance of initial flow recommendations.												
I.A.2.a.	Summer/Fall.	UT	Complete										
I.A.2.b.	Winter/Spring.												
I.A.2.b.(1)	Review scientific basis.	UT	Complete										
I.A.2.b.(2)	Assess legal and physical availability of water.	UT	Complete										
I.A.3.	Deliver identified flows.												
>*	I.A.3.a. Operate Flaming Gorge pursuant to the 1992 Biological Opinion to provide summer and fall flows.	BR	Complete										
>*	I.A.3.b. Operate Flaming Gorge to supply winter and spring test flows for research.	BR	Complete										
	I.A.3.c. Complete NEPA on reoperation of Flaming Gorge pursuant to Biological Opinion and Record of Decision.	BR	Complete										
>*	I.A.3.d. Operate Flaming Gorge Dam to provide winter and spring flows and revised summer/fall flows, pursuant to the new Biological Opinion and Record of Decision.	BR	Ongoing	X	X	X	X	X	X	X	X	The States and USBR will need to continue to provide conservation flows (as per BR's ROD and / or as identified as a component of a post-Program cooperative agreement).	The Upper Green River snowpack reached approximately 104% of normal around April 1, 2016. Unregulated Apr-July flow into the Flaming Gorge Reservoir was very nearly the median volume for the 42 year record. This was the fifth year of the Larval Trigger Study Plan, see I.D.1.b(4)(a) below. Reclamation operated Flaming Gorge Dam under the ROD and BiOp to meet or exceed a target peak of 18,600 cfs in Reach 2 (as measured at the Jensen, UT gage). The observed average daily peak of 20,500 cfs, occurred on June 12, 2016. Average August and September baseflows recorded in Reach 2 were 2,156 cfs and 2,145 cfs respectively. These summer flows fell within a preferred base flow range (1,700 - 3,000 cfs; Bestgen and Hill 2016).
	I.A.3.d.1. Conduct real-time larval razorback and Colorado pikeminnow sampling to guide Flaming Gorge operations.	LFL/FWS	Ongoing	X	X	X	X	X	X	X	X		Researchers detected the first larval razorback sucker in middle Green River habitats on May 28, 2016 as per sampling protocols identified in Project #22f. This information was communicated immediately to USBR and the FGTWG and was used to trigger USBR's spring operations at Flaming Gorge Dam.
	I.A.4. Legally protect identified flows.												
	I.A.4.a. Protect Summer/Fall flows.												
	I.A.4.a.(1) Hold public meeting to establish future appropriation policy.	UT	Complete 10/94										
	I.A.4.a.(2) Adopt and implement new policy (new appropriations subject to flow criteria).	UT	Complete 11/94										
>*	I.A.4.a.(3) In 1994 the Utah State Engineer adopted a policy to protect flows required for the endangered fish on the Green River between Flaming Gorge Dam to the confluence of the Duchesne River by subordination of post-1994 applications to appropriate water and water right change applications during June 22 to November 1. To meet future needs new diversions totaling 20 cfs are exempt.	UT	Ongoing	X	X	X	X	X	X	X	X		
	I.A.4.a.(4) Evaluate effectiveness of policy.	UT	In progress	X	X	X	X	X	X	X			
	I.A.4.b. Protect Winter/Spring flows.												
	I.A.4.b.(1) Hold public meeting to establish future appropriation policy.	UT	Complete										
	I.A.4.b.(2) Identify legal and technical process and schedule for streamflow protection.												
	I.A.4.b.(2)(a) Develop work plan (Utah Department of Natural Resources 2010) and provide annual progress report to Management Committee (mid-November with other Program annual reports).	UT	Plan complete; progress reports continue	X									In 2016, Utah's Green River Utah Water Acquisition Team (GRUWAT) refined use of USBR's Flaming Gorge operations Riverware model (monthly timestep) with Utah's MODSIM model (daily timestep). Utah began working on Green River flow protection in a policy committee within the State along with TNC and FWS. The GRUWAT timelines will need to be updated.
	I.A.4.b.(2)(b) Identify issues, concerns and timeframe.	UT	Complete										
	I.A.4.b.(2)(c) Prioritize potential methods and criteria for flow protection.		In progress										
	I.A.4.b.(2)(d) Amalgamate technical information needed to model and resolve modeling issues.	UT	Complete										
	I.A.4.b.(2)(e) Develop model to analyze historic and future scenarios	UT	Complete										
	I.A.4.b.(2)(f) Analyze model results	UT	In progress	X									Draft Technical Report complete; currently under review
	I.A.4.b.(2)(g) Establish internal policy committee to work with Program partners to explore flow protection options.	UT	In progress	X	X								
	I.A.4.b.(2)(hg) As necessary, obtain additional authority to protect flows	UT	In progress	X	X								
>*	I.A.4.b.(3) Implement legal streamflow protection.	UT	Pending		X								Completion date will depend on how Utah ends up protecting flows.

GREEN RIVER ACTION PLAN

I.B.	Green River below the Duchesne River																
I.B.1.	Initially identify year-round flows needed for recovery while providing experimental flows.	FWS-ES	Complete														
I.B.2.	State acceptance of initial flow recommendations (dependent on development of initial flow recommendations).																
I.B.2.a.	Review scientific basis.	UT	Complete														
I.B.2.b.	Assess legal and physical availability of water from Green River and tributaries.	UT	Complete														
I.B.3.	Legally protect identified flows (dependent on development of initial flow recommendations).																
I.B.3.a.	Hold public meeting to establish future appropriation policy.	UT	Complete														
I.B.3.b.	See I.A.4.b.(2-3), above. (As necessary, obtain additional authority to protect flows and Implement legal streamflow protection.)	UT	In progress	X	X												
I.C.	Price River																Passive PIT-tag antennas installed in Price River for 3-Species work also pick up endangered fish; in 2016, Utah State University researchers will submit all detection information to STReAMS database.
I.C.1.	Determine endangered fish spring through autumn use of the Price River.	UT	Complete														
I.C.2.	Determine winter use and seasonal flow needs for Colorado pikeminnow in the Price River.	UT/FWS	Complete														
I.C.3.	Work with State of Utah and local water users to develop a plan to provide and enhance summer base flows (either increase average daily flows thresholds or increase the frequency that those flows occur) in the lower Price River that are conducive to pikeminnow use. For example, consider securing an emergency pool of water to avoid periods of dewatering in the lower Price River.	PD/UT/Water users	In progress	X	X												BLM, UDWR, TNC, and others continue to investigate potential water sources to support flows in the lower Price River. Price River Team last met August 31, 2016. These efforts are coordinated by Sue Bellagamba <sbellagamba@inc.org>, Jimenez, Justin" <jjimenez@blm.gov>, Dan Keller <danielkeller@utah.gov>
I.C.4.	Implement plan to provide and enhance summer base flows (in the lower Price River	PD/UT/Water users	Pending			X	X	X	X	X	X						
I.D.	Evaluate and revise as needed, flow regimes to benefit endangered fish populations. See Kitcheyan and Montagne 2005, Bestgen et al. 2006.	FWS/Program	Ongoing	X	X	X	X	X	X	X	X						See I.D.1.i. below
I.D.1.	Develop study plan to evaluate flow recommendations.	FWS/BOR/WAPA	Complete														
I.D.1.a.	Evaluate survival of young and movement of subadult razorback suckers from floodplains into the mainstem in response to flows. See Hedrick et al. 2012 and Speas et al 2017.	UDWR	Ongoing	X	X	X	X	X	X	X	X						
I.D.1.b.	Evaluate recent peak flow studies related to floodplain inundation and entrainment of larval razorback suckers.																
I.D.1.b.(1)	Complete final report on entrainment of larval razorback suckers in floodplains.	UDWR/LFL	Complete														
I.D.1.b.(2)	Monitor changes in the magnitude, timing, and size distribution of sediment. (Data series summarizing 2005-2008 daily sediment sampling on Gunnison, Green and Duchesne rivers [Williams et al. 2009] and scientific investigations report [Williams et al. 2013] completed.) See General I.A.4.b.(2).	USGS															See General I.A.4.a see General I.A.4.a
I.D.1.b.(3)	Synthesize physical and biological data from recent peak flow studies related to floodplain inundation and entrainment of larval razorback suckers.	LFL	Complete														
I.D.1.b.(4)	Develop a Larval Trigger Study Plan (LTSP) to experiment with timing Flaming Gorge releases to be coincident with the presence of wild produced larval razorback sucker, as recommended in Bestgen et al. 2011.	PD	Complete														
I.D.1.b.(4)a	Implement LTSP		In progress	X	X	X	X	X	X	X	X						We expect US+P100BR will use observed and/or predicted larval emergence to schedule spring releases from Flaming Gorge Reservoir. In response to reports of first capture of larval razorback sucker on May 28, 2016, USBR began ramping up at Flaming Gorge Dam (FGD) on May 31. Releases steadily increased to full bypass (~ 9,100 cfs) on June 8 and remained at that level through the month of June. Releases were ramped down to summer baseflow levels by July 9. These FGD releases contributed to achieving the following Reach 2 LTSP floodplain connection flow targets (i.e., flows measured at the Jensen, UT gage after larval detection): 37 days above 8,300 cfs; 22 days above 14,000 cfs; 8 days above 18,600 cfs; and 1 day above 20,300 cfs. Spring flows in Reach 2 in 2016 resulted in widespread floodplain connection (refer to Section II.A.5, below).
I.D.1.b.(4)b	Integrate and synthesize LTSP reports for evaluation and recommended revision of flow and temperature recommendations.	PDO/USBR/Argonne/LFL	In progress	X	X												
I.D.1.c.	Develop baseflow and spike flow study plan.	PDO/USBR/Argonne/LFL	In progress	X	X												
I.D.1.d.	Monitor larval razorback suckers in mainstem, and synthesize information on drift as related to flows and other conditions.																See I.A.3.d.1 above.
I.D.1.d.(1)	Conduct annual monitoring of larval razorback suckers and analyze historic monitoring data.	FWS/LFL/UDWR	Ongoing	X	X	X	X	X	X	X	X						Work has been expanded to include Larval Trigger Study Plan. See related assessment under II.A.5, below.
I.D.1.e.	Determine relationship of backwater development to sediment availability and peak flows in Reach 2. To be combined with I.D.1.f (4)	LFL/Argonne	Ongoing														Biological portion of FR-BW SYNTH (Bestgen and Hill 2016a) approved by Biology and Water Acquisition committees in January 2016. Grippo et al. need to respond to peer reviews and finalize the Physical portion of FR-BW SYNTH, which also will include a section that integrates the physical and biological components of this project.
I.D.1.f.	Evaluate effect of base flow variability on backwater maintenance and quality.																
I.D.1.f.(1)	Conduct annual monitoring of larval Colorado pikeminnow.	LFL	Ongoing	X	X	X	X	X	X	X	X						
I.D.1.f.(2)	Monitor age-0 Colorado pikeminnow in backwaters.	UDWR	Ongoing	X	X	X	X	X	X	X	X						See V.C.3 below.

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I.D.1.f.(3)	Evaluate response of native fish to nonnative predator removal	UDWR	Ongoing	X	X	X	X	X	X	X	X		
I.D.1.f.(4)	Integrate biological and physical data on backwaters.	LFL/Argonne	Ongoing										See I.D.1.e above.
I.D.1.f.(5)	Periodically monitor surface area and number of backwater habitats in the Green River using aerial or satellite imagery (Peak Flow Tech Supplement priority).	WAPA/Argonne	Ongoing	X	X								WAPA funding work on this in FY17 (with a depth component).
I.D.1.g.	Determine influence of flow and temperature recommendations on entire fish community with emphasis on nonnative fish life history in lower Reach 1 and upper Reach 2.	LFL/FWS	Ongoing	X	X	X	X						In 2016, LFL summer sampling in Browns Park yielded 10 Colorado pikeminnow. All were captured with electrofishing and trammel nets in the lower 400 meters of Vermillion Creek during higher flow releases from Flaming Gorge Dam; one of these individuals was captured twice. Congregations of adult Colorado pikeminnow in spawning condition were first discovered at this location in 2011.
I.D.1.h.	Determine entrainment (see also Green River Study Plan) of nonnative fish at Flaming Gorge Dam.	UDWR	Ongoing	X	X	X	X						Program relies on UDWR tailrace surveys coupled with Project FR-115 and other studies conducted farther downstream to monitor escapement (UDWR will provide annual data to nonnative fish coordinator). Burbot Risk Assessment is overdue. As called for in recent Flaming Gorge flow request letters, UDWR, NPS, PDO, WAPA agreed to develop a risk assessment of burbot escapement. One burbot was collected in Reach 3 of the Green River in 2016.
I.D.1.i.	Integrate and synthesize reports for evaluation and recommended revision of flow and temperature recommendations.	PD/FWS	Ongoing	X									X This evaluation is behind schedule. In spring 2015, the Green River Evaluation and Assessment Team (GREAT) was convened to evaluate: 1) the Program's performance meeting the Muth et al. flow and temperature since the 2006 ROD; 2) the results of studies identified in the Green River Study Plan (e.g. Floodplain Synth; BW-Synth; and nonnative studies); and 3) the need for revision of the recommendations. In 2016, the GREAT met for workshops in SLC, UT in January and October and convened multiple conference calls / webinars. USBR has contributed considerable modeling expertise to describe implementation of larval-triggered spring operations and elevated summer base flows and resultant impacts to reservoir storage.
I.E.	Assess need for tributary management plan for San Rafael River.												
I.E.1.	Estimate future water demands on San Rafael River.	PD/Utah	Complete										
I.E.2.	Develop tributary management plan for San Rafael River.	State	Pending										Daniel Keller <danielkeller@utah.gov> chairs the San Rafael committee for native fish conservation. They are working with local water users to get them on board with investing time, money, water, upfront on projects that benefit the 3-species to prevent the need to list them under ESA. CCA's have the potential to be successful for this strategy.
I.E.3.	Conduct appropriate Section 7 and NEPA compliance to implement tributary management plan.	PD/FWS	TBD										
II.	RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)												
II.A.	Restore and manage flooded bottomland habitat.												See assessments under II.A.5 below
II.A.1.	Conduct site restoration.												
II.A.1.a.	Old Charlie Wash.												See II.A.5.c below
>*	II.A.1.a.(1) Construct water control structure and fish kettle.	BR	Complete										
II.A.2.	Acquire interest in high-priority flooded bottomland habitats between Ouray NWR and Jensen to benefit endangered fish.												
II.A.2.a.	Identify and evaluate sites.	FWS-FR	Complete										
II.A.2.b.	Pre-acquisition planning and identification of acquisition options.	PD	Complete										
II.A.2.c.	Conduct appraisal/NEPA compliance.	PD	Complete										
>*	II.A.2.d. Negotiate acquisition and acquire.	PD	Complete										
II.A.2.e.	Evaluate effectiveness of land acquisition activities and provide recommendations.	PD	Complete										
II.A.3.	Implement levee removal strategy at high-priority sites.												
II.A.3.a.	Preconstruction (contaminants screening, floodability assessments, environmental compliance, design, and engineering).	PD/BR	Complete										
>*	II.A.3.b. Construction (levee breaching). [NOTE: Subject to review and approval for depression wetlands.]	BR	Complete										
>*	II.A.3.c. Operate and maintain.	BR/FWS	Complete										
II.A.3.d.	Evaluation.	FWS	Complete										
II.A.4.	Develop Green River Subbasin Floodplain Management Plan (Valdez and Nelson 2004).	Program	Complete										
>*	II.A.4.a. Implement, validate and refine Green River Subbasin Floodplain Management Plan (Valdez and Nelson 2004)	Program	Ongoing	X	X	X	X						
II.A.4.a.(1)	Survey levee breaches and associated connection channels for floodplain wetlands along the Green River between the Yampa and White Rivers.												

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II.A.4.a.(1)(a)	Conduct surveys following high-magnitude peak flows (e.g., > 20,000 cfs) to ensure continued connection in average years (similar to those conducted in 2012 and 2014) (Peak Flow Tech Supplement priority).	Program/ANL	Ongoing	X	X	X	X							The Biology Committee approved two final Green River floodplain breach elevation survey reports (2012 and 2014) conducted by Argonne National Laboratories. Preliminary survey information is also available from 2016. The GREAT will incorporate this survey information into their review of Muth et al. 2000.
II.A.4.a.(1)(b)	Conduct new surveys of lower elevation downstream levee breaches and associated connection channels following lower magnitude peak flows that normally connect these channels (e.g., 12,000 to 15,000 cfs) (Peak Flow Tech Supplement priority).	Program/ANL	Ongoing	X	X	X	X							See II.A.4.a.(1)(a)
II.A.5.	Manage and/or modify priority floodplain sites for nursery habitat for endangered fish (as identified in Floodplain Synthesis, LTSP, etc.) Bestgen et al. 2011, Speas et al. 2017.													! Speas, Breen, and Jones completed "Updated floodplain wetland priorities for recovery of endangered fish in the Middle Green River" in 2016. New key recommendations made for floodplain management: control water conditions for filling and draining; exclude large-bodied nonnative fish; enhance water conditions throughout the summer.
II.A.5.a.	Stewart Lake	Program /UDWR	Ongoing	X	X	X	X	X	X	X	X	X		Ongoing site management by UDWR ! UDWR researchers operated floodgate structures to control inflows and managed picket weirs to exclude large-bodied nonnative fishes at this site in 2016 (similar to LTSP study operations which began in 2012). Stewart Lake was filled beyond capacity in 2016 during the larval drift phase. After a three month inundation period ending on 19 September, 2,110 age-0 razorback suckers, 18 age-1 Colorado pikeminnow and nine age-0 bonytail, were sampled returning to the Green River during draining of the wetland that continued through mid-October. ! Bonytail reproduction was confirmed in Stewart Lake in 2015 and 2016.
II.A.5.b.	Johnson Bottom	Program/FWS-NWR	Ongoing	X	X	X	X	X	X	X	X	X		Ongoing site management by FWS. Johnson Bottom (JB) connected to the Green River from approximately May 9 (avg daily flow measured at Ouray, UT = 10,700 cfs) through June 29 (avg daily flow measured at Ouray, UT = 12,100 cfs). Razorback sucker larvae were collected in JB between June 8-10. The fish community in JB was sampled in mid-July. Draining commenced on October 6, 2016 and continued into November. The overwhelming majority of fish collected during the autumn draining and associated sampling were nonnative. However, a total of 48 bonytail were captured; 43 adults and 5 age-0. Stocking records indicate 39 of the 43 adults were stocked in May 2016. USFWS researchers attribute the absence of razorback sucker from autumn samples, at least in part due to the presence of large nonnative predatory species. ! CSU-LFL confirmed that the 5 age-0 bonytail were spawned in JB - this represents the first detection of bonytail spawning at this site.
II.A.5.c.	Old Charlie Wash.	Program/FWS-NWR	Pending										X	Ongoing site management by FWS. USFWS-Ouray NWR personnel continue to negotiate terms of a renewed lease with the Northern Ute Tribe for the southern portion of the refuge. Although researchers can not access this site for sampling, USFWS reported that Old Charley did connect to the river in spring 2016.
II.A.5.d.	Sheppard Bottom	Program/FWS-NWR	Pending	X	X	X	X	X	X	X	X	X		Ongoing site management by FWS. ! Sheppard Bottom Cooperative Recovery Initiative funded by FWS in 2016. Ouray NWR leading restoration planning. An interior Unit (S5) will likely be used as a razorback rearing location with nonnative fish exclusion, whereas the remainder of the wetland will be naturally functioning without nonnative fish exclusion. The entire wetland will connect at lower flows than its current condition through levee removal.
II.A.5.e.	Other sites	TBD	TBD										X	Ongoing site management (various agencies). USFWS reported that the following additional floodplain sites were connected during spring flows in 2016: Escalante Ranch, Bonanza Bridge, Stirrup, Above Brennan, and Wyasket Lake.. USFWS reported that larval razorback sucker were collected at Bonanza Bridge, Stirrup and Above Brennan. Some sites may not warrant continued management (under review).
II.B.	Restore native fish passage at instream barriers.													
II.B.1.	Assess and make recommendations for fish passage at low flows at Tusher Wash.	FWS-FR/ - WR/BR	Complete											! Fish Passage and PIT tag antennas included in Tusher Wash rebuild completed in 2016.
II.B.1.a	Maintain fish passage at Tusher Wash Diversion	BR/Water users	Ongoing	X	X	X	X	X	X	X	X	X		Maintain fish passage through O&M contract with local water users Fish passage maintenance needs to be included in an O&M contract with the local water users. Fish passage is easily clogged with debris, such as occurred in fall 2016.
II.B.2.	Screen Green River Canal to prevent endangered fish entrainment.													

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II.B.2.a.	Assess need.	UDWR	Complete													All four endangered species continue to be entrained in the canal, with 243 individuals present in the canal during the 2016 irrigation season. Razorback sucker were the dominant species. The number of individuals has decreased over time which may be flow related (higher flows associated with lower entrainment). Less than 20% of individuals have been documented in the Upper Basin after being detected in the canal, indicating that the canal may continue to be a source of mortality. There seems to be higher mortality for individuals who swim into the canal and past the siphon (only ~15% seen again) than for individuals who are detected only at the flume antennas (~85% seen again). Approximately 80% of fish entering the canal are detected at the siphon antennas.
II.B.2.b.	Design.	BR, NRCS	In progress	X	X											USBR WCAO presented conceptual design to BC in September 2016 that included a weir wall with fish screen. USBR subsequently presented to Green River Canal Company. Design approved. Green River Canal Company requested additional features be included in the project, including replacement of 8 gate structure and canal siphon. MC elected to have a sub-committee negotiate with GRCC on those terms; but negotiations with GRCC were postponed until after Board elections in January 2017.
>*	II.B.2.c.	Construct.	Utah, BR	Pending	X	X										Fall construction planned after terms negotiated with GRCC. See above.
>*	II.B.2.d.	Operate and maintain.	BR/Water users	Pending		X	X	X	X	X	X	X	X			Maintain fish screen through O&M contract with local water users Maintenance of facility, including debris management will need to be included in an O&M contract with local water users.
II.C.	Enhance water temperatures to benefit endangered fishes.															
II.C.1.	Identify options to release warmer water from Flaming Gorge Reservoir to restore native fish habitat in the Green River.		BR	Complete												
II.C.2.	Meet temperature targets pursuant to Flaming Gorge ROD.		BR	Ongoing	X	X	X	X	X	X	X	X	X			USBR operates selective withdrawal structure at Flaming Gorge and monitors downstream temperature. USBR's operations to meet ROD temperature targets in the Green River downstream of Flaming Gorge and past performance in Reach 1 and at the Yampa River confluence are being assessed in the GREAT evaluation of Muth et al. 2000. Generally, temperature targets have been met since 2006. See assessment in I.D.1.i above.
II.D.	Support actions to reduce or eliminate selenium impacts at Ashley Creek and Stewart Drain. [NOTE: selenium remediation (in all reaches) will be conducted independently of and funded outside of the Recovery Program.]		FWS-ES	Ongoing	X	X	X	X	X	X	X	X	X			USBR will continue to meet selenium remediation requirements under the latest Biological Opinion. PDO undertaking selenium analysis of YOY razorback sucker that resided in Stewart Lake over summer since 2013. Utah Dept. of Water Quality funded multiple years of sample analysis beginning in 2016. Previously analyzed samples include larval fish (baseline), juvenile fish (test subjects), and other species (ecological surrogates). Draft results indicate razorback sucker do uptake selenium in Stewart Lake, but levels are decreasing over time. Uptake is apparently higher in lower water years and decreased uptake is likely related to improved supplemental water supply practices. Razorback sucker in Stewart Lake are growing, surviving, and emigrating despite selenium uptake. Razorback sucker from Johnson Bottom carry a lower selenium load than those at Stewart Lake. Riverine larval razorback also carry a selenium load.
III.	REDUCE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)															
III.A.	Reduce negative impacts to endangered fishes from sportfish management activities.															
III.A.1.	Determine relationship between Flaming Gorge test flows and the fish community in Lodore Canyon..		UDWR	Complete												
>*	III.A.2.	Control escapement of nonnative fishes from Ouray National Wildlife Refuge originating from Pelican Lake.		FWS-RW	Complete											
>*	III.A.3.	Identify and control sources of catfish and centrarchids in the middle Green River.		UDWR	Complete											
III.A.4.	Develop and implement control programs for nonnative fishes in river reaches occupied by the endangered fishes to identify required levels of control. Each control activity will be evaluated for effectiveness, and then continued as needed. See III.A.2.c.1.& 2. under General Recovery Program Support Action Plan.															
>*	III.A.4.a.	Northern pike in the middle Green River.		UDWR/FWS	Ongoing	X	X	X	X	X	X	X	X			Monitor and continue removal actions at appropriate levels Captures of northern pike remained steady in 2016, with 45 pike removed. Size distribution continues to be skewed towards larger individuals.
III.A.4.b.	Nonnative cyprinids and centrarchids in nursery habitats.															
>*	III.A.4.b.(1)	Small nonnative cyprinids from backwaters and other low-velocity habitats in the lower Green River.		UDWR	On hold											See III.A.2.f. - Mechanical removal deemed ineffective (Trammell et al. 2005), but impacts can be reduced on a reach-wide scale through flow management, such as elevated base flows to support Colorado pikeminnow production (Bestgen et al. BW-Synth). Elevated baseflows produce negative impacts on nonnative cyprinid densities.
>*	III.A.4.b.(2)	Small nonnative cyprinids from backwaters and other low-velocity habitats in the middle Green River.		UDWR/FWS	On hold											Awaiting 158 report; nonnative cyprinid management on hold until Project 158 report reviewed

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>*	III.A.4.b.(3)	Smallmouth bass in middle and lower Green River.	UDWR/FWS	Ongoing	X	X	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Total smallmouth bass catch rates in the middle Green River continue to decline, likely because of three consecutive years of higher spring peak flows and cooler water temperatures unfavorable to bass recruitment, as well as nest disruption in prime spawning habitat in Island Park. For the third straight year, crews performed spawning disruption removal of smallmouth bass in Island Park. The effort yielded much higher catch rates and removed a significant number of adults relative to passes later in the summer. A population estimate of the Echo Park to Split Mountain reach produced a point estimate of 1,300 bass ≥100 mm, or 52 bass/mile. Similar to 2015, catch rates of smallmouth bass in Deso were substantially less than the high year of 2014, but bass continued to encompass the entire reach of canyon, demonstrating an apparent downstream shift since the 2000s. Smallmouth bass have not been detected below the Tusher Wash Diversion Dam.
>*	III.A.4.c.	Channel catfish (e.g. Deso./Gray Canyons) to protect humpback chub populations, and in the middle Green River to protect razorback sucker and Colorado pikeminnow. On hold pending development of more efficient techniques.	FWS/UDWR	On hold										Channel catfish are not targeted for removal, but one channel catfish >400 mm died in 2016 during each of projects 128, 123a, & 129.
>*	III.A.4.d.	Walleye in the middle and lower Green River	Program	Ongoing	X	X	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Field crews removed 292 walleye throughout the Green River sub-basin during various field efforts in 2016. Removals occurred under projects specifically targeting walleye as well as projects targeting other species where walleye were collected as ancillary captures. Targeted walleye removal passes consistently produced higher catch rates than did other sampling efforts within reaches, illustrating that we are able to increase the efficacy with which we remove this predatory nonnative fish from the Green River by timing our effort properly and focusing that effort on reaches containing high value walleye habitat. Green River sub-basin-wide walleye catch rates were considerably higher during the spring and late fall than they were through the summer and early fall. Total walleye captures in the middle Green River decreased slightly in 2016, and we concentrated in the Ouray to Sand Wash reach. Searches for additional walleye spawning aggregations in Dinosaur National Monument demonstrated no new spawning activity. In the lower Green River, walleye concentrations are highest immediately below Tusher Wash Diversion.
	III.A.4.e.	Develop lake management plan for Red Fleet Reservoir to address walleye escapement.	UDWR	Complete										! UDWR implementing new Lake Management Plan, which includes stocking triploid walleye, requiring a screen below the dam (see III.A.4.e)
>*	III.A.4.f.	Install permanent fish barrier at Red Fleet Reservoir.	UDWR			X	X					X	Maintain integrity of barrier long term.	Downstream screen below Red Fleet Reservoir is being designed, with planned installation in 2018 (allowing Starvation Reservoir to be screened first in 2017).
>*	III.A.4.g.	Other emerging nonnative fishes.	UDWR/FWS	Ongoing	X	X	X	X	X	X	X	X	Monitor fish community of the Green River and respond appropriately to any new introductions or proliferation of nonnative species.	! WGF and UDWR supported a burbot ice-fishing tournament in Flaming Gorge in January 2017 (another to follow in February), and one in Fontenelle in January 2017, as well. X A single adult burbot was captured in the middle Green River near Sand Wash boat ramp in 2016. The fish was not in good health upon capture. Burbot risk assessment should be completed to guide actions. Green sunfish still continue to dominate the catch in floodplain wetlands, such as Stewart Lake, despite not being a dominant catch in the river. X The first instance of white crappie was documented in Whirlpool Canyon.
IV.	MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)													
IV.A.	Augment or restore populations as needed, and as guided by the Genetics Management Plan.													
IV.A.1.	Develop integrated stocking plan for the four endangered fishes in the Green River.													
IV.A.1.a.	Prepare plan.		UDWR	Complete										
IV.A.1.b.	Program acceptance.		UDWR	Complete										
>	IV.A.1.c.	Implement plan.	UDWR	Ongoing	X	X	X	X	X	X	X	X		
	IV.A.1.c.(1)	Conduct high-priority lab/field studies identified in bonytail reintroduction plan.	UDWR	Draft not accepted; dropped.										
	IV.A.1.d.	Evaluate stocking success as identified in monitoring plan for stocked fish.	LFL/FWS/STATES/PD	Ongoing	X	X	X	X	X	X	X	X		
V.	MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)													

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V.A.	Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.													
V.A.1.	Verify additional Colorado pikeminnow spawning areas in lower Green.	UT	Complete											
V.A.2.	Identify additional razorback sucker spawning areas in lower Green.	UT	Complete											
V.B.	Conduct population estimate for humpback chub.													
V.B.1.	Desolation/Gray. (Sampling occurs in September and October, overlapping fiscal years. Sampling is conducted for 2 years, followed by no sampling for 2 years, with report write-up in the first year following sampling, then sampling resumes in September of the second year). See Jackson and Hudson 2005, Badame 2012.	UDWR	Ongoing	X	X	X	X	X	X	X	X		Continue to estimate abundance of humpback chub in Desolation/Gray canyons.	Preliminary estimates of HBC have been reported. In 2014 and 2015, estimates for canyon-wide were 1863 and 1672 adults, respectively.
V.C.	Conduct population estimate for Colorado pikeminnow. Sampling is conducted for 3 years, followed by no sampling for 2 years.													
V.C.1	Middle Green River (including Yampa and White rivers). See Bestgen et al. 2005 and 2010.	LFL/UDWR/ FWS	Ongoing	X	X	X	X	X	X	X	X		Continue to estimate abundance of Colorado pikeminnow in Middle Green River..	The abundance estimated for Colorado pikeminnow was started for another 3-year sampling effort after the usual 2-year hiatus.
V.C.2	Lower Green River. See Bestgen et al. 2005 and 2010.	LFL/UDWR/ FWS	Ongoing	X	X	X	X	X	X	X	X		Continue to estimate abundance of Colorado pikeminnow in Lower Green River..	See above.
V.C.3	Monitor age-0 Colorado pikeminnow in backwaters.	UDWR	Ongoing	X	X	X	X	X	X	X	X		Continue monitoring age-0 Colorado pikeminnow.	Age-0 pikeminnow monitoring conducted as per protocols identified in Project #138. Annual monitoring has occurred since 1979. In 2016, UDWR reported a below average catch (n=6 individuals) in middle Green River habitats, and above average captures (n= 426) in the lower Green River.
V.D.	Complete monitoring plan in FY 11 (based, in part, on recommendations from evaluation of stocked razorback report). See Bestgen et al., 2012.	LFL/PD	Complete											
V.D.1.	Implement razorback sucker monitoring plan. See Webber and Beers 2014.	LFL, UDWR, FWS	Ongoing/ pending	X	X	X	X	X	X	X	X			Preliminary estimates of abundance in the Green River 2011-2013 had a mean of 25,019, with a range of 24,785-25,221, annually. In addition, remote flat-plate PIT tag antennas were deployed during razorback sucker spawning again in 2015 and detected 582 razorback sucker, 5 bonytail, and 9 Colorado pikeminnow (majority of fish detected had not been otherwise captured in active sampling).

GREEN RIVER ACTION PLAN: YAMPA AND LITTLE SNAKE RIVERS

	ACTIVITY	WHO	STATUS	FY 17	FY 18	FY 19	FY20 10/19	FY21 10/20	FY22 10/21	FY23 10/22	Post-	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X), (Focused on February 1, 2016 - January 31, 2017)
				10/16-9/17	10/17-9/18	10/18-9/19	9/20	9/21	9/22	9/23	Program		
I.	PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)												
I.A.	<u>Basin-wide activities</u>												
I.A.1.	Identify fish habitat and flow needs												
I.A.1.a.	Complete Phase II feasibility study.	CRWCD/ CWCB/BR	Complete										
I.A.1.b.	Revise and update estimates of basin water needs.	CRWCD/FWS	Complete										
I.A.1.c.	Evaluate and recommend low flow and passage needs (also relates to restoration of fish passage, if needed -- Recovery Element II).	CDOW/FWS/ CRWCD	Complete										
I.A.1.d.	Provide hydrology support to develop and evaluate flow augmentation alternatives.	CWCB	Complete										
I.A.1.e.	Report synthesizing the results of water demand, low flow recommendations and hydrologic analyses.	FWS	Complete										
I.A.1.f.	Install, operate, and/or maintain stream flow monitoring gages.	FWS	Ongoing	X	X	X	X	X	X	X	X	Continue gage O&M.	
I.A.1.g.	Install, operate, and/or maintain sediment monitoring gages.		Complete										
I.A.2.	Develop and implement Yampa River management plan (Roehm 2004).												
I.A.2.a.	Negotiate a Cooperative agreement to implement the Yampa River management plan.	Program	Complete										
I.A.2.a.(1)	Develop a biological assessment for the management plan; initiate intra-Service Section 7 consultation based on the Service intent to enter into the Cooperative Agreement.	FWS	Complete										
I.A.2.a.(1)(a)	Complete intra-Service consultation, resulting in a programmatic biological opinion (PBO) for the Yampa Basin.	FWS	Complete										
I.A.2.a.(2)	Fulfill NEPA requirements for the management plan.	FWS	Complete										
I.A.2.b.	Sign Cooperative Agreement to implement the management plan.	FWS/Program/ Colorado/ CRWCD	Complete										
I.A.3.	Develop public involvement plan.	FWS/CDOW	Complete										
I.A.3.a.	Implement public involvement plan.	FWS/CDOW	Complete										
I.A.4.	Evaluate and revise as needed flow regimes to benefit endangered fish populations.	FWS/Program	Ongoing	X	X	X	X	X	X	X	X		
I.B.	<u>Yampa River above the Little Snake River</u>												
I.B.1	Initially identify year-round flows needed for recovery.	FWS-FR	Complete										
I.B.2	Provide augmentation of low flows.												
I.B.2.a	Identify and acquire water source(s).												
I.B.2.a.(1)	Steamboat Lake.												
I.B.2.a.(1)(a)	Change decree.	CDPOR	Complete 5/97										
I.B.2.a.(1)(b)	Lease up to 2,000 af. to augment late summer flows.	FWS-WR	Complete										
I.B.2.a.(1)(c)	Quantify transit losses.	CWCB	Complete										
I.B.2.a.(2)	Identify and evaluate water supply alternatives for up to 7,000 af of stream flow augmentation.	Program	Complete										
I.B.2.a.(2)(a)	Complete all necessary administrative, legal, environmental compliance, institutional and financial arrangements needed for development of Elkhead Reservoir enlargement.												
I.B.2.a.(2)(a)i)	Complete environmental compliance.	CRWCD	Complete										
I.B.2.a.(2)(a)ii)	Complete funding agreement.	CRWCD/CWCB	Complete										
I.B.2.a.(2)(a)iii)	Construct	CRWCD	Complete										
I.B.2.a.(2)(b)	Deliver water for endangered fish.	Program	Ongoing	X	X	X	X	X	X	X	X	Continue delivering Elkhead flows.	The April 2016 forecast of inflow to the Yampa at the Maybell plus Lily locations was 1,130 KAF, for an "average-dry" year (58% exceedance). The actual observed runoff volume was 32% more than this, at 1,496 KAF, due to late-season snow. Peak flow at Maybell was 11,100 cfs. The baseflow target at Maybell was 134 cfs for the months of Aug through October. Elkhead Reservoir released the entire 5,000 AF fish pool to support base flows beginning in mid-August and continued through early October. Flow dropped below the 134 cfs target for a total of 35 days during this period. Program providing cost-share of Section 7 funds to install an automated gate in the Maybell Canal to better manage Elkhead fish releases.
I.B.3.	Evaluate need for instream flow water rights.												
I.B.3.a	Review scientific basis.	CWCB/CDOW	Complete										
I.B.3.b	Assess legal and physical availability of water.	CWCB	Complete										
I.B.3.c	Assess compact considerations.	CWCB	Complete										
I.B.3.d.(1)	If necessary, evaluate how identified flows will be legally protected.	CWCB	Pending, if needed										

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I.B.3.e.	Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS/WAC	Pending	X	X														Long-term flow protection agreements to ensure maintenance of adequate flows post-Program.	In 2011, the WAC determined that additional permanent protection in the form of instream flow filings was not then necessary. The WAC was expected to review, by September 2016, mechanisms for current flow protection, and determine if additional mechanisms or instream flow filings are needed. At the Aug 2016 WAC meeting, the WAC reviewed a draft table identifying flow protections. Most protections consist of PBOs and BOs, some of which may be out of date as to future water demands (including the Yampa) or adapted project operations). USFWS position is that for downlisting the endangered fish, it's assumed all of these protections would remain in place, but longer-term protections also will need to be established. A Flow Protection workgroup was formed to evaluate what kind of flow protection (e.g., conservation agreements) would be appropriate to succeed the Program. Questions were also raised as to whether additional or updated PBO's are needed at this time. If significant new depletions are projected or proposed in excess of those in the Yampa PBO, then flow protection may be warranted even if the current level of depletions is largely unchanged.
I.B.4.	Provide a depletion accounting report as outlined in the Yampa River PBO; including 1) calculation of past depletions every 5 years as a 10-year moving average as determined by CWCB and reported to FWS & the Program; 2) a back-casted baseline of current depletions that can be used in projecting the impact of significant new depletions; and 3) a recommendation and justification regarding whether or not additional instream flow filings or other flow protection mechanisms should be considered in light of projected future depletions and other factors.	CWCB/FWS	In progress	X																X Still overdue; however, Wilson's Water Group (WWG) has been contracted by CWCB to provide updated depletion accounting in the Yampa River after the Colorado River accounting is completed. Draft anticipated by end of May 2017.
I.C.	<u>Little Snake River (Colorado and Wyoming)</u>																			
I.C.1.	Evaluate importance of Little Snake to endangered fishes and develop management action plan. (Determine if habitat exists to protect under Colorado's instream flow program.)	BR/LFL	Complete																	
I.C.2.	Initially identify year-round flows needed for recovery (needed).																			
I.C.2.a.	Develop work plan.	BR/LFL	Complete																	
I.C.2.b.	Identify flows.	FWS-WR	Complete																	
I.C.3.	Evaluate need for instream flow water rights.																			
I.C.3.a.	Review scientific basis.	CWCB/CDOW	Complete																	
I.C.3.b.	Assess legal and physical availability of water.	CWCB	Complete																	
I.C.3.c.	Assess compact considerations.	CWCB	Complete																	
I.C.3.d.	Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS/WAC	Pending																	See I.B.3.e.
I.C.3.d.(1)	If necessary, evaluate how identified flows will be legally protected.	CWCB/Wyoming	Pending																	
I.C.4.	Assess Wyoming's current and future water needs.	Wyoming	Complete																	
I.D.	<u>Yampa River below Little Snake River</u>																			
I.D.1.	Initially identify year-round flows needed for recovery.	FWS-FR	Complete																	
I.D.1.a.	Modify based on revisions to environmental baseline.	FWS-WR	Complete																	
I.D.1.b.	Update flow recommendations to include flows from the Little Snake River.	FWS	Complete																	
I.D.2.	Evaluate need for instream flow water rights.																			
I.D.2.a.	Review scientific basis.	CWCB/CDOW	Complete																	
I.D.2.b.	Assess legal and physical availability of water.	CWCB	Complete																	
I.D.2.c.	Assess compact considerations.	CWCB	Complete																	
I.D.2.d.	Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS/WAC	Pending																	See I.B.3.e.
I.D.2.d.(1)	If necessary, evaluate how identified flows will be legally protected.	CWCB	Pending																	
II.	RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)																			
II.A.	<u>Yampa River from Dinosaur National Monument to Craig, Colorado</u>																			
II.A.1.	Restore native fish passage at instream barriers and reduce impacts of maintaining diversion structures. Note: disturbance of fish habitat related to maintenance of diversion structures was evaluated and found to be minimal based on the limited area and duration of the disturbance.																			
II.A.1.a.	Inventory potential barriers.	CRWCD	Complete																	
II.A.1.b.	Determine threshold (passage) flows between Craig and Dinosaur National Monument (low-flow dependent).	CDOW/FWS	Complete																	
II.A.1.c.	Develop guidelines to facilitate fish passage at new diversion structures.	PD/FWS-ES	Complete																	
II.A.2.	Reduce/eliminate entrainment of Colorado pikeminnow at diversion structures.																			
II.A.2.a.	Identify and evaluate existing diversion structures for entrainment of Colorado pikeminnow. Hawkins 2009, Speas et al. 2014.	PD/FWS-ES	Complete																	
>*	II.A.2.b. Develop and implement remedial measures, as necessary, to reduce or eliminate entrainment.	PD/CPW/ FWS	TBD																	

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II.A.2.c.	Develop guidelines to reduce or eliminate entrainment at new diversion structures, if necessary.	PD/CDO/FWS	Complete													
II.A.3.	Review NPS/USGS report to assess potential for negative impacts of elevated pH to endangered fish.	Program	Complete													
III.	REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)															
III.A.	Develop guidance documents and revise as needed.															
III.A.1.	Develop aquatic management plan (Colorado) to reduce nonnative fish impacts while providing sportfishing opportunities. CDO 1998, 2010.	CDO	Complete													
III.A.2.	Develop Yampa River Nonnative Fish Control Strategy (Program)	Program	Complete													
>* III.B.	Implement CPW Yampa Basin aquatic wildlife management plan and the Recovery Program's Yampa River Nonnative Fish Control Strategy. Each control activity will be evaluated for effectiveness and then continued as needed. See also III.A.2.c.1. & 2. under General Recovery Program Support Action Plan.	Program/CPW	Complete													
III.B.1.	Prevent nonnative fish introduction; reduce invasion and recruitment.															
III.B.1.a.	Identify potential conflicts between present fisheries management in existing Elkhead Reservoir and endangered fishes and formulate Elkhead Lake Management Plan.	CDO	Complete													
III.B.1.a.(1)	Evaluate nonnative fish escapement and control options at Elkhead Reservoir (during and after Elkhead expansion construction). See Miller et al. 2005, Breton et al. 2013.	FWS-FR/CPW	Complete	X											Escapement prevention must be maintained as long as smallmouth bass and northern pike continue to reside in Elkhead Reservoir.	Escapement demonstrated to be detrimental to downstream endangered fish management. Elkhead outlet and spillway are now screened to prevent escapement of smallmouth bass and northern pike. Control within the reservoir guided by LMP, which proposes angler removal and largemouth bass stocking.
>* III.B.1.a.(2)	Implement control measures as needed to control escapement (during and after Elkhead expansion construction). Post-construction: monitor and maintain Elkhead screens (YS C-1).	Program	Complete	X	X	X	X	X	X	X	X	X	X	X	CPW will monitor and maintain Elkhead net per agreement with Program; CRWCD will maintain outlet screens.	Elkhead net installed in September 2016. Will be evaluated for performance in spring 2017. Elkhead outlet works continue to be screened.
III.B.1.a.(2)(a)	Establish compatible sportfishery in Elkhead Reservoir	CPW	Complete	X	X	X	X	X	X	X	X	X	X	X	CPW will continue to stock Elkhead Reservoir with replacement fisheries pursuant to the LMP and continue to manage against smallmouth bass and northern pike.	CPW finalized Elkhead Reservoir LMP, which proposes angler removal (harvest tournaments and unlimited harvest regulations) and stocking of largemouth bass as a replacement fishery. LMP revision completed. / 529 smallmouth bass were removed by anglers at the 2016 Elkhead Tournament
III.B.1.a.(2)(a)(i)	Revise Lake Management Plan	CPW	Complete													
III.B.1.a.(2)(a)(ii)	Install screen	CRWCD	Complete													/ Net, debris boom, anchors, and shore matting installed in September 2016 by Pacific Netting Products. Colorado Water Conservation District managed project design, permitting, and completion.
III.B.1.a.(2)(a)(iii)	Develop / Implement Communications Plan	CPW / Program	Complete	X	X											CPW and Program partners held public meeting April 2016 to discuss Elkhead LMP, net install, and Yampa River removal projects.
III.B.1.a.(2)(a)(iv)	Complete any necessary environmental compliance	CPW / CRWCD	Complete													NEPA completed February 2016: https://www.usbr.gov/uc/envdocs/ea/pdf/ElkheadReservoirFinalEA.pdf
III.B.1.a.(2)(v)	Identify and secure sources of replacement compatible sport fish.	CPW	Ongoing or Complete													CPW has stocking source (one of their hatcheries).
III.B.1.a.(2)(a)(vi)	Stock compatible sport fish.	CPW	Ongoing	X	X	X	X	X	X	X	X	X	X	X	CPW will stock replacement fisheries until populations no longer warrant stocking.	CPW stocked largemouth bass summer of 2016 with assistance of anglers.
>* III.B.1.a.(2)(a)(vii)	Evaluate reservoir and associated habitats in the upper Elkhead Creek drainage / treat if necessary.	CPW / Program / CRWCD	Pending												Treatment of Elkhead Reservoir is still an option if smallmouth bass population cannot be adequately reduced or contained with the current net and LMP.	CPW should investigate upstream habitats and make a determination of risk and future actions.
III.B.1.b.	Address escapement of northern pike from upstream reservoir sources.	Program	Ongoing	X	X	X	X	X	X	X	X	X	X	X	Continue addressing nonnative fish escapement at upstream reservoirs in the Yampa Basin through maintenance of escapement prevention devices and control actions.	CPW continues to plan to treat Chapman Reservoir, but needs reservoir mapping to determine size of reservoir for implementation.
>* III.B.1.b.(1)	Convert and extend the ongoing Stagecoach Reservoir northern pike escapement study to a removal effort of northern pike and walleye.	CPW / potentially Program in outyears	Pending													CPW will no longer tag northern pike and removes northern pike under standard sampling. CPW would require Program funding to implement a targeted removal effort of northern pike and walleye (currently CPW conducts monitoring and removes pike as part of that). CPW continues to work with Upper Yampa Water Conservancy District on northern pike control options at Stagecoach Reservoir. CPW continues to support harvest tournament at Stagecoach, and requires removal of walleye and northern pike.
III.B.1.b.(2)	Install escapement prevention at Lake Catamount	CPW / potentially Program in outyears	Pending	X	X	X	X	X	X	X	X	X	X	X		CPW has continued work at Catamount to reduce northern pike population. Population has shifted to smaller individuals and other species have increased in abundance. Program made initial contact with Catamount Metro District to discuss potential for net installation. Program to present to Metro District Board in summer 2017.
III.B.1.c	Identify and evaluate natural and artificial spawning/nursery habitats for northern pike in the Yampa River for exclusion devices.	CDO	Complete													
>* III.B.1.c.(1)	Implement remedial measures to reduce pike reproduction in Yampa River.	Program/CPW	Ongoing	X	X	X	X	X	X	X	X	X	X	X		CPW continues to net backwater habitats to disrupt spawning and remove large reproducing adults. 469 northern pike were removed via backwater netting in 2016 during 19 days. CPW would like to prolong this operation in future years for as long as nets are productive. CSU LFL and FWS continue to target backwater habitats in early season sampling to disrupt reproduction.

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III.B.1.c.(1)(a)	Evaluate feasibility of habitat modification at Walton Creek to eliminate / reduce northern pike spawning habitat. Bidelspach and Fairley 2015.	CPW / Program / BR	Complete										Feasibility study completed in 2015.
> III.B.1.c.(1)(b)	Modify Walton Creek habitat as indicated through feasibility investigations.	CPW / Program / BR	Pending										Project implementation on hold for now because costs exceed \$1 million, requiring important cost share from local stakeholders. Still a CPW priority and discussions ongoing. (Feasibility report ranked nine options, the two highest would cost \$1.3 and \$0.8 million respectively.)
III.B.1.d	Review proposed new structures to minimize creation of habitat suitable for pike spawning/nursery.	CPW, FWS	Ongoing	X	X	X	X	X	X	X	X	X	States, FWS, and local governments will continue to require nonnative fish management as a key component of floodplain modifications. Conflict can occur between desired and proposed wetlands creation/restoration in the upper Yampa River and the high density of northern pike due to the likelihood that additional wetland habitat would be invaded by northern pike or serve as reproduction/recruitment habitat. FWS & States comment on stream alteration actions. Review protocol needed with counties prior to pond construction in areas where undesirable nonnative fish may invade (e.g., golf course ponds). CPW and Program considering speaking to Routt County commissioners to request that new pond construction require screening.
III.B.1.e	Other emerging nonnative species	Program	Ongoing	X	X	X	X	X	X	X	X	X	Monitor fish community of the Yampa River and respond appropriately to any new introductions or proliferation of nonnative species. White sucker: see General, III.A.1.c.
III.B.2.	Control nonnative fishes via mechanical removal												
III.B.2.a.	Estimate nonnative abundance, status, trends & distribution (YS I-3)	Program	Ongoing	X	X	X	X	X	X	X	X	X	Monitor nonnative fish populations to track trends and distribution. Crews marked and released smallmouth bass in Little Yampa Canyon to preserve this long term dataset and estimate abundance. Crews marked and released smallmouth bass in the Echo Park/Split Mountain of the Green River reach to determine abundance.
III.B.2.b.	Develop and refine nonnative fish removal criteria (YS K-1)	Program	Ongoing	X	X	X	X						Breton et al. 2014 concluded 30 fish/mile was too high; model helps us understand implications of smallmouth bass population abundance and size structure. Nonnative Fish Strategy (2014) recommended minimizing smallmouth bass to the greatest extent possible to remove propagule pressure.
III.B.2.c.	Identify and evaluate gear types and methods to control nonnative fishes (YS I-5)	Program	Ongoing	X	X	X	X	X	X	X	X	X	Continually evaluate new gear for nonnative removal. CPW and FWS continue to use gill nets to remove northern pike. CSU LFL continues to use multiple gear types to remove smallmouth bass
> III.B.2.d.	Remove (formerly "and translocate") northern pike from Yampa River designated critical habitat. See Hawkins et al. 2005. (YS J-1)	CPW/FWS	Ongoing	X	X	X	X	X	X	X	X	X	States will monitor and continue removal actions at appropriate levels. During the 2015 sampling season, 540 northern pike were euthanized. Compared to 2015, the middle Yampa River section yielded an overall decreased electrofishing catch per unit effort, almost entirely attributable to the decline of a strong 2015 northern pike age class. Pike removed from backwater netting increased, likely because of better timing of net deployment during the spawning period. Pike produced in 2015 were still evident in 2016, but reduced in frequency. The lack of another large year class in 2016 lends credence to 2015 being an early reproduction year that preceded the netting effort, rather than a compensatory response of removal of large adults.
> III.B.2.d.(1)	Remove northern pike and smallmouth bass above Craig, CO (YS C-3)	CPW	Ongoing	X	X	X	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels. In 2016 crews euthanized 31 smallmouth bass, 2,302 white suckers, and 198 northern pike. More smallmouth bass and northern pike were removed in 2016 than 2015, and the number of white suckers removed increased, as it has every year since 2012, when white sucker removal began. Higher northern pike catch rates in 2016 resulted from focusing and recording effort in backwaters to increase efficiency and data resolution, not from noticeably higher pike densities. Lower northern pike catch rates in comparison to efforts previous to 2015 were likely a result of gill netting removal performed by CPW shortly before this project began in 2016.

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>	III.B.2.e.	Remove (formerly "and translocate") smallmouth bass. (YS J-1)	CPW	Ongoing	X	X	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels.	<p>X Efforts to reduce densities of this species in Little Yampa Canyon and other reaches of the Yampa River appear to be hampered by the immigration of smallmouth bass adults and recruits from adjacent reaches, particularly upstream sources which sustain propagule pressure and the proliferative/invasive capacity of this species.</p> <p>Population estimates for adult bass in Little Yampa Canyon in 2016 were 882 adult smallmouth bass and 2653 sub-adult smallmouth bass. Abundance of adult smallmouth bass was among the four lowest measured over the past 13 years. While slightly higher than the 611 observed in 2015, the population in Little Yampa Canyon has greatly declined from the strong year class produced in 2012 that reached adult size in 2014.</p> <p>In total, 13,702 smallmouth bass were removed by all gear types combined in all sampled reaches, including 7,670 juveniles (<100 mm), 3,736 sub-adults (100-199 mm), and 2,296 adults (≥200 mm) in all reaches.</p> <p>X More effort should be applied to the upper Maybell reach, and increased landowner outreach would be beneficial.</p> <p>2016 catch rates were down in Yampa Canyon compared to 2014 levels and continue to represent fish spawned in 2012 and 2013.</p> <p>2017 work will continue to intensify smallmouth bass removal / nesting disruption further into the spawning period (e.g., sampling schedules being extended to exploit smallmouth bass in post-peak flows on the Yampa).</p> <p>Smallmouth bass produced strong year classes in 2012 and 2013.</p>
	III.B.2.f.	Control channel catfish in Yampa Canyon by removing fish >400mm. (Previous focus shifted to smallmouth bass with catfish >400 mm removed during smallmouth bass removal.)	FWS	Ongoing	X	X	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels.	USFWS removed 32 channel catfish meeting the size threshold in 2016.
	III.B.2.g.	Develop and refine native fish response criteria (YS K-2)	Program	Complete										
	III.B.2.h.	Monitor native and endangered fish response (YS L-2)	Program	Ongoing	X	X	X	X	X	X	X	X	Monitor endangered fish populations under a monitoring plan.	<p>Compared to early sampling (2003-2004), Project #140 reports that native species richness in Little Yampa Canyon has increased as has abundance of native fishes and their frequency in samples between 2008 and 2011. However, 2012 -2016 numbers dropped precipitously compared to 2011. 2016 catches of native fish increased markedly compared to 2015.</p> <p>Comparison of native fish frequency and abundance in a control and treatment reach suggested that both nonnative predator removals, as well as environmental effects due mostly to higher water, are responsible for gains, and increase in bass reproduction in 2012 and 2013 are responsible for declines. Native species remain a strong component of the fish community in Lily Park and Yampa Canyon, which would presumably serve as a source to upstream reaches when nonnative predator abundances are reduced.</p> <p>Synthesis report of this data is included in FY16-17 Program Guidance.</p>
	III.B.2.i.	Remove bag and possession limits on warmwater nonnative sportfishes within critical habitat in Colorado.	CDOW	Complete										
	IV.	MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)												
	IV.A.	Yampa River in Dinosaur National Monument												
	IV.A.1.	Augment or restore populations as needed, and as guided by the Genetics Mgmt. Plan.												
	IV.A.1.a.	Develop integrated stocking plan for bonytail in the Yampa River.	CDOW	Complete										
>	IV.A.1.a.(1)	Implement stocking plan.	FWS/CPW	Ongoing	X	X	X	X	X	X	X			
	IV.A.1.b.	Research the survivability of young-of-year Gila species in transport and hatcheries.	FWS/CDOW	Complete										
	IV.A.1.c.	Evaluate stocking success as identified in monitoring plan for stocked fish.	LFL/FWS/States/PD	Ongoing	X	X	X	X	X	X	X			
	V.	MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)												

GREEN RIVER ACTION PLAN: DUCHESNE RIVER

	ACTIVITY	WHO	STATUS	FY 17 10/16-9/17	FY 18 10/17-9/18	FY 19 10/18-9/19	FY20 10/19- 9/20	FY21 10/20- 9/21	FY22 10/21- 9/22	FY23 10/22- 9/23	Post- Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X), (Focused on February 1, 2016 - January 31, 2017)
I.	PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)												
I.A.	Identify initial year-round flows needed for recovery.	FWS-ES	Complete										
I.A.1.	Conduct hydrology/water availability study.	UT	Complete										
I.A.2.	Conduct follow-up study to evaluate and refine flow recommendations.	FWS/UT	Complete										
I.B.	State acceptance of initial flow recommendations (dependent on development of initial flow recommendations).												
I.B.1.	Review scientific basis.	UT	Complete										
I.B.2.	Assess legal and physical availability of water. See Central Utah Water Conservancy District 2013.	UT, CUWCD, FWS	Ongoing	X	X								Duchesne River Working Group (DRWG) recommended updating Duchesne 2013 water management report (covered 2004-2011) at least every 5 years, as agreed upon by the DRWG. (WAC asked if this report adequately assesses legal & physical availability of water. It doesn't, rather, it reports on water actually delivered, but coordinated reservoir operations model [see I.C.1.a] looked at water availability.)
I.C.	Legally protect and deliver identified flows.	UT, CUWCD, FWS	Ongoing	X	X	X	X	X	X	X	X		Lower Duchesne River Workgroup stakeholders, primarily Central Utah Water Conservancy District, will continue to supply flows according to the 2005 Biological Opinion. The Duchesne River Basin snowpack peaked at 109% of normal in early April. The Program's Priority 1 target is a baseflow of 50 cfs at the Randlett gage as called for in the 2005 BO. To support this priority, a total of 5,225 AF of releases from Starvation Reservoir (beginning Apr 25) and Big Sand Wash Reservoir (beginning Jul 29) helped maintain flows above that minimum target for all but 18 days. The minimum baseflow at the gage was 35 cfs. 35 days fell below the Priority 4 target (Mar 1 to July 1) of 115 cfs. The average flow in Aug-Oct was 154 cfs. ! DOI has 1,500 af of leased water in Big Sand Wash, all of which af was used in 2016. Lease extended through 2020.
I.C.1.	Strawberry Valley Project.												
I.C.1.a.	Determine amount of water available from the Strawberry Valley Project for fish use. (BR/CUWCD completed coordinated reservoir operations model in 2003. Task completion part of I.D.1) (This is part of the coordinated reservoir operation in I.D.)	USBR/DOI/PD/ Strawberry Water Users	Ongoing as opportunity arises										Water may become available for temporary leasing through Section 207.
I.C.2.	Management of Daniels Transbasin Diversion.												
I.C.2.a.	Determine the amount of water available from the Daniels Diversion for endangered fish use and pattern and location for delivery. (BR/CUWCD completed coordinated reservoir operations model in 2003. Task completion part of I.D.1)	DOI/IBAT/FWS/ Mitig. Comm./ CUWCD/ Ute Tribe	Complete										
>*	I.C.2.b. Develop agreements if feasible to deliver and protect water available from the Daniels Diversion.	UT/IBAT /FWS/DOI/ Mitig.Comm./ CUWCD	TBD										Lower Duchesne River Workgroup stakeholders, primarily Central Utah Water Conservancy District, will continue to fulfill agreements. If deemed necessary, Utah State Engineer may need to determine additional ways to protect flows. Daniels Replacement Project water is being delivered to support Duchesne flows. Once released from Starvation Reservoir, this water is protected by agreement among the CCAA/SHA parties (as opposed to Utah State water law). CUWCD must internally manage this water in accordance with Central Utah Project Completion Act (CUPCA) provision (Public Law 102-575), project purposes as given in the congressionally-approved Supplement to the 1988 Definite Plan Report for the Bonneville Unit (DPR), and other CUWCD contracts.
I.D.	Coordinate reservoir operation.												
I.D.1.	Determine feasibility and benefits of coordinated reservoir operation.	BR/CUWCD/ DOI	Complete										
>*	I.D.2. Develop agreements if feasible to coordinate reservoir operations and protect flows to the Green River.	BR/CUWCD/ UT/Ute Tribe	Ongoing	X	X	X	X	X	X	X	X		Lower Duchesne River Workgroup stakeholders will continue to investigate ways to protect water to Green River. If deemed necessary, Utah State Engineer may need to determine additional ways to protect flows. The CCAA/SHA agreement legally protects flows to the Myton Diversion, but not all the way to the Green River. If the CCAA/SHA is successful, FWS recommends investigating how it might be modified to add water users between Myton and Green River, to protect flows all the way to the confluence. The flows currently appear be protected in practice, but not legally.
>*	I.D.2.a. Rehabilitate Myton Town diversion.	BR/CUWCD/ UT/Ute Tribe	Complete										Myton Diversion fish passage structure was in operation for 34 days in late spring 2016. No flannelmouth sucker, bluehead sucker, roundtail chub, or endangered fish were passed through the structure. Approximately 50 native fish and 153 invasive fish entered the structure. All invasive fish were removed from the river system. Flow in the structure was between 8 and 15 cfs.
I.E.	Examine the feasibility of other options for obtaining water.	BR/DOI/PD/ Ute Tribe	Ongoing	X	X	X	X	X	X	X	X		Lower Duchesne River Workgroup stakeholders will continue to investigate additional options for obtaining water until 50 cfs base flow is easily met in most water years. Water delivery continues to supply baseflows at a much improved rate, but available volumes and delivery constraints continue to preclude meeting base flows 100% of the summer period. Additional sources of water should continue to be investigated.
I.F.	Determine need and feasibility of additional gaging.	BR/FWS/UT	Complete										
I.F.1.	Construct additional gages, as needed.	TBD	Complete										

GREEN RIVER ACTION PLAN: DUCHESNE RIVER

I.G.	Evaluate and revise as needed, flow regimes to benefit endangered fish populations	FWS/Program	Pending						X						The Recovery Program is currently coordinating with the Northern Ute tribe to reinstate collaborative fish community investigations / nonnative predator control in the Duchesne River. Until we have gathered a significant body of new information we can not even consider reviewing or revising these flow recommendations.
III.	REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)														
III.A.	Reduce negative interactions between nonnative and endangered fishes.														
III.A.1.	Identify most damaging nonnative fishes.	UDWR	Complete												
III.A.2.	Assess options to control negative interactions from nonnative fishes from the Duchesne River to benefit Colorado pikeminnow and razorback sucker young-of-the-year.	UDWR	Complete												
III.A.3.	Implement and evaluate the effects of viable measures to control negative interactions from nonnative fishes. (See III.A.3. under Green River Mainstem Action Plan.)														
III.A.3.a.	Evaluate feasibility of screen on Bottle Hollow Reservoir to control nonnative fish escapement and explore alternative funding sources.	FWS-FAO/Ute Tribe/BOR	Complete												
>*	III.A.3.a.(1) If feasible and necessary, screen Bottle Hollow Reservoir	Ute Tribe	Complete												
III.A.3.b.	Evaluate escapement of nonnative fishes from Starvation Reservoir and the feasibility of screening.	UDWR	Complete												
III.A.3.b.(1)	If feasible and necessary, screen Starvation Reservoir	N/A	Being revisited; see below												
III.A.b (2)	Develop a management strategy to address escapement of walleye (and smallmouth bass) from Starvation Reservoir. <i>UDWR 2014.</i>	UDWR	Complete												Positive Barriers to Sportfish Escapement from Starvation Reservoir. August 2014. UDWR Publication Number 16-22. Starvation Lake Fisheries Management Plan completed fall 2016.
>*	III.A.b (3) Implement recommendations from the escapement strategy.	UDWR, CUWCD, USBR, Program	Ongoing	X	X	X	X	X	X	X	X	X			UDWR will maintain the Starvation escapement screen and continue to implement the lake management plan. / A modular, hard-wire temporary barrier was installed in 2015, operated during both 2015 and 2016, and cleaned consistently. Stilling basin chemically treated in 2015 and 2016 to remove escaped fish. 90% engineering of permanent barrier completed in 2015, with an estimated cost of \$400,000. Final barrier construction anticipated in fall 2017 by Provo BOR. / DWR finalized a Lake Management Plan in fall 2016, indicating potential for stocking of triploid walleye.
>*	III.A.3.c. Remove nonnative fish (smallmouth bass, channel catfish and northern pike). See III.A.2.c.1. & 2. under General Recovery Program Support Action Plan.	FWS-FR/Ute Tribe	On hold	X	X	X	X	X	X	X	X	X			UDWR and FWS will work with the Ute Tribe to implement removal at appropriate levels. X Extent of contribution of smallmouth bass and walleye from the Duchesne River entering the Green River remains unknown. X Ute Tribe no longer conducting nonnative fish removal activities, but has indicated interest to do so in 2018.

GREEN RIVER ACTION PLAN: WHITE RIVER

	ACTIVITY	WHO	STATUS	FY 17 10/16-9/17	FY 18 10/17-9/18	FY 19 10/18-9/19	FY20 10/19- 9/20	FY21 10/20- 9/21	FY22 10/21- 9/22	FY23 10/22- 9/23	Post- Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X), (Focused on February 1, 2016 - January 31, 2017)
I.	PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)												
I.A.	Assess need for tributary management plan for the White River.	PD	TBD										
I.A.1.	Estimate future water demands on the White River.	TBD	Pending	X									CWCB contracted with the Wilson Water Group (through the YWG Roundtable) to use StateMod to model current hydrologic conditions and water demands in the White River basin. This daily time step model will assist the Recovery Program by testing preliminary endangered fish flow targets against future demand scenarios. WWG will eventually expand the model into Utah down to the Green River confluence.
I.B.	Initially identify year-round flows needed for recovery.												
I.B.1.	Develop work plan.	FWS-FR	Complete										
I.B.2.	Identify flows. Initial report complete (Haines et al. 2004).	FWS-FR	In progress	X									Mr. Tom Econpouly (USFWS - Water Resources) has volunteered to lead this effort for the PDO. In 2017, biologists from UDWR and USFWS will assist the PDO by updating the biological basis for flow recommendations with new information gathered since 2010.
I.B.3.	Develop and implement a White River management plan	Program	Pending	X	X								A detailed schedule of work and coordination activities was developed by the PDO, TNC, the States of Colorado and Utah and White River water users this past year. Ultimately, the Recovery Program's flow recommendations, a White River Management Plan, and a White River PBO are currently scheduled for completion by summer 2018. (This also should incorporate ongoing work and recommendations of the Flow Protection workgroup.) The PDO and the State of Utah continue to reach out to and hopefully engage the Northern Ute Tribe as a partner in this process.
I.B.3.a.	Conduct programmatic Section 7 and NEPA compliance on recovery actions and a level of future water demand.	FWS	Pending	X	X	X							See I.B.3
I.C.	Evaluate how identified flows will be legally protected.	CWCB	Pending	X	X	X							See I.B.3
I.D.	State acceptance of initial flow recommendations (dependent on development of initial flow recommendations).												
I.D.1.	Review scientific basis, dependent on development of flow recommendations by FWS.	UT/CO	Pending	X									See I.B.3
I.D.2.	Assess legal and physical availability of water.	UT/CO	Complete										
I.D.3.	Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete										
I.D.4.	CWCB notice of intent to appropriate (in Colorado).	CWCB	On hold										
I.E.	Legally protect identified flows (dependent on development of initial flow recommendations).												
I.E.1.	Protect flows in Colorado.												Long term conservation flows will be identified in the White River Management Plan. This Management Plan (and the mechanism that implements it) could serve as a component of a future post-Program cooperative agreement.
I.E.1.a.	Appropriate.												
I.E.1.a.(1)	CWCB approval to appropriate.	CWCB	On hold										
>*	I.E.1.a.(2) Colorado Attorney Generals Office file date.	CWCB	On hold										
>*	I.E.1.a.(3) Water court adjudication (litigation dependent).	CWCB	On hold										
I.E.2.	Protect flows in Utah.												Long term conservation flows will be identified in the White River Management Plan. This Management Plan (and the mechanism that implements it) could serve as a component of a future post-Program cooperative agreement.
I.E.2.a.	Hold public meeting to establish future appropriation policy.	UT	Complete										
I.E.2.b.	Identify legal and technical process and schedule for streamflow protection.	UT	Pending	X	X	X							
>*	I.E.2.c. Implement process for streamflow protection.	UT	Pending										
I.F.	Evaluate and revise as needed flow regimes to benefit endangered fish populations.	FWS/Program	Ongoing	X	X	X	X						
II.	RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)												
II.A.	Restore native fish passage at instream barriers.												
II.A.1.	Assess and make recommendations for fish passage at Taylor Draw.	PD	Complete										
III.	REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)												
III.A.	Reduce negative interactions between nonnative and endangered fishes.												
III.A.1.	Monitor nonnative fishes in Kenney Reservoir and upstream. Initial assessment complete (Elmblad 1998).	CPW	Ongoing	X	X	X	X	X	X	X	X	CPW will continue to monitor fish communities upstream of Taylor Draw Dam.	May not have been sampled in 2016.
III.B.	Reduce negative impacts to endangered fishes from sportfish management activities.												
III.B.1.	Assess adequacy of current regulations and options (including harvest) to reduce negative impacts on native fishes from nonnative sportfish and options to reduce angling mortality on native fishes below Kenney Reservoir.	CDOW	Complete										
III.B.1.a.	If necessary, assess management options to reduce escapement of black crappie from Kenney Reservoir.	CDOW	Complete										

GREEN RIVER ACTION PLAN: WHITE RIVER

III.B.2.	Preclude new nonnative species introductions, translocations or invasions to preserve native species dominance within critical habitat.	Program	Ongoing	X	X	X	X	X	X	X	X	Monitor and implement appropriate actions.	X UDWR reports higher white sucker x flannelmouth sucker hybridization rates in the White River in 2015, which further increased slightly in 2016. See General III.A.1.c
III.B.2.a.	Determine and implement an adequate level of mechanical removal to reduce smallmouth bass.	CPW/UDWR/Program	Ongoing	X	X	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels.	X Significant increase in smallmouth bass population was first detected in 2011, removal projects began in 2012, and continue through 2016. Bass production was high in 2012 and 2013, primarily within Colorado. Catch rates in Colorado were higher in 2016 than the previous two years, where the highest densities of adults and spawning occur, but lower than the first two years of this project (2012 and 2013). Catch rates in Utah, where the smallmouth bass population is apparently still expanding and establishing, were higher this year than the previous three years. However, catch rates are impacted by across-year flow variability and changing removal strategies (especially in Utah). Three size classes were caught, demonstrating that successful reproduction and survival have occurred in this system for the past three years. Bass densities are highest in the uppermost section below Taylor Draw Dam. Efforts to reduce the abundance of smallmouth bass are as high as possible in the Colorado portion. Four additional removal days were added in the Utah portion in 2016 to allow for more targeted disruption of spawning adults.
V.	MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)												
V.A.	Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.												
V.A.1.	Determine relative abundance and fate of Colorado pikeminnow congregation below Kenney Reservoir.	FWS-FR	Complete										
V.A.2.	Monitor the White River fish community downstream of Kenney Reservoir to determine long-term effects of mainstream impoundment on the White River.	FWS-FR	Complete										

COLORADO RIVER ACTION PLAN

	ACTIVITY	WHO	STATUS	FY 17 10/16-9/17	FY 18 10/17-9/18	FY 19 10/18-9/19	FY20 10/19- 9/20	FY21 10/20- 9/21	FY22 10/21- 9/22	FY23 10/22- 9/23	Post- Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X), (Focused on February 1, 2016 - January 31, 2017)
I.	PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)												
I.A.	Colorado River above Gunnison River												
>*	I.A.1. Develop, issue and implement PBO.	FWS	Complete										
	I.A.2. Initially identify year-round flows needed for recovery.												
	I.A.2.a. Rifle to Roller Dam.	FWS-FR	Complete										
	I.A.2.b. Roller Dam to 15-Mile Reach.	FWS-FR	Complete										
	I.A.2.c. 15-Mile Reach.	FWS-FR	Complete										
	I.A.3. Provide a depletion accounting report as outlined in the 15-Mile Reach PBO.												
	I.A.3.a. Collect data.	CWCB/FWS-ES/BR	Ongoing	X	X	X	X	X	X	X	X		
	I.A.3.b. Develop consumptive use and losses report with CRDSS model to verify level of depletions.	CWCB	Complete										
	I.A.3.c. Calculate new depletions every 5 years (2006-2010, etc.) and record within the depletion report the Program and WAC determination regarding whether or not additional instream flow filings or other flow protection mechanisms should be considered.	CWCB	In progress	X			X				X		X Still overdue; however, in 2016 Wilson's Water Group (WWG) was contracted by CWCB to provide depletion accounting in the Colorado and then Yampa Rivers. There is concern with the change in the methodology used for crop consumption/evapotranspiration regarding initial versus current depletions. CWCB also firming up what was included in the historic accounting. Draft anticipated by end of April 2017.
	I.A.4. Evaluate need for instream flow water rights.												
	I.A.4.a. Rifle to Roller Dam (Dependent on initial flow recommendations).												
	I.A.4.a.(1) Assess legal and physical availability of water.	CWCB	Complete										
	I.A.4.a.(2) Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete										
	I.A.4.a.(3) Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS	Pending	X	X		X				X		X A draft 2015 15-Mile Reach PBO Review was distributed to the BC and WAC in August 2016. That review is currently being revised based on comments received from water user and environmental representatives. The determination for additional protection rests with the Program and WAC, but will be recorded within the CWCB depletion reports due every 5 years. The WAC discussed this in July and November 2011 and determined that additional permanent protection in the form of instream flow filings was not deemed necessary at this time. It appears unlikely that there have been significant new depletions in the Colorado River. A Flow Protection workgroup also has been formed to evaluate what kind of flow protection (e.g., conservation agreements) would be appropriate to succeed the Program.
	I.A.4.a.(3)(a) If necessary, evaluate how identified flows will be legally protected.	CWCB	On hold										
	I.A.4.b. Roller Dam to 15-Mile Reach (Dependent on initial flow recommendations).												
	I.A.4.b.(1) Assess legal and physical availability of water.	CWCB	Complete										
	I.A.4.b.(2) Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete										
	I.A.4.b.(3) Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS	Pending								X		See I.A.4.a.(3), above.
	I.A.4.b.(3)(a) If necessary, evaluate how identified flows will be legally protected.	CWCB	On hold										
	I.A.4.c. 15-Mile Reach.												
	I.A.4.c.(1) Instream flow water right secured - 581 cfs (July - September).		Complete										
	I.A.4.c.(2) Irrigation season return flows legally protected - 300 cfs.		Complete										
	I.A.5. Provide and legally protect instream flows pursuant to Colorado River PBO.												Snowpack in 2016 was above average, resulting in a peak at Cameo of 19,200 cfs which compares to 137% of average (14,000 cfs). The 2016 peak flow at the Palisade gage was 17,600 cfs. Through Coordinated Reservoir Operations (CROS), 29,374 AF was released from reservoirs to augment peak flows. The baseflow target for the 15-Mile Reach was 1,240 cfs. Including a total of 106,192AF of releases from the Green Mountain, Ruedi, Wolford, and Granby Reservoirs, flows generally were maintained in the 750 to 1,400 cfs range throughout the August - October period, averaging 1,010 cfs.
>*	I.A.5.a. Pursuant to Ruedi Biological Opinion (and subsequently, the 15-Mile Reach PBO), deliver 5,000af annually & an additional 5,000af 4 out of 5 years (ongoing and protect by short-term agreement).	BR/CWCB	Ongoing	X	X	X	X	X	X	X	X		See I.A.5, above.

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I.A.5.k.(2)	Develop acceptable cost-sharing agreement for escrow account to fund O&M costs.		Complete															
I.A.5.k.(3)	Conduct environmental assessment																	
>*	I.A.5.k.(4)	Design and construct features of the OMID project	In progress		X	X												A construction contract for the OMID regulating reservoir was awarded in FY 2016; a July 2017 completion date is projected. Orchard Mesa Irrigation District continued to line select canal reaches to eliminate system seepage losses. Planning and permitting activities for the final phases of the project are proceeding.
I.A.5.l.	Water Division 5 Coordinated Facilities Study (CFOPS).																	
I.A.5.l.(1)	Evaluate options for providing and protecting additional peak flows to the 15-Mile Reach. Phase I completed 2001; Phase II completed 2003 (Brown and Caldwell 2003).	Water Users	In progress															Several parties have reviewed the latest CFOPs draft and it is very close to completion.
>*	I.A.5.l.(2)	Deliver additional peak flows as determined feasible in the evaluation.	TBD	Ongoing	X	X	X	X	X	X	X	X						
I.A.6.	Review implementation of RIPRAP items to determine timely compliance with applicable schedules (every 2 yrs. beginning in 2003).	FWS	Ongoing		X		X		X		X	X						See I.A.4.a.(3) above; a draft 2015 15-Mile Reach PBO Review is being revised based on comments received.
I.B.	Colorado River from the Gunnison to the Colorado-Utah State line (Includes the 18-Mile Reach)																	
I.B.1.	Initially identify year-round flows needed for recovery.	FWS-FR	Complete															
I.B.2.	Evaluate how identified flows will be legally protected.	CWCB	On hold															
I.B.3.	State acceptance of initial flow recommendations.																	
I.B.3.a.	Review scientific basis, dependent on development of flow recommendations by FWS.	CWCB/CPW	Pending															
I.B.3.b.	Assess legal and physical availability of water.	CWCB	Complete															
I.B.3.c.	Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete															
I.B.3.d.	CWCB notice of intent to appropriate (in Colorado).	CWCB	On hold															
I.B.4.	Legally protect identified flows.																	
>*	I.B.4.a.	Acquire (see Colorado River above Gunnison and Gunnison River).																
I.B.4.b.	Appropriate.																	
I.B.4.b.(1)	CWCB approval to appropriate.	CWCB	On hold															
>*	I.B.4.b.(2)	Colorado Attorney Generals Office file date.	CWCB	On hold														
>*	I.B.4.b.(3)	Water court adjudication (litigation dependent).	CWCB	On hold														
I.B.4.c.	Deliver and legally protect flows from Aspinall (see Colorado River above Gunnison and Gunnison River).																	
>*	I.B.4.c.(1)	Operate Aspinall to provide test flows.	BR	Complete														
>*	I.B.4.c.(2)	Continue annual coordination meetings.	BR	Ongoing	X	X	X	X										
I.B.4.c.(3)	Operate Aspinall to provide flows pursuant to biological opinion and record of decision.																	Program is monitoring fish community in the Colorado River below the Gunnison River (Project # 163) (post-Gunnison PBO and Aspinall ROD, see IB5). This reach is also one of three which USBR is evaluating robustness of modeling for environmental factors (post Basin Supply and Demand Study).
I.B.4.c.(3)(a)	Determine if change in water right and/or contract is needed.	BR	Complete															
I.B.4.c.(3)(b)	Enter into contract if needed.	BR	Complete															
>*	I.B.4.c.(3)(c)	Deliver flows.	BR	Complete														
I.B.5.	Develop study plan to evaluate flow recommendations (Aspinall Study Plan)	Program	Complete															
I.B.5.a.	Monitor Physical Response in the Colorado River to the Proposed Action																	
I.B.5.a.(1)	Collect aerial photography during the peak flows to determine area of floodplain inundation at floodplain sites (Valdez and Nelson 2006)	BR																
I.B.5.a.(2)	Collect aerial photography during base flows to monitor channel width and complexity and to serve as base maps for habitat mapping.	BR																
I.B.5.a.(3)	Repeat depth-to-embeddedness surveys in the 18-mile reach.	TBD																
I.B.5.b.	Monitor Biological Responses in the Colorado River to the Proposed Action																	
I.B.5.b.(1)	Initiate a fish community monitoring study in Colorado River main channel and floodplain habitats (focus on 18-mile reach)	CPW/FWS	Ongoing		X	X	X	X										
I.B.5.b.(2)	Assess primary and secondary productivity in cobble bars (runs and riffles)	TBD	Pending															
I.B.5.b.(3)	Continue ongoing fish community monitoring (CPM and HBC pop estimation; CPM Age-0 monitoring)	FWS/UDWR	Ongoing		X	X	X	X										
I.B.6.	Integrate and synthesize information to evaluate and recommend necessary revision of the proposed action	Program	In progress															
I.C.	Colorado River from Colorado-Utah State line to Green River																	
I.C.1.	Initially identify year-round flows needed for recovery.	FWS-FR	Complete															
I.C.2.	State acceptance of initial flow recommendations.																	
I.C.2.a.	Review scientific basis.	UT	Pending															
I.C.2.b.	Assess legal and physical availability of water.	UT	Pending															
I.C.3.	Legally protect identified flows.																	
I.C.3.a.	Hold public meeting to establish future appropriation policy.	UT	Pending															
I.C.3.b.	Adopt and implement new policy (new appropriations subject to flow criteria).	UT	Pending															

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>*	I.C.3.c.	Prepare and execute contracts with water users as required to subordinate diversions associated with approved and/or perfected rights.	UT	Pending														
	I.D.	Colorado River below Green River																
	I.D.1.	Initially identify year-round flows needed for recovery.	FWS	Pending	X	X												After evaluation of flow recommendations in the Gunnison, Colorado, and Green rivers is completed, the Service needs to determine if combination of Colorado and Green River flows below the confluence are adequate for recovery.
	I.D.2.	Assess adequacy of combined flows from Colorado and Green rivers to provide fish habitat (and meet recovery goals) in the Cataract Canyon reach of the Colorado River.	FWS	Pending	X	X												See comment under 1.D.1, above.
	I.E.	Evaluate and revise as needed flow regimes to benefit endangered fish populations. See also 1.B.5.	FWS/Program	Ongoing	X	X	X	X										
	II.	RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)																
	II.A.	Restore and manage flooded bottomland habitat.																
	II.A.1.	29-5/8 Road Gravel Pit (became part of larger "Hot Spot Complex" in 2003.)																
	II.A.1.a.	Develop and approve management plans.	FWS-FR	Complete														
	II.A.1.b.	Site design/complete environmental compliance.	BR	Complete														
>*	II.A.1.c.	Construct.	BR	Complete														
>*	II.A.1.d.	Operate and maintain.	BR	TBD, revisit as needed														
	II.A.1.e.	Monitor and evaluate success; modify as needed.	FWS-FR	TBD, revisit as needed														
	II.A.2.	Adobe Creek.																
	II.A.2.a.	Develop and approve management plans.	FWS-FR	Complete														
	II.A.2.b.	Site design/complete environmental compliance.	BR	Complete														
>*	II.A.2.c.	Construct.	BR	Complete														
>*	II.A.2.d.	Operate and maintain.	BR	TBD, revisit as needed														
	II.A.2.e.	Monitor and evaluate success; modify as needed.	FWS-FR	TBD, revisit as needed														
	II.A.3.	Walter Walker.																
	II.A.3.a.	Develop and approve management plans.	FWS-FR	Complete														
	II.A.3.b.	Site design/complete environmental compliance.	BR	Complete														
>*	II.A.3.c.	Construct.	BR	Complete														
>*	II.A.3.d.	Operate and maintain.	BR/FWS/ CDO	TBD, revisit as needed														
	II.A.3.e.	Monitor and evaluate success; modify as needed.	FWS-FR	TBD, revisit as needed														
	II.A.4.	Develop and implement levee removal strategy at high-priority sites.																
	II.A.4.a.	Preconstruction (contaminants screening, floodability assessments, environmental compliance, design & engineering.	BR/FWS	Complete														
>*	II.A.4.b.	Construction (levee breaching) [NOTE: Subject to review and approval for depression wetlands.]	BR	Complete														
>*	II.A.4.c.	Operate and maintain.	BR/FWS	Complete														
	II.A.4.d.	Evaluation	FWS	Complete														
	II.A.5.	Acquire interest in high-priority flooded bottomland habitats.																
	II.A.5.a.	Identify and evaluate sites.	FWS	Complete														
	II.A.5.b.	Pre-acquisition planning and identification of acquisition options.	PD	Complete														
	II.A.5.c.	Conduct appraisal/NEPA compliance.	PD	Complete														
>*	II.A.5.d.	Negotiate and acquire.	PD	Complete														
	II.A.5.e.	Evaluate effectiveness of land acquisition activities and provide recommendations	PD	Complete														
	II.A.6.	Develop Colorado River Subbasin Floodplain Management Plan	Program	Complete														
>*	II.A.6.a.	Implement, validate and refine Colorado River Subbasin Floodplain Management Plan	Program	Ongoing	X	X	X	X	X	X	X	X						

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II.B.	Restore native fish passage at instream barriers.														See fish passage data under II.B.1.b.(3) and II.B.3.a.(2). Fish salvage was performed in the GVIC system in November 2015, collecting a total of 1,005 stranded fish. This included two razorback sucker that had been stocked in 2014 in the Colorado River at Rifle, CO. Fish salvage in the GVWU Canal collected 49,101 fish. This also included two razorback sucker stocked in the Colorado River at Rifle in 2014. A meeting with Grand Valley irrigators was not held in 2016. Their annual reports and commitments to maintaining fish screens are invaluable. In all years there was frequent communication during the irrigation season via the weekly HUP calls. Biannual irrigation coordination meetings (chaired by USBR with Grand Valley Water Users, Irrigation Companies, Service, and Program staff) continued in 2016.
II.B.1.	Restore passage at Grand Valley Irrigation Co. Diversion Dam (Palisade)														
II.B.1.a.	Evaluate and implement viable options to restore fish passage.	BR/FWS	Complete												
II.B.1.a.(1)	Obtain landowner consent/agreement.	BR	Complete												
II.B.1.a.(2)	Site design/environmental compliance.	BR	Complete												
>*	II.B.1.a.(3) Construct.	BR	Complete												
>*	II.B.1.a.(4) Operate and maintain.	FWS-FR/BR	Ongoing	X	X	X	X	X	X	X	X	X	X	The GVIC passage will need to be maintained and operated in perpetuity.	
II.B.1.a.(5)	Monitor and evaluate success.	FWS-FR/BR	Complete												
II.B.1.b.	Screen GVIC diversion to prevent endangered fish entrainment, if warranted.														
II.B.1.b.(1)	Design.	BR	Complete												
>*	II.B.1.b.(2) Construct.	BR	Complete												
>*	II.B.1.b.(3) Operate and maintain.	FWS-FR/BR	Ongoing	X	X	X	X	X	X	X	X	X	X	The GVIC screen will need to be maintained and operated in perpetuity.	GVIC fish passage screens were operated 78% of the time during the Apr 4 through Aug 23 in 2016. Shutdowns to deal with excessive debris, algae, river elevations, or mechanical issues resulted in 165 days on, 46 days off.
II.B.2.	Restore fish passage at Price Stubb.														
II.B.2.a.	Evaluate and implement viable options.														
II.B.2.a.(1)	Obtain landowner consent/agreement.	BR	Complete												
II.B.2.a.(2)	Site design/environmental compliance.	BR	Complete												
>*	II.B.2.a.(3) Construct.	BR	Complete												
>*	II.B.2.a.(4) Operate and maintain.	BR	Ongoing	X	X	X	X	X	X	X	X	X	X	Maintenance (primarily debris removal at the upstream entry point) will need to be conducted in perpetuity. The State of Colorado and the USFWS will need to determine if continued operation of the PIT antenna is worthwhile.	The Price-Stubb PIT tag antennas (at river mile 188.3) produced multiple hits on 536 unique PIT tags during FY 2016. Six native species were detected including endangered bonytail (n=126), razorback sucker (n=36), and Colorado pikeminnow (n=13). See project 16 annual report for greater detail.
II.B.2.a.(5)	Monitor and evaluate success.	FWS-FR/BR	Ongoing	X	X	X	X	X	X	X	X	X	X		
II.B.3.	Restore fish passage at Government Highline (aka Grand Valley Project or Roller Dam).														
II.B.3.a.	Evaluate and implement viable options.														
II.B.3.a.(1)	Site design/environmental compliance.	BR	Complete												
>*	II.B.3.a.(2) Construct.	BR	Complete												
>*	II.B.3.a.(3) Operate and maintain.	BR	Ongoing	X	X	X	X	X	X	X	X	X	X	The GVP passage will need to be maintained and operated in perpetuity.	The fish passage at the GVWU dam was used by a total of 15,889 fish over a 136-day period in 2016 (25 Apr through 14 Oct), the third-highest ever documented for the facility. This included 36 razorback sucker and 44 bonytail. Colorado pikeminnow were also documented using this passage for the third consecutive year. Native fishes accounted for 86.6% of the total catch in 2016. The roller closest to the fish passage was opened for several weeks during 2016 spring high flow to help sluice away a sediment accumulated in 2015. Multiple rainstorm spikes in summer 2016 again created sediment deposition challenges, and it has been proposed that the large, heavily-vegetated portion of the left riverbank immediately upstream of the fish ladder be physically removed (would require significant excavation). (Sluicing is generally adequate when high flows are available.)
II.B.3.a.(4)	Monitor and evaluate success.	FWS-FR/BR	Ongoing	X	X	X	X								
II.B.3.b.	Screen Government Highline diversion to prevent endangered fish entrainment.														
II.B.3.b.(1)	Design.	BR	Complete												
>*	II.B.3.b.(2) Construct.	BR	Complete												
>*	II.B.3.b.(3) Operate and maintain.	FWS-FR/BR	Ongoing	X	X	X	X	X	X	X	X	X	X	The GVP screen will need to be maintained and operated in perpetuity.	Operation of the GVWUA screen in 2016 began on Mar 26 and terminated Oct 28. The screens were operated for approximately 95% of the total irrigation season. The fish screen was bypassed fully for a total of only 14 hours for maintenance. The brushes ran for a total of 680 hours in 2016.

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II.C.	Support actions to reduce or eliminate contaminant impacts. [NOTE: Contaminants remediation (in all reaches) will be conducted independently of and funded outside of the Recovery Program.]												USFWS ES in Grand Junction continues to work with the local mosquito control agency to prevent mosquito exposure of endangered Colorado River fish in backwater and wetland habitat in approximately 30 miles of the Colorado and Gunnison rivers. The total treatment area is approximately 73 square miles (46,720 acres). USFWS has collected data on 6 – 8 tributaries that enter the 18- mile reach of the Colorado River. An area of concern is the outflow from the Fruita wastewater treatment facility that flows into a backwater that endangered fish are known to use. Contaminants found in the wastewater effluent and downstream include a suite of pharmaceuticals including antidepressants, blood pressure medications, narcotics, and several others. Sampling for pesticides, pharmaceuticals, etc., in 2015 moved from sites in the Grand Valley to sites in the Uncompahgre Valley between Delta and Montrose. Continued sampling was planned for the Uncompahgre Valley in 2016. Barb Osmundson working with wastewater treatment plants in the Grand Valley and encouraging the remaining two (Fruita and Clifton) to add effluent diffusers.
II.C.1.	Support actions to reduce or eliminate contaminant impacts of selenium in the Grand Valley.	FWS-ES	Ongoing	X	X	X	X	X	X	X	X	X	USBR and FWS Grand Junction EC staff remained involved with both the Gunnison Basin Selenium Task Force and Grand Valley Selenium Task Force. The latter dropped the temperature probe at Colorado River at State-Line, but the Recovery Program and the River District split the cost and will continue to support this probe operated by USGS.
II.C.2.	Support remediation of groundwater contamination at the Atlas Mill tailings site.	FWS-ES	Ongoing	X	X	X	X						
II.C.3.	Identify measures to minimize risk of hazardous materials spills in Black Rocks and Westwater Canyon from transport along the adjacent railway to protect humpback chub populations.	FWS-ES	Ongoing	X	X	X	X						EPA has developed a Sub-Area Spill Contingency Plan for the Green River and is now developing the same for the Colorado River drainage. EPA initiated planning efforts for this plan in 2015 and Colorado EC staff has participated in these planning meetings and activities since early February of 2015.
III.	REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)												
III.A.	Develop and implement control programs in reaches of the Colorado River occupied by endangered fishes. Each control activity will be evaluated for effectiveness and then continued as needed. See III.A.2.c.1.& 2. under General Recovery Program Support Action Plan.												
III.A.1.	Determine relationship between Aspinall test flows and nonnative fish abundance.	UDWR/ FWS-FR	Complete										
>*	III.A.2. Reclaim ponds in critical habitat.	CDOW	Complete										
	III.A.2.a. Evaluate and make recommendations.	CDOW	Complete										
III.A.3.	Nonnative cyprinids and centrarchids in nursery habitats.												
III.A.3.a.	Remove small nonnative cyprinids from backwaters and other low velocity habitats.	CDOW/UDWR	Complete										
III.A.3.b.	Remove nonnative centrarchids from backwaters and other low velocity habitats.	FWS	Complete										
III.A.4.	Preclude escapement from ponds in critical habitat as needed and feasible.												CPW constructed a Merwin trap for the Mamm Creek Pit #1 and operated it in 2016. CPW visited the pond 23 times, using the trap and multiple gears to remove over 3,000 fish, 292 of which were pike and the majority of the rest of which were largemouth bass. CPW also removed fish from two other Mamm Creek ponds, in both of which pike were present in low densities.
III.A.4.a.	Evaluate sources of nonnative fishes and make recommendations.	CPW/FWS	Ongoing										Continue to determine sources of problematic nonnative fishes and make recommendations as needed. See General, III.C for discussion of isotopic analysis.
III.A.4.b.	Screen Rifle Creek below Rifle Gap Dam (non-Program funds).												CPW will continue to operate and maintain screen.
	III.A.4.b.(1) Design with appropriate peer review	CPW/BOR /FWS	Complete										
>*	III.A.4.b.(2) Construct screen (2013)	CPW	Complete										
	III.A.4.b.(3) Finalize lake management plan, per Nonnative Fish Stocking Procedures	CPW	Complete										Rifle Gap LMP finalized in summer of 2015. LMP includes harvest regulations that promote removal of northern pike and smallmouth bass; agency removal of northern pike, smallmouth bass, and fertile walleye; public outreach related to the nonnative fish problem; and continued operation of the screen. CPW will stock triploid walleye back in Rifle Gap Reservoir to promote angler satisfaction.
	III.A.4.b.(4) Conduct follow-up monitoring prior to and following stocking to determine effectiveness of screen.	CPW	Ongoing	X	X	X	X	X	X	X	X	X	CPW will continue to monitor the screen for effectiveness. Fish escapement past the screen is being evaluated for five years (see biological opinion). Screen was demonstrated to exclude a broad range of fish sizes (e.g., northern pike smaller than 20mm and larger than 500mm) and no pike were detected below the screen in 2016.
>*	III.A.5. Develop and implement program to identify required level of channel catfish control.	FWS	On hold										

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>*	III.A.6.	Develop and implement program to identify required level of smallmouth bass control.	FWS/CPW	Ongoing	X	X	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Crews removed 482 smallmouth bass in 2016. Catches of age-0 smallmouth bass indicate a weak year class (< 100 mm) was produced in 2016 in the Grand Valley reaches of the Upper Colorado. The catch rate for YOY and juvenile size smallmouth bass < 100 mm increased (48%) from 2015. The catch rate for adult smallmouth bass > 200 mm increased (3%) from 2015.
>*	III.A.7.	Develop and implement program to identify required level of northern pike control.	FWS/CPW	Ongoing	X	X	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Northern pike are not common in Colorado River removal efforts. Seven adult northern pike were removed by CPW and USFWS crews in 2016, all greater than 600mm.
>*	III.A.8.	Walleye in the middle and lower Green River	Program	Ongoing	X	X	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	X Walleye captures in the Colorado River went from being 'rare' during 2003-2009 to 'common' in 2010, and then increased dramatically by 2013. Distribution within the lower reach in 2010 appeared to be restricted to the lowest 80 miles of the study area (ending at the Green River confluence); however, by 2013, captures extended upstream to RM 112 at the top of the lower reach, indicating upstream range expansion. Unlike smallmouth and largemouth bass, whose primary distribution is in the upper reach, walleye directly overlap with small size classes of both Colorado pikeminnow and razorback sucker. In 2016, field crews removed a total of 56 adult walleye throughout the upper Colorado River, primarily under targeted walleye removal efforts. Targeted efforts to remove walleye were split fairly evenly between spring and fall and concentrated on the reach between Cottonwood Wash (RM 112.3) below Westwater Canyon to Potash, UT (RM 47.2). While spring walleye catch rates remained relatively unchanged, between 2015 and 2016, our fall catch rates declined from 1.04 fish/hr. (2015) to 0.45 fish/hr. (2016).
	III.A.9	Other emerging nonnative fishes.	Program	Ongoing	X	X	X	X	X	X	X	X	Monitor fish community of the Colorado River and respond appropriately to any new introductions or proliferation of nonnative species.	Gizzard shad populations expanded upstream of Lake Powell during the mid 2000s, invading both the Green and Colorado Rivers. This expansion may be exacerbating the increase in walleye numbers. Larval grass carp were confirmed from Lake Powell in 2015, representing the first instance of this species reproducing in the UCR basin. All grass carp stocking in the upper basin states is required to be with triploid (sterile) fish.
>*	III.A.10.	Upstream of Grand Valley Project dam: Determine and implement an adequate level of mechanical removal in the main channel. More importantly, use all techniques available to eradicate northern pike (and other nonnative species of concern) from floodplain habitats.	CPW/Program	Ongoing	X	X	X	X	X	X	X	X	Monitor fish community of the Colorado River and respond appropriately to any new introductions or proliferation of nonnative species.	CPW removed fish from Silt to Beavertail. Catch rates were low for problematic predators (3 northern pike and 9 smallmouth bass), but substantial numbers of green sunfish were removed. Non-native fish removal in Grand Valley gravel pit ponds resulted in the removal of 4,852 fish. These removal efforts resulted in capture of 445 razorback sucker and 4 bonytail which were released to the Colorado and Gunnison rivers.
	III.B.	Reduce negative impacts to endangered fishes from sportfish management activities.												
>*	III.B.1.	Evaluate control options and implement measures to control nonnative fish escapement from Highline Reservoir.	CDOW/CRWCD	Complete										
	III.B.1.a.	Operate and maintain Highline Reservoir net.	CPW	Ongoing	X	X	X	X	X	X	X	X	CPW will maintain Highline Reservoir net (and it will need to be replaced periodically).	The net was replaced for the second time on March 14, 2014, is currently in good shape and performing as designed. CPW performed 4 net cleanings in 2016. Gizzard shad were first discovered in Highline Lake during standard annual sampling in October, 2015, and continue to be very abundant. Possible sources include the Government Highline Canal, illegal introductions and/or illegal use of live fish as bait. No gizzard shad were collected in Mack Wash downstream of Highline Lake in 2015 or 2016, suggesting the net has been effective in preventing escapement from Highline Lake.
	III.B.1.b.	Evaluate Highline Reservoir net.	CDOW	Complete										
	III.B.2.	Remove bag and possession limits on warmwater nonnative sportfishes within critical habitat in Colorado.	CDOW	Complete										
	III.B.3.	Develop basinwide aquatic management plan to reduce nonnative fish impacts while providing sportfishing opportunities.	CDOW	Complete										
>*	III.B.3.a.	Implement CPW's Colorado River Aquatic Management Plan.	CPW	Ongoing	X	X	X	X	X	X	X	X		
	IV.	MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHERIES)												
	IV.A.	Augment or restore populations as needed, and as guided by the Genetics Management Plan.												
	IV.A.1.	Razorback sucker.												
	IV.A.1.a.	Develop experimental augmentation plan and seek Program acceptance.	FWS-FR	Complete										
	IV.A.1.b.	Implement experimental augmentation plan.												
>	IV.A.1.b.(1)	Stock fish.	FWS-FR	Complete										
	IV.A.1.b.(2)	Monitor and evaluate results; make recommendations regarding further augmentation.	FWS-FR	Complete										
	IV.A.2.	Monitor the fish community in the upper Colorado River (above Palisade) and develop management action plan, including recommendations for Colorado pikeminnow and razorback sucker augmentation.	CDOW	Complete										

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	ACTIVITY	WHO	STATUS	FY 17 10/16-9/17	FY 18 10/17-9/18	FY 19 10/18-9/19	FY20 10/19- 9/20	FY21 10/20- 9/21	FY22 10/21- 9/22	FY23 10/22- 9/23	Post- Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X), (Focused on February 1, 2016 - January 31, 2017)
I.	PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)												
I.A.	Identify fish habitat and flow needs.												
I.A.1.	Initially identify year-round flows needed for recovery (Flow recommendations will be provided upon completion of Aspinall Unit studies.)												
I.A.1.a.	Complete draft technical synthesis report.	FWS	Complete										
I.A.1.b.	Complete draft biological assessment.	BR	Complete										
I.A.1.c.	Complete final technical synthesis report.	FWS	Complete										
I.A.1.d.	Complete final biological assessment.	BR	Complete										
I.A.1.e.	Complete draft NEPA document .	BR	Complete										
I.A.1.f.	Complete final NEPA document and record of decision.	BR	Complete										
I.A.1.g.	Complete ESA Section 7 consultation resulting in a programmatic biological opinion (PBO) for the Gunnison Basin.	FWS/BR/ WAPA	Complete										
I.B.	State acceptance of initial flow recommendations (Flow recommendations will be provided upon completion of Aspinall Unit studies.)												
I.B.1.	Review scientific basis, dependent on development of flow recommendations by FWS.	CWCB/CDOW	Complete										
I.B.2.	Assess legal and physical availability of water.	CWCB	Complete										
I.B.3.	Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete										
I.B.4.	CWCB notice of intent to appropriate (in Colorado).	CWCB	On hold										
I.C.	Legally protect identified flows.												
I.C.1.	Acquire (flow recommendations will be provided upon completion of Aspinall Unit studies.)												
I.C.1.a.	Assess, acquire and convert water rights to instream flows.	CWCB	On hold										
I.C.2.	Appropriate (flow recommendations will be provided upon completion of Aspinall Unit studies.)												
I.C.2.a.	CWCB approval to appropriate.	CWCB	On hold										
>*	I.C.2.b. Colorado Attorney General's Office file date.	CWCB	On hold										
>*	I.C.2.c. Water court adjudication (litigation dependent).	CWCB	On hold										
I.C.3.	Deliver.												
>*	I.C.3.a. Aspinall Unit supplemental releases to maintain 2,000 cfs minimum flow at Colorado-Utah state line 9 out of 10 years. Provide annual report. (Through 2001 only.)	BR	Complete										
I.C.3.b.	Flows from Aspinall Unit for research studies.												
>*	I.C.3.b.(1) Deliver flows.	BR	Complete										
>*	I.C.3.b.(2) Protect research flows.	FWS/BR/ CWCB	Complete										
>*	I.C.3.c. Continue annual coordination meetings.	BR	Ongoing	X	X	X	X	X	X	X	X	USBR will continue coordination & releases.	
I.C.3.d.	Flows from Paonia Reservoir in accordance with FWS Horsethief Biological Opinion.												
>*	I.C.3.d.(1) Deliver flows.	BR	Ongoing	X	X	X	X	X	X	X	X	USBR will continue coordination & releases.	
I.C.3.e.	Flows from Aspinall Unit pursuant to Aspinall Biological Opinion and record of decision..												The May 1, 2016, forecast inflow for Blue Mesa Reservoir was an "Average Dry" 525 KAF, corresponding to a target peak flow at the Whitewater gage of 10 days at half bankfull (8,070 cfs), and an Aug-Dec baseflow of 1,050 cfs. The actual Blue Mesa inflow volume was 602,000 acre-feet (15% greater than forecast), due to late-arriving precipitation. A peak of 9,900 cfs was achieved at the Whitewater gage, with 10 days above half-bankfull. Baseflow was maintained above 1,050 for the entire Aug-Dec period.
I.C.3.e.(1)	Determine if change in water right and/or contract is needed.	BR	Complete										
I.C.3.e.(2)	Enter into contract if needed.	BR	Complete										
>*	I.C.3.e.(3) Deliver flows.	BR	Ongoing	X	X	X	X	X	X	X	X	USBR will continue coordination & releases.	
I.C.3.e.(3)(a)	Study Gunnison River return flows to determine consumptive use to be charged against flow deliveries.	USGS	Complete										
I.D.	Evaluate and revise as needed flow regimes to benefit endangered fish populations. (Data series summarizing 2005-2008 daily sediment sampling on Gunnison, Green and Duchesne rivers completed [Williams et al. 2009] and scientific investigations report [Williams et al. 2013] completed)	FWS/Program	Ongoing	X	X	X	X						In 2016, USGS repeated proof-of-concept study using hydrophones to capture the ascending limb of hydrograph to understand at what flow bedload begins to move (a "surrogate technology" which may replace more traditional bedload sampling, which is very expensive and can be dangerous). See also Peak Flow Technical Supplement discussion under General, I.A.4.a. Results presented by Toby Minear at 2017 Researchers meeting (Toby is now at CU).
I.D.1.	Develop study plan to evaluate flow recommendations / evaluate Selenium Management Program.	FWS/BOR/ WAPA	Complete										
I.D.1.a.	Monitor Physical Response in the Gunnison River to the Proposed Action.												
I.D.1.a.(1)	Reinstate sediment monitoring in the Gunnison River as directed by project 85f.	Program	New start										See General I.A.4.a.

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I.D.1.a.(2)	Collect aerial photography during the peak flows to determine area of floodplain inundation at Escalante SWA and other sites.	Program	Pending																See General I.A.4.a.
I.D.1.a.(3)	Collect aerial photography during base flows to monitor channel width and complexity and to serve as base maps for habitat mapping.	BR	Pending																
I.D.1.a.(4)	Repeat depth-to-embeddedness (DTE) surveys in the Escalante area.	BR	New start																
I.D.1.a.(5)	Evaluate the effect of operations to meet the Proposed Action on the Gunnison River thermal regime.	BR	New start																
I.D.1.b.	Monitor Biological Responses in the Gunnison River to the Proposed Action.																		
I.D.1.b.(1)	Initiate a fish community monitoring study in Gunnison River main channel and floodplain habitats.	CPW/FWS	Ongoing	X	X	X	X												
I.D.1.b.(2)	Assess primary and secondary productivity in cobble bars (runs and riffles).	TBD	Pending																
I.D.1.c.	Support Reclamation's Selenium Management Program.																		
I.D.1.c.(1)	Collect tissues from endangered fish (or surrogate species) as directed by FWS (coordinated with fish community monitoring, I.D.1.b.(1)).	CPW/FWS	Ongoing	X	X	X	X												For contaminants evaluation, muscle plugs collected again in 2016 from endangered fish and surrogate species (evaluation funded outside of Program). Results from this selenium study will be used in the new Selenium Management Program (SMP) to determine baseline selenium concentrations and evaluate effectiveness of selenium remediation efforts.
I.D.1.c.(2)	Investigate selenium toxicity in razorback sucker.	FWS	New start	X	X	X	X												From 2010-2012, muscle plugs were collected and analyzed in native fish, including 4 bonytail and 4 Colorado pikeminnow and analyzed for selenium. Bonytail concentrations ranged from 0.8 to 8.6 ug/g, which may be a function of how long they reside in the Gunnison River or Butch Craig pond after hatchery release. Selenium in one of the three Colorado pikeminnow exceeded the toxicity guideline of 8 ug/g DW. One pikeminnow captured July 2012 was recaptured October 2012 and its selenium load had increased from 2.9 to 5.1 ug./g DW. Selenium in recently-released hatchery-reared razorback sucker had <2 ug/g DW, but a razorback later caught in the Gunnison River had 7.3 ug/g DW, approaching the 8 ug/g DW toxicity guideline. Final report was to have been completed in 2016.
I.D.2.	Integrate and synthesize information to evaluate and recommend necessary revision of the proposed action (implement flow recommendation)	Program	New start		X	X													The 2016 checkpoint may need to be deferred based on limited range of flow conditions evaluated to date.
I.D.3.	Evaluate bed-load transport in gravel and cobble-bed portions of the Gunnison River below Hartland Dam (Peak Flow Tech Supplement priority).	Program	New start	X															Toby Minnear conducted pilot hydrophone study in 2014 and 2016; report anticipated in 2017.
I.E.	Initiate investigations of the feasibility of modifying releases from Aspinall Unit dams to increase water temperatures that would allow for upstream expansion of Colorado pikeminnow in the Gunnison River.	BR/Contract	Complete																
II.	RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)																		
II.A.	Restore and manage flooded bottomland habitat.																		
II.A.1.	Develop management plan for Escalante State Wildlife Area.		Complete 5/94																
II.A.2.	Develop and implement levee removal strategy at high-priority sites.																		
II.A.2.a.	Preconstruction (contaminants screening, floodability assessments, environmental compliance, design & engineering).	BR	Complete																
>* II.A.2.b.	Construction (levee removal)	BR	Complete																
II.A.2.c.	Operate and maintain.	BR/FWS	Complete																
II.A.2.d.	Evaluation.	FWS	Complete																
II.A.3.	Acquire interest in high-priority flooded bottomland habitats.																		
II.A.3.a.	Identify and evaluate sites.	FWS	Complete																
II.A.3.b.	Pre-acquisition planning and identification of acquisition options.	PD	Complete																
II.A.3.c.	Conduct appraisal/NEPA compliance.	PD	Complete																
>* II.A.3.d.	Negotiate & acquire.	PD	Complete																
II.A.3.e.	Evaluate effectiveness of land acquisition activities and provide recommendations.	PD	Complete																
>* II.A.4.	Develop and implement Colorado River Subbasin Floodplain Management Plan (Valdez and Nelson 2004b).	Program	Ongoing	X	X	X	X												
II.B.	Restore native fish passage at instream barriers.																		
II.B.1.	Restore passage at Redlands.																		
II.B.1.a.	Assess and make recommendations for fish passage.	FWS	Complete																
II.B.1.b.	Implement viable options to restore fish passage.																		
II.B.1.b.(1)	Design passage, conduct NEPA compliance.	BR	Complete																
>* II.B.1.b.(2)	Construct fish ladder.	BR	Complete																

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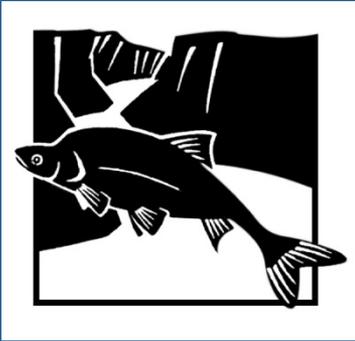
>	II.B.1.c.	Operate and maintain fish ladder.	FWS-FR/BR	Ongoing	X	X	X	X	X	X	X	X	X	The Redlands fish ladder will need to be maintained and operated in perpetuity.	! In 2016, the Redlands fish passageway was operational from 25 April to 14 October. This was the 21st year of operation. An annual record 33 Colorado pikeminnow were captured this year, bringing the total captured at this site since 1996 to 180. One razorback sucker was captured, bringing the 21-year total to 35. Thirty-three bonytail were captured, the second-highest of any year of operation. A total of 10,347 fish of all species were handled at the Redlands fish passage between 25 April and 14 Oct. Native fishes composed 72% of the total in 2016. Overall, native fish account for about 82% of all fish processed during the 21 years of this passageway's operation. All 33 pikeminnow and 17 of the bonytail were translocated to the Gunnison River at Escalante, river mile 42.7. One of these fish was detected on a PIT antenna at Roubideau Creek in summer 2016.
	II.B.1.d.	Monitor and evaluate success.	FWS-FR/BR	Complete											
	II.B.1.e	Identify minimum flows below Redlands Diversion Dam.	FWS-FR	Complete											
>	II.B.1.f.	Deliver flows below Redlands.	BR	Ongoing	X	X	X	X	X	X	X	X	X	USBR will continue to provide flows for passage operation.	
	II.B.1.g.	Screen Redlands diversion structure to prevent endangered fish entrapment.													
	II.B.1.g.(1)	Design.	BR	Complete											
>	II.B.1.g.(2)	Construct.	BR	Complete											
>	II.B.1.h.	Operate and maintain fish screen.	Redlands	Ongoing	X	X	X	X	X	X	X	X	X	The Redlands fish screen will need to be maintained and operated in perpetuity.	! The Redlands fish screen was put online 02 May 2016 and was taken off line at the end of the irrigation season on 24 Oct 2016. The screen was bypassed only for a portion of one day in May (stuck activator switch) and for 5 days in July (broken trash rake). The Redlands screen was operational for 96.6% of the entire 2016 irrigation season.
	II.B.2.	Restore passage at Hartland.													
	II.B.2.a.	Assess and make recommendations for fish passage. (Passage at Hartland not identified as necessary for recovery in species' recovery goals).	FWS-FR	Complete											
	II.B.2.b.	Evaluate viable options to restore fish passage.	BR	Complete											
	II.B.2.c.	Support local interests in efforts to pursue removal of the Hartland Diversion dam. [NOTE: These efforts will be conducted independently of and funded outside of the Recovery Program]	BR/FWS/PD	Complete											
	II.B.2.d.	Screen Hartland diversion to prevent endangered fish entrapment, if warranted.		Complete											
	II.B.2.d.(1)	Assess need.	BR/FWS/PD	Complete											
	III.	REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)													
	III.A.	Reduce negative interactions between nonnative and endangered fishes.													
>	III.A.1.	Reclaim ponds in critical habitat	CDOW	Complete											
	III.A.1.a.	Evaluate and make recommendations.	CDOW	Complete											
	III.A.2.	Develop basinwide aquatic management plan to reduce nonnative fish impacts while providing sportfishing opportunities.	CDOW	Complete											
>	III.A.2.a.	Implement CPW's Gunnison River Aquatic Management Plan.	CPW	Ongoing	X	X	X	X	X	X	X	X	X	CPW will continue to implement plan.	
	III.A.3.	Preclude new nonnative species introductions, translocations or invasions to preserve native species dominance within critical habitat.	Program	Ongoing	X	X	X	X	X	X	X	X	X	Monitor and implement appropriate actions.	Riverine habitats in the Gunnison River drainage remain a native fish stronghold. All manner of prevention needs to take place to prevent nonnative fish from colonizing the Gunnison River.
>	III.A.3.a	Install <i>and maintain</i> net to prevent escapement of smallmouth bass at Ridgway Reservoir.	CPW / BR	Ongoing	X	X	X	X	X	X	X	X	X	Stakeholders will continue to operate and maintain net per agreements (in development). CPW will continue to implement revised LMP (in draft).	Illegal introduction of smallmouth bass in Ridgway Reservoir was confirmed in 2013. Sampling demonstrated multiple size classes, but low densities of adult fish, indicating the population may be expanding from initial introduction. Densities of smallmouth bass near the spillway were high, indicating a high risk of escarpment from reservoir spilling. ! CPW implemented an unlimited harvest of smallmouth bass beginning on April 1, 2015. ! TriCounty Water Conservancy District successfully avoided spills from 2014 through 2016. A working group focused on installing a nonnative fish escapement solution (likely a net) last met in January 2017. USBR will purchase a net once design criteria are finalized, with design criteria the same as Elkhead. ! CPW conducted a harvest tournament for smallmouth bass in summer 2015 and 2016. They estimate that 35% and 24% of the smallmouth bass population was removed during the tournament in 2015 and 2016, respectively.

COLORADO RIVER ACTION PLAN: GUNNISON RIVER

III.A.3.b	Implement control measures to prevent escapement of northern pike at Crawford Reservoir.	CPW	Ongoing	X	X	X	X	X	X	X	X	X	Northern pike removal in Crawford Reservoir continues. In 2008, a pilot project was conducted to determine if mechanical removal of northern pike would be effective. The project showed that 24% of the pike population could be removed with gill netting during the spawning season. In 2014-2015 the mechanical removal project was continued with 68% of the adult pike population removed in 2015. CPW has drafted a possible water management strategy to further limit the pike production at Crawford, however USBR analyzed the water management interests at the reservoir and determined that the pike suppression strategies would likely limit storage and delivery capabilities.
IV.	MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)												
IV.A.	Augment or restore populations as needed and as guided by the Genetics Management Plan.												
IV.A.1.	Razorback sucker.												
IV.A.1.a.	Develop experimental augmentation plan and seek Program acceptance.	FWS-FR	Complete										
IV.A.1.b.	Implement experimental augmentation plan. (Goal: 10 adults/river mile.)												
> IV.A.1.b.(1)	Stock fish.	FWS-FR	Complete										
IV.A.1.b.(2)	Monitor and evaluate results; make recommendations regarding further augmentation.	FWS-FR	Complete										
IV.A.2.	Develop integrated stocking plan for Colorado pikeminnow in the Gunnison River.												
IV.A.2.a.	Program acceptance.		Complete										
> IV.A.2.b.	Implement Colorado pikeminnow integrated stocking plan.	CPW/FWS	On hold										
IV.A.2.c.	Evaluate stocking success as identified in monitoring plan for stocked fish.	FWS/CPW	On hold										
IV.A.3.	Develop integrated stocking plan for razorback sucker in the Gunnison River.												
IV.A.3.a.	Program acceptance.		Complete										
> IV.A.3.b.	Implement razorback sucker integrated stocking plan.	CPW/FWS	Ongoing	X	X	X	X						
IV.A.3.c.	Evaluate stocking success as identified in monitoring plan for stocked fish.	LFL/FWS/ STATES/PD	Ongoing	X	X	X	X						All life stages being monitored through project 163. See General, V.A.1.a.
V.	MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)												
V.A.	Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.												
V.A.1.	Conduct Colorado pikeminnow and razorback sucker inventory in Gunnison River above Redlands.	FWS-FR	Complete										
V.A.2.	Identify additional spawning sites of endangered fishes on the Gunnison River.	FWS-FR	Ongoing	X	X	X	X						Gunnison River fish community monitoring ongoing (Project #163).

COLORADO RIVER ACTION PLAN: DOLORES RIVER

	ACTIVITY	WHO	STATUS	FY 17 10/16-9/17	FY 18 10/17-9/18	FY 19 10/18-9/19	FY20 10/19- 9/20	FY21 10/20- 9/21	FY22 10/21- 9/22	FY23 10/22- 9/23	Post- Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X), (Focused on February 1, 2016 - January 31, 2017)
III.	REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)												
III.A.	Reduce negative interactions between nonnative and endangered fishes.												
III.A.1.	Assess need and options to control nonnative fish escapement from McPhee Reservoir.	BR	Complete										
III.B.	Reduce negative impacts to endangered fishes from sportfish management activities.												
III.B.1.	Identify potential conflicts between present fish management practices in McPhee Reservoir and endangered fishes and formulate an alternative management plan.	CDOW	Complete										
III.B.2.	Recovery Program needs to determine if nonnative fishes in the Dolores River basin pose a threat to endangered fishes and determine appropriate response.	CPW											X Persistence and increasing numbers of smallmouth bass in the upper Dolores River raise concern that the Dolores may become an additional source for this invasive species in the Colorado River. Walleye are in McPhee Reservoir, but have not been captured downstream in the Dolores River in more than two decades of sampling. (Catches of walleye in the Colorado River are high near the confluence with the Dolores, but their origin is unknown.) In 2012, response options discussed with CPW, USBR and others to consider possible smallmouth bass removal action in 2012 or beyond (and propose action item(s) to be added to the RIPRAP in 2013). Lower Dolores River Monitoring, Implementation & Evaluation Plan (see O7), which contains objectives for nonnative fish monitoring and removal. Otoliths have been collected for analysis of spawning chronology (to relate to flow manipulation). FWS Grand Junction and USGS Lakewood will analyze walleye otoliths to ensure that no walleye from the lower Colorado demonstrate McPhee markers.
>*	III.B.2.a. Reclaim Miramonte Reservoir.	CPW	Complete 2013										
V.	MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)												
V.A.	Survey native and nonnative fish in Dolores River (UDWR funding outside of Program).	UDWR/USBR/CPW	Complete										Installation of two PIT antennas in the Dolores River near Disappointment Creek and upstream of confluence with the Colorado River to monitor native fishes completed in 2014.

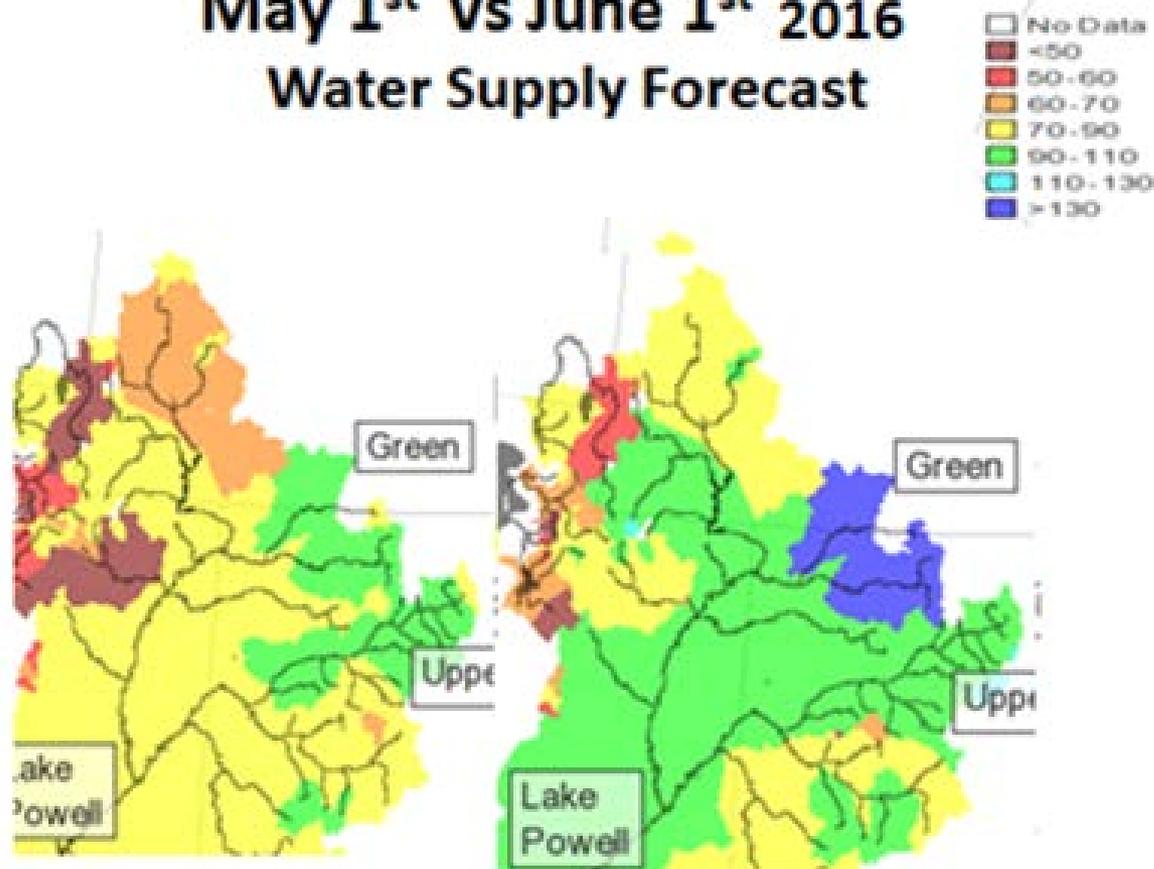


5.0 2017 RIPRAP Flow Management Assessment



GENERAL

May 1st vs June 1st 2016 Water Supply Forecast



Just like Miracle May in 2015, large precipitation events occurred late in May of 2016 and the May 1st forecast limited flows for the Recovery Program in Flaming Gorge and the Aspinnall Units
<https://www.cbrfc.noaa.gov/wsup/wsup.php>

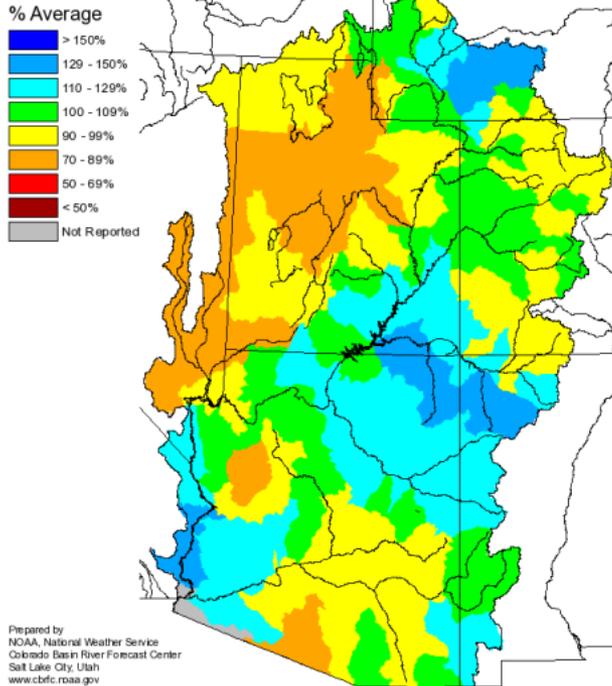
2016 Spring Peak Flows

River	Location	Annual Peak Mean Daily Flow		% of Avg Peak
		Long-term Mean	2016	
Yampa	<i>Deerlodge Park</i>	12,500	15,600	125%
Green	<i>Jensen</i>	16,500	20,500	124%
White	<i>Watson</i>	2,400	2,320	96%
Green	<i>Green River</i>	18,500	24,200	131%
Colorado	<i>Cameo</i>	19,000	19,200	101%
Colorado	<i>Palisade</i>	17,363	17,600	101%
Gunnison	<i>Grand Junction</i>	8,000	9,920	124%
Colorado	<i>Cisco</i>	23,000	24,500	107%
San Juan	<i>Bluff</i>	11,730	8,140	69%

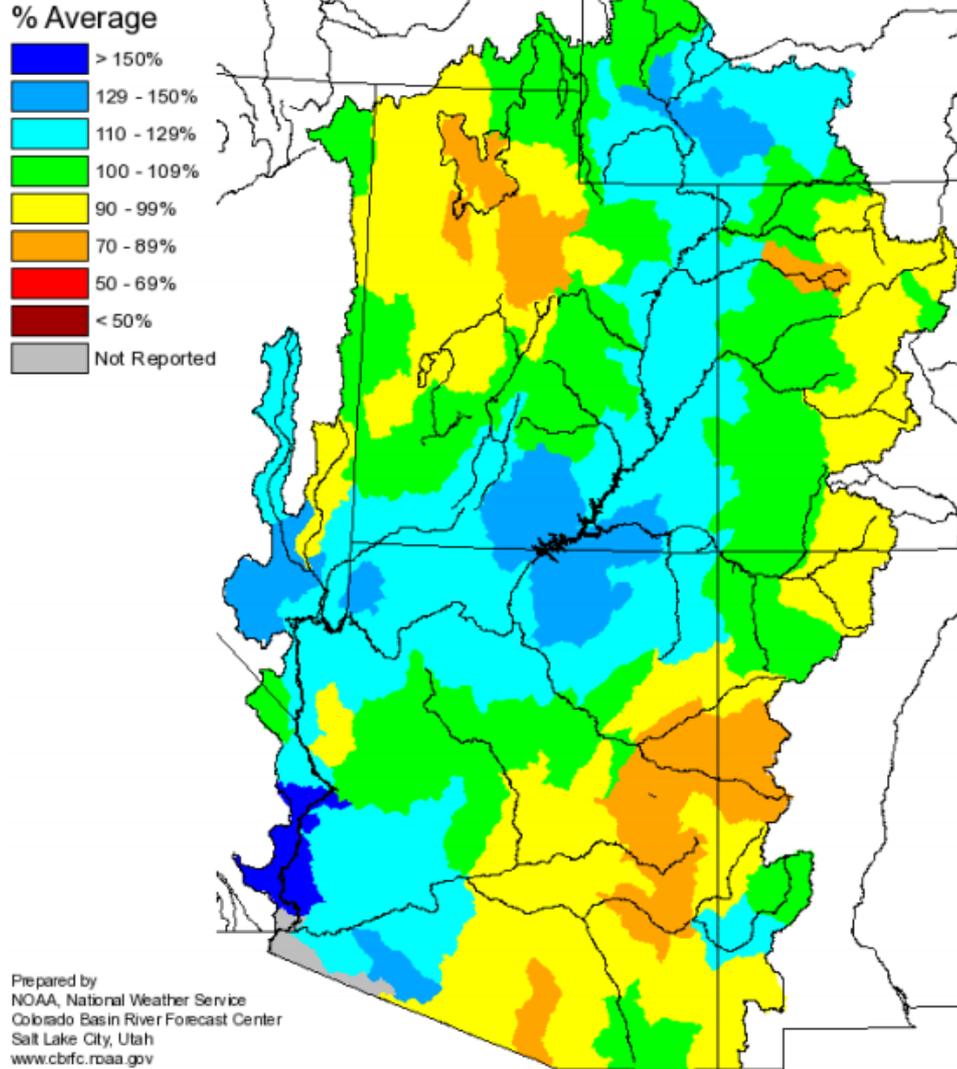
2016 Base Flow Targets

River	Location	% Aug-Oct Avg	Minimum
Yampa	<i>Maybell</i>	58%	83
Yampa	<i>Deerlodge Park</i>	60%	138
Green	<i>Jensen</i>	97%	1,770
White	<i>Watson</i>	82%	145
Green	<i>Green River</i>	99%	1,940
Colorado	<i>Cameo</i>	93%	2,010
Colorado	<i>Palisade</i>	80%	657
Gunnison	<i>Grand Junction</i>	139%	1,580
Colorado	<i>Cisco</i>	104%	3,470
San Juan	<i>Bluff</i>	48%	500

Seasonal Precipitation, October 2014 - September 2015
(Averaged by Hydrologic Unit)



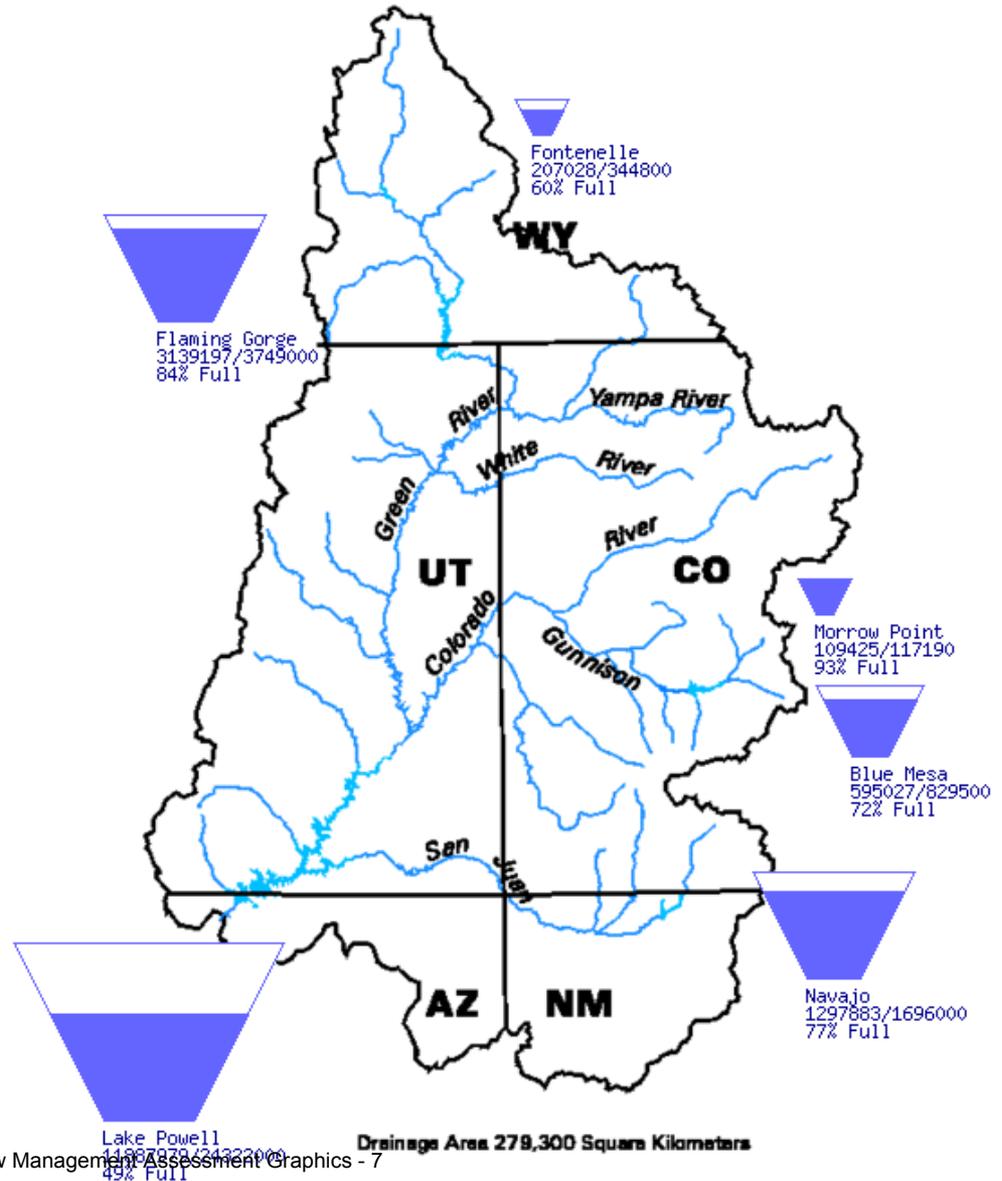
Seasonal Precipitation, October 2015 - September 2016
(Averaged by Hydrologic Unit)



Upper Colorado River Basin Hydrology

The water year 2016 unregulated inflow volume to Lake Powell was 9.62 maf (89 percent of average). The period 2000-2016 is the lowest 17-year period since the closure of Glen Canyon Dam in 1963, with an average unregulated inflow of 8.57 maf, or 79 percent of the 30-year average (1981-2010). At the beginning of water year 2017, total system storage in the Colorado River Basin was 30.7 maf (51 percent of 59.6 maf total system capacity). This is nearly the same as the total storage at the beginning of water year 2016 which began at 30.8 maf (52 percent of capacity). (USBR 2016)

Upper Colorado River Drainage Basin



CRSP System Storage 2016

Observed April-July Inflow
Percent of Average Volume

- Fontenelle – 106%
- Flaming Gorge – 106%
- Blue Mesa – 105%
- Navajo – 84%
- Lake Powell – 94%

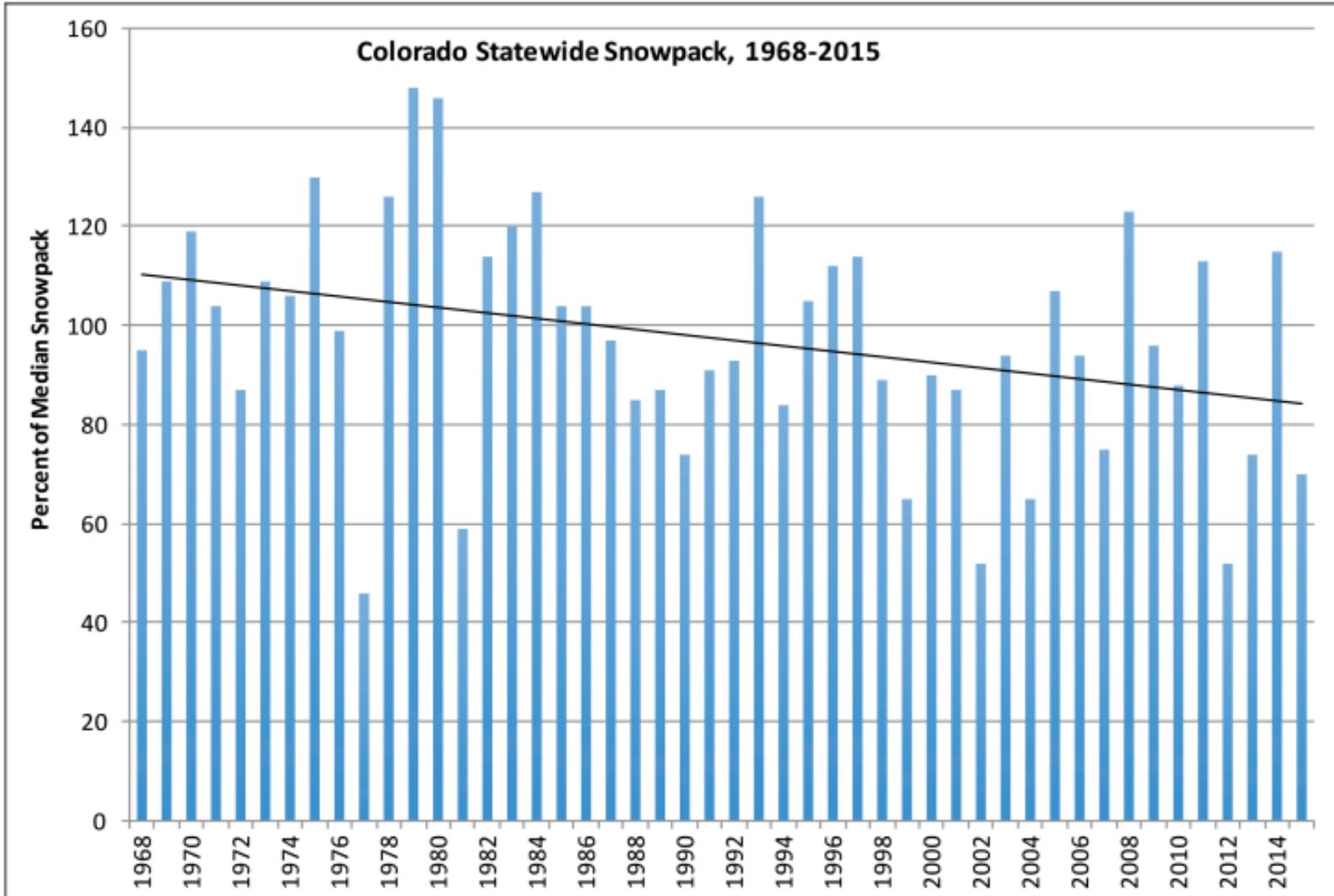
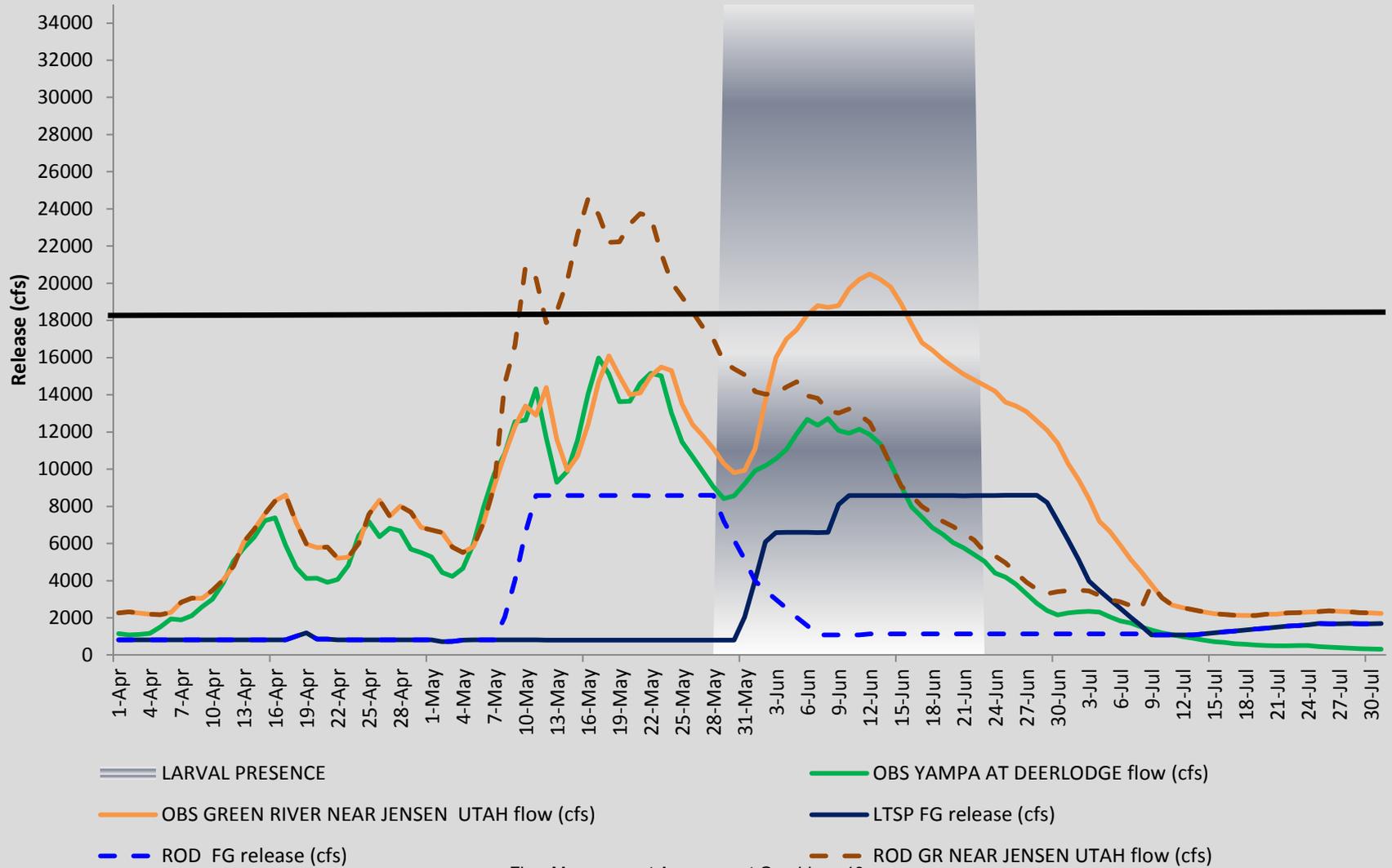


Figure 4. Statewide April 1 snow water equivalent as measured by the NRCS from 1968-2015 shows a decreasing trendline. Data Source: nrcs.usda.gov/wps/portal/nrcs/detail/co/snow/products/?cid=nrcs144p2_063325

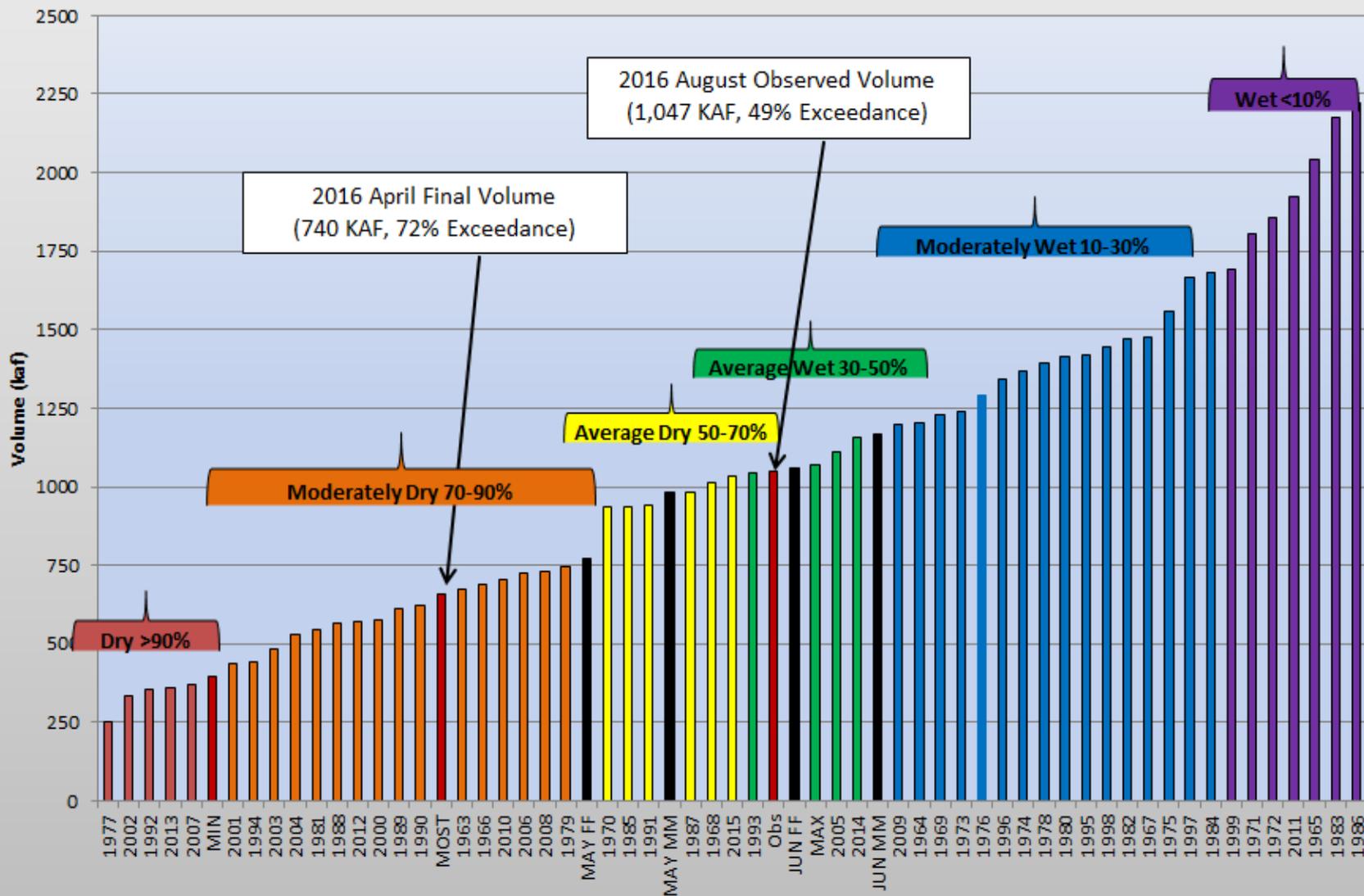
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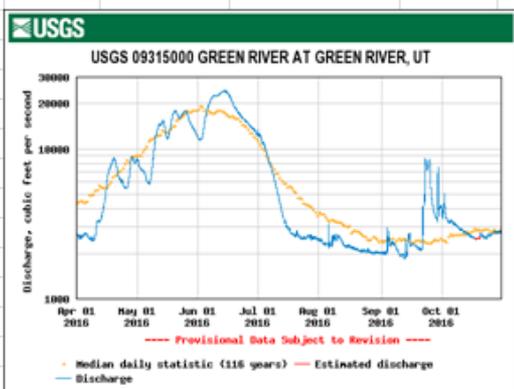
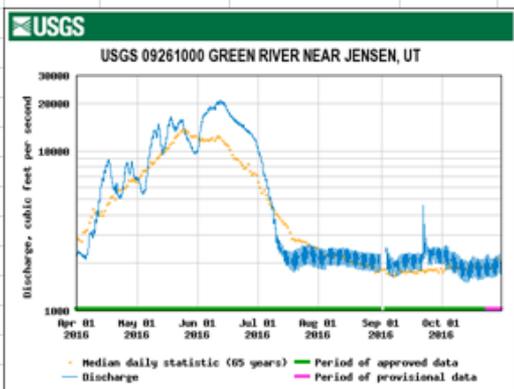
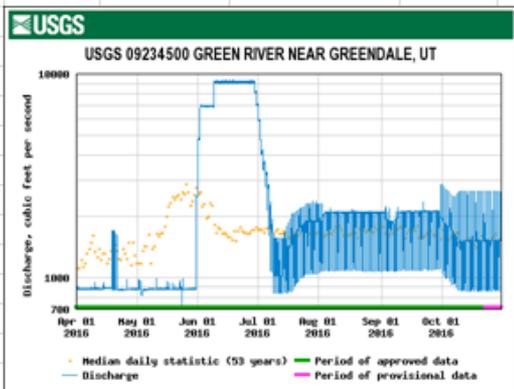
GREEN RIVER

FG Release and Green River Flows April-July 2016



Flaming Gorge Reservoir Historic April-July Unregulated Inflow Volume Ranking (1963-2015)





Colorado Basin River Forecast Center Upper Green Group

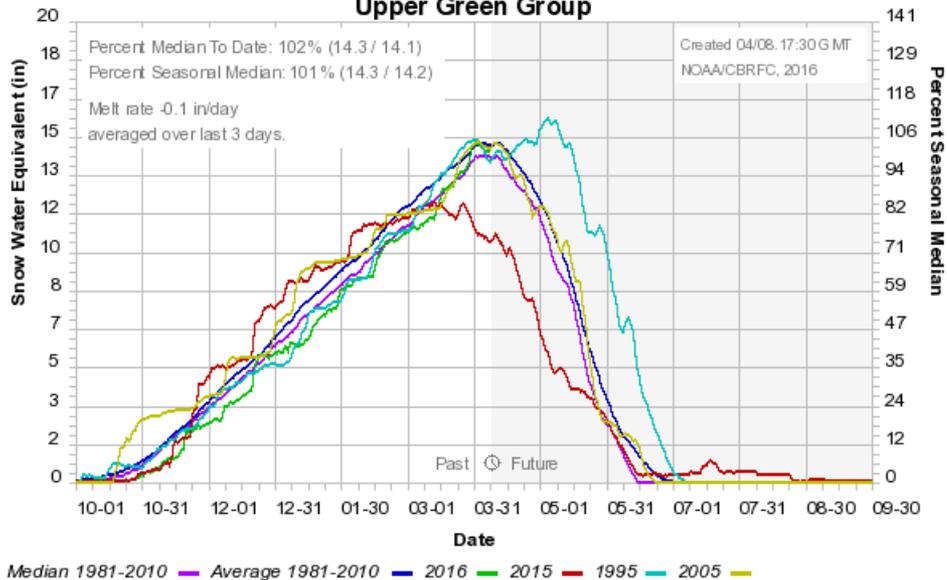
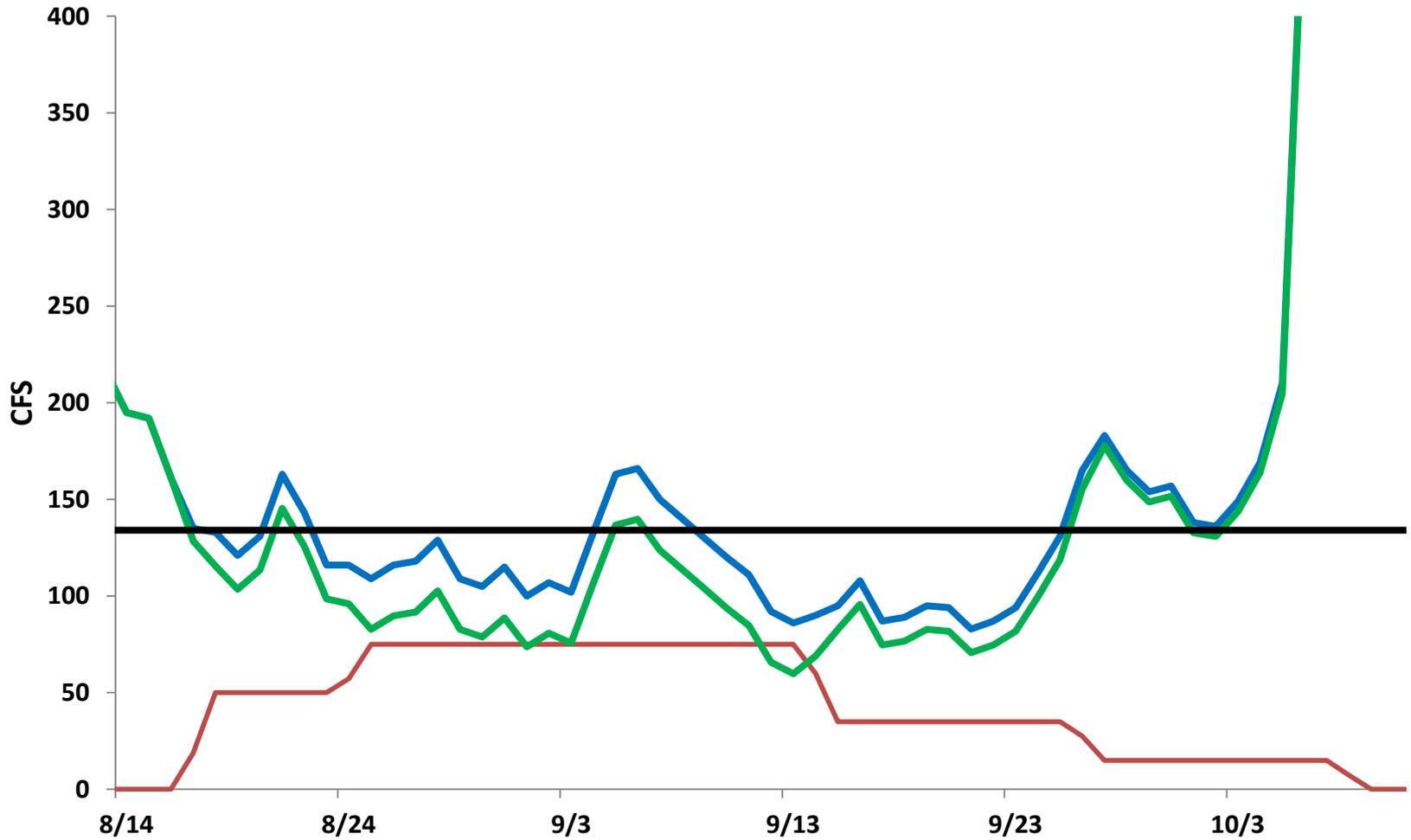


FIGURE 1. Upper Green River Basin Snotel Tracking. 1981-2010 percent of median compared against 2016 YTD Snow Water Equivalent (SWE) and 1995, 2005 and 2015 percent of average SWE

YAMPA RIVER

Summer 2016 Yampa River at Maybell with Elkhead Reservoir Fish Releases

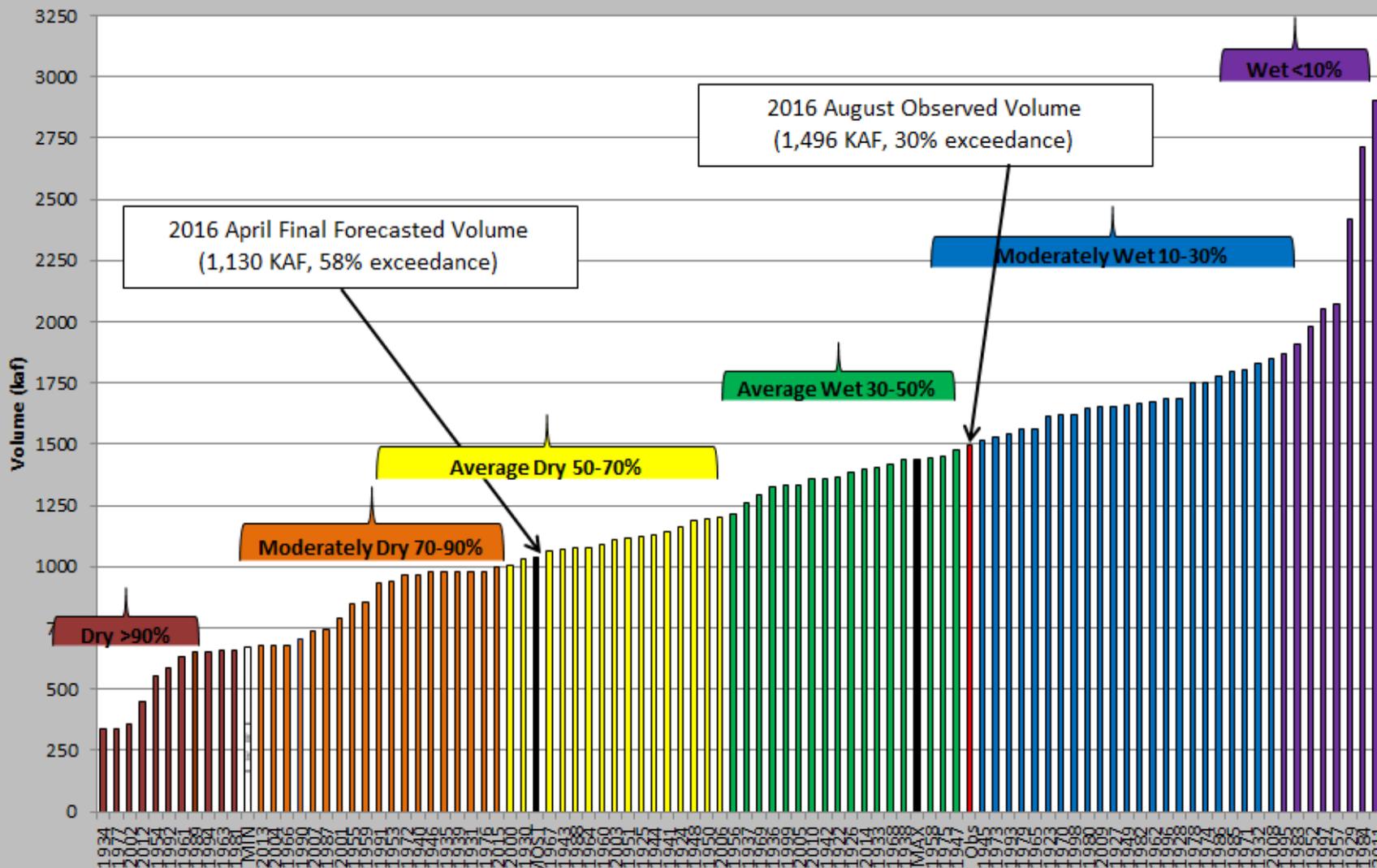


The estimated delivery loss is 35%. This number should be examined more closely. The few times the group looked at it the loss seemed more like 25% or less.

Flow Management Assessment Graphics - 14

- Gage
- EH Release
- Gage-35%
- Target

Yampa River Basin - Maybell Plus Lily Historic April-July Unregulated Inflow Volume Ranking (1922-2015)



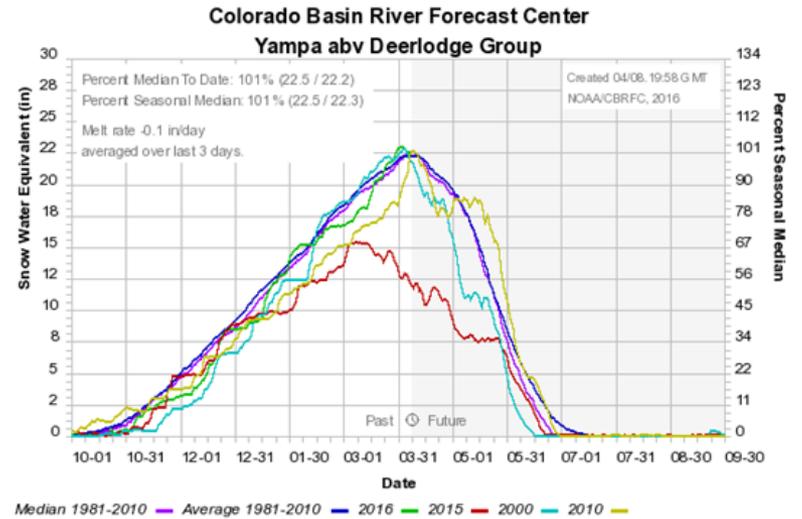
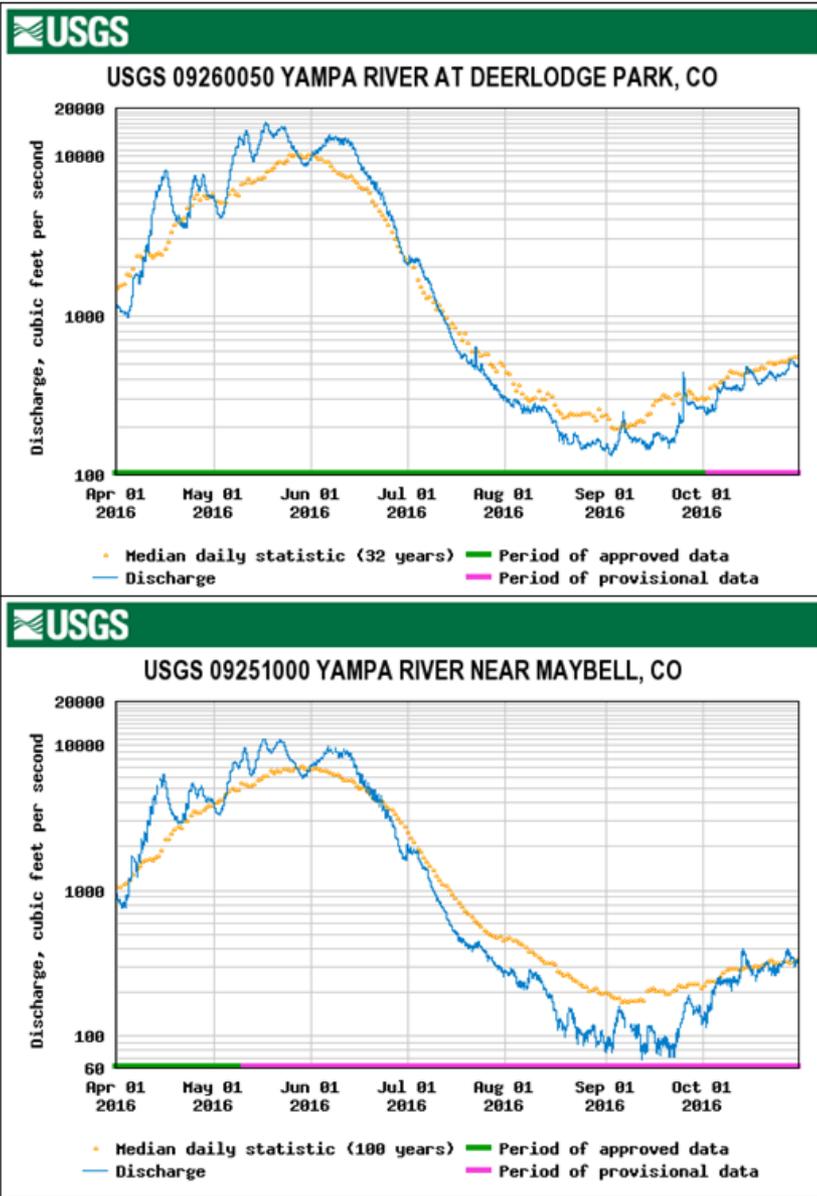
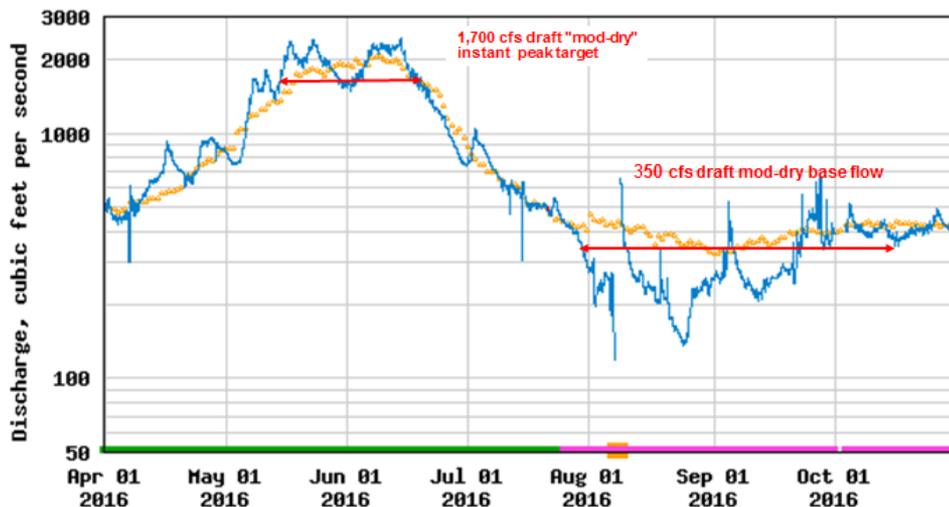


FIGURE 6. Yampa River above Deerlodge SNOTEL Group. 1981-2010 percent of average SWE compared against 2016 YTD, and analog years 2000, 2010 and 2015 percent of median SWE

WHITE RIVER

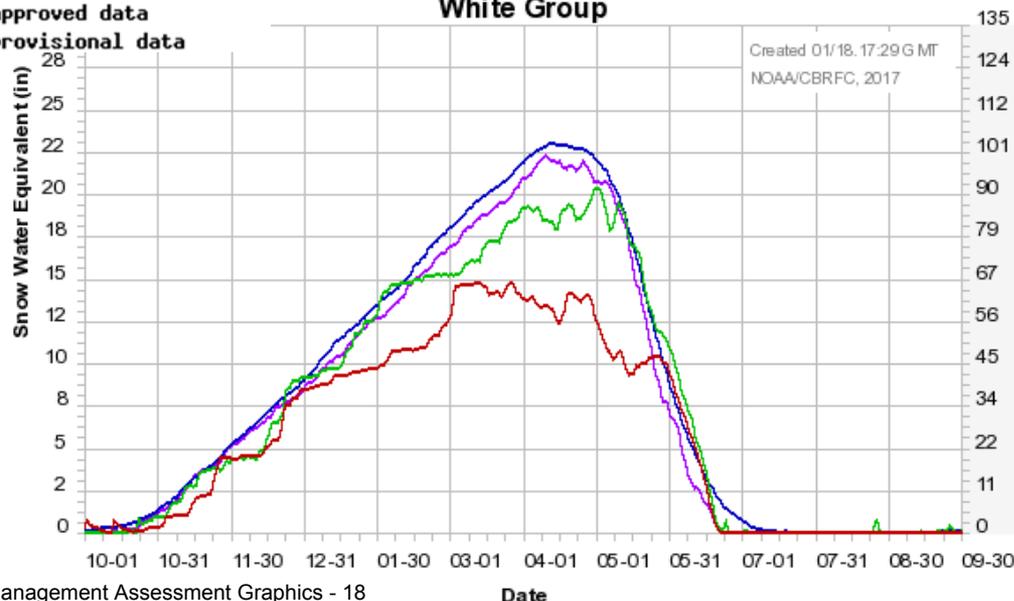


USGS 09306500 WHITE RIVER NEAR WATSON, UTAH



- Median daily statistic (86 years)
- Data temporarily unavailable
- Discharge
- Estimated discharge
- Period of approved data
- Period of provisional data

Colorado Basin River Forecast Center
White Group

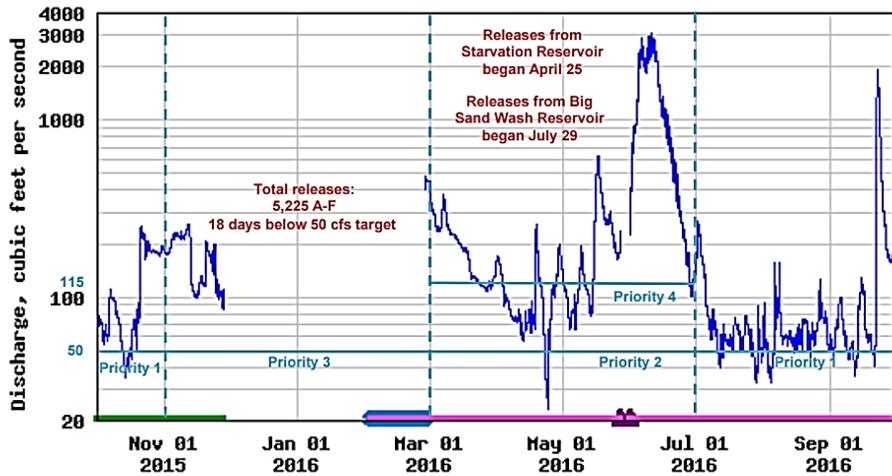


DUCHESNE RIVER



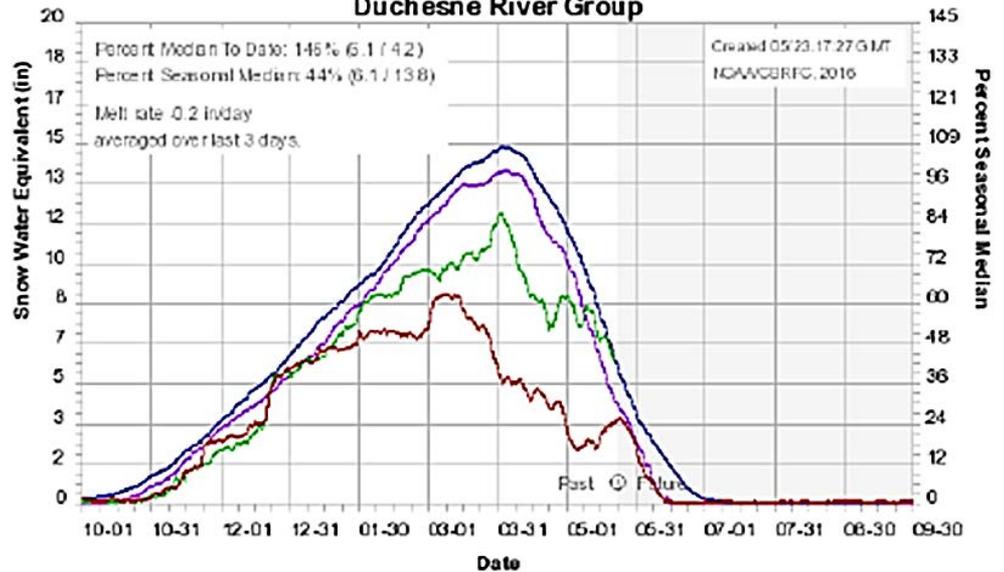
WY 2016

USGS 09302000 DUCHESNE RIVER NEAR RANDLETT, UT

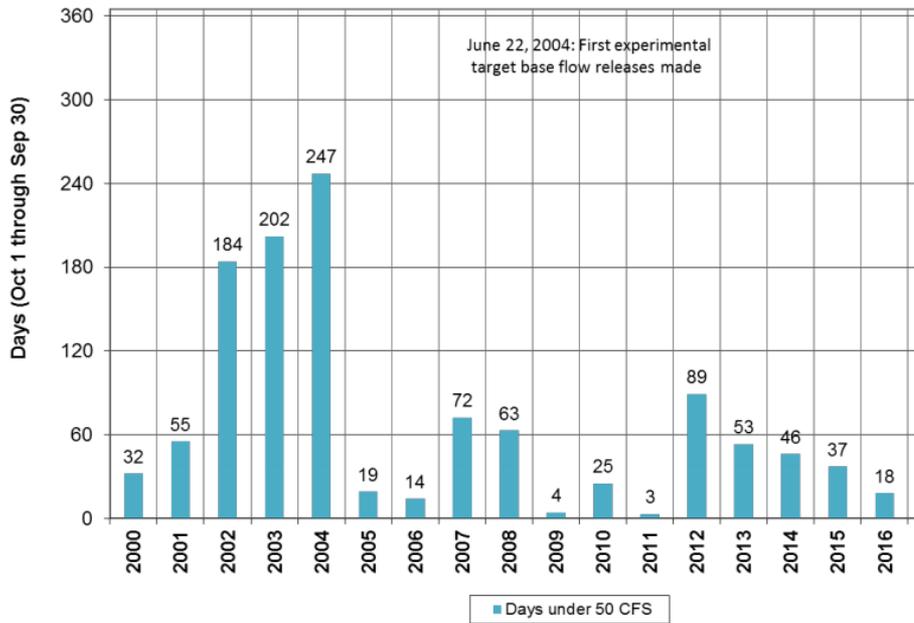


- Discharge
- Period of approved data
- ▲ Equipment malfunction
- Flow at station affected by ice
- Period of provisional data
- Period of flow augmentation

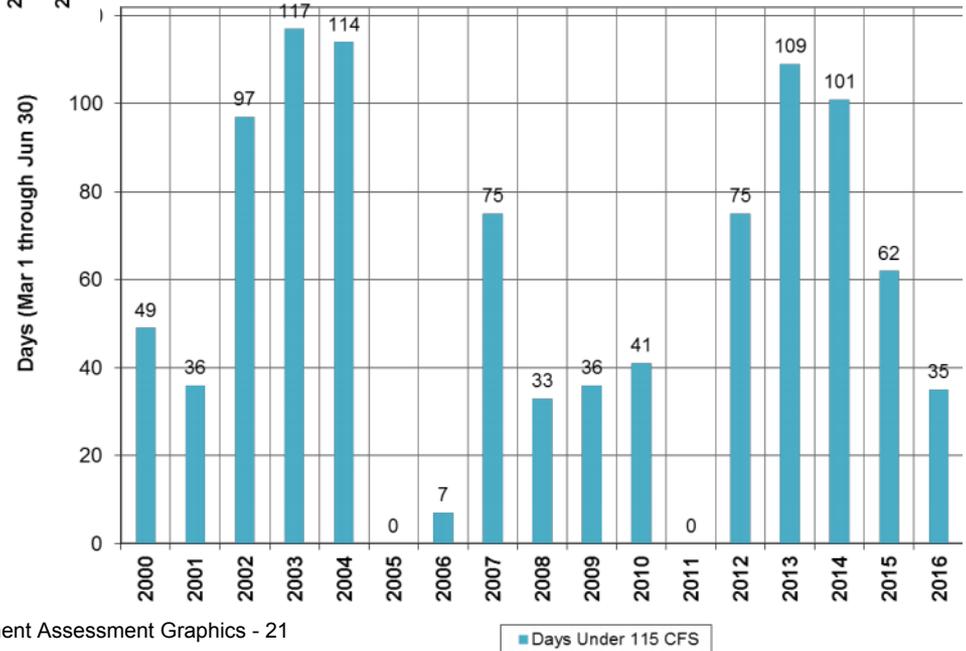
Colorado Basin River Forecast Center
Duchesne River Group



Duchesne River Near Randlett
Number of Days below 50-CFS Target (Priority 1, 2, and 3)



Duchesne River Near Randlett
Number of Days below 115-CFS Target (Priority 4)



WY 2016 Water Supply:

Daniels Replacement Project (Starvation)	2,900 A-F
DOI Section 207 (Starvation) (899 Banked + 430)^	1,329 A-F
Rediverted "44,400" Water (Starvation)*	0 A-F
DOI Section 207 (Big Sand Wash)^	<u>1,500 A-F</u>
	5,729 A-F

*Value as of October 1, 2015

*Subject to Spill

^Temporary 207 Contracts to be Renewed for 5 Years for 2016-2020 Delivery Seasons

WY 2016 Water Supply:

Daniels Replacement Project (Starvation)	2,900 A-F
DOI Section 207 (Starvation) (899 Banked + 430)	1,329 A-F
Rediverted "44,400" Water (Starvation)*	4,879 A-F
DOI Section 207 (Big Sand Wash)	<u>1,500 A-F</u>
	10,608 A-F

*Value as of April 1, 2016

*Subject to Spill

WY 2016 Deliveries:

Daniels Replacement Project (Starvation)	2,900 A-F
DOI Section 207 (Starvation)	825 A-F
Rediverted "44,400" Water (Starvation)*	0 A-F
DOI Section 207 (Big Sand Wash)	<u>1,500 A-F</u>
	5,225 A-F

* Remaining DOI Section 207 (Starvation)* 504 A-F

* Remaining DOI Section 207 (Big Sand Wash)* 0 A-F

* 4,879 A-F Spilled from Starvation Reservoir

WY 2017 Water Supply:

Daniels Replacement Project (Starvation)	2,900 A-F
DOI Section 207 (Starvation) (504 Banked + 430)^	934 A-F
Rediverted "44,400" Water (Starvation)*	0 A-F
DOI Section 207 (Big Sand Wash)^	<u>1,500 A-F</u>
	5,334 A-F

*Value as of October 1, 2016

*Subject to Spill

^Temporary 207 Contracts were Renewed for 5 Years for the 2016-2020 Delivery Seasons

COLORADO RIVER

Augmentation of peak flows in the 15-mile reach for endangered fish (AF)

Reservoir	Home-stake	Lake Granby	Green Mtn	Ruedi	Williams Fork	Willow Ck	Windy Gap	Wolford Mtn	Moffat	Total AF
1997			3,568	693	946			10,635		15,842
1998			12,482	5,106	1,672			4,431		23,691
1999		8,515	11,010	3,602	1,543	6,631		8,555		39,856
2006			6,788	6,297	6,625			9,007		28,717
2008			2,101	4,848						6,949
2009			14,113	5,858	5,044	2,638	2,061	13,069		42,783
2010			34,666	10,050	19,982			9,273		73,971
2015		18,002	11,292	4,599	2,733	8,000	906	4,587		32,117
2016	1,430		8,632	4,007	4,893			8,452	1,960	29,374
Sum	1,430	26,517	104,652	45,060	43,438	17,269	2,967	68,009	1,960	311,302

Average AF over all years, 1997-2016 15,565
 Average AF in CROS years only 34,589

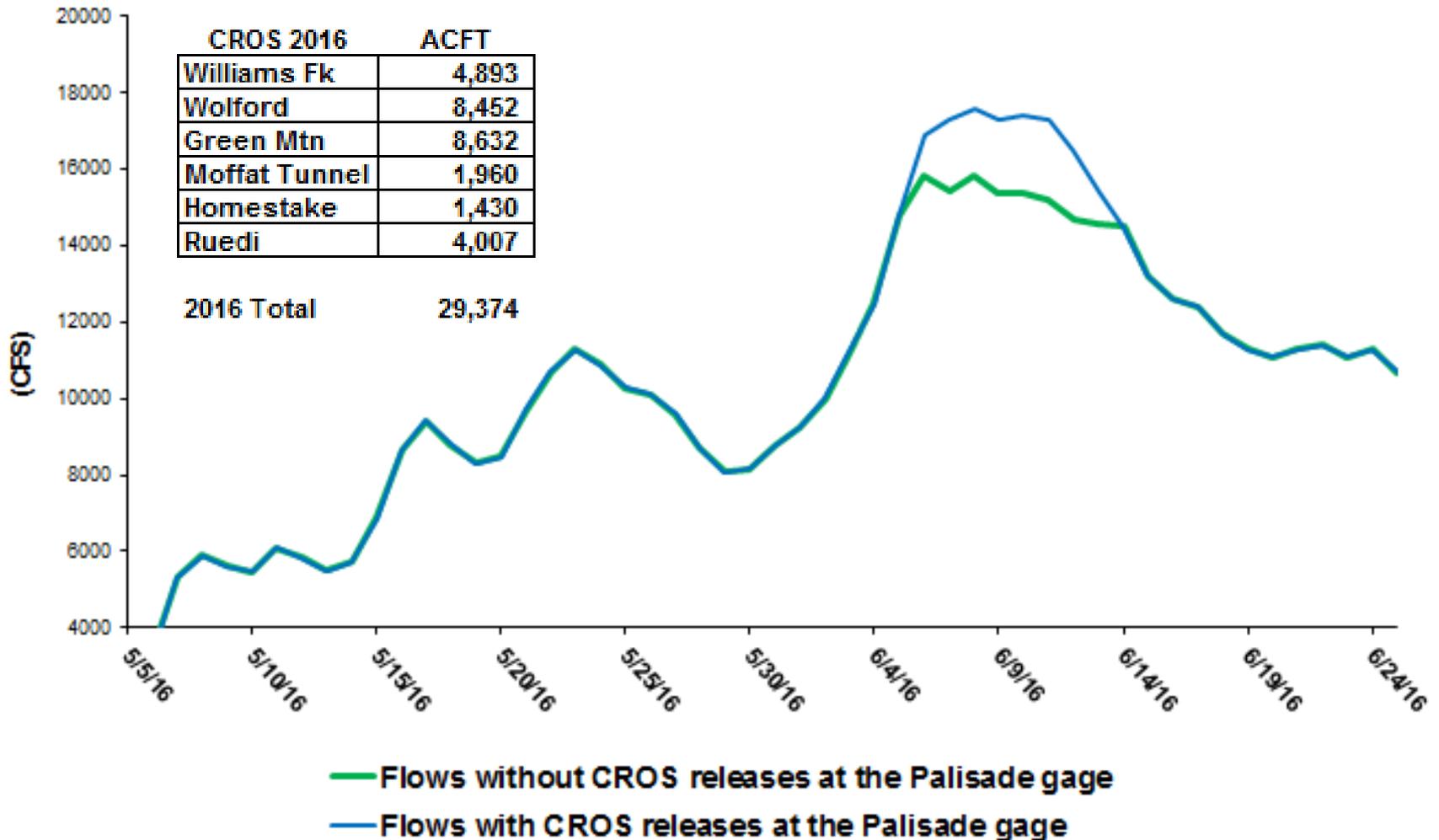
Augmentation of baseflows in the 15-mile reach for endangered fish (AF)

Reservoir	Lake Granby	Green Mtn	Palisade Bypass	Ruedi	Williams Fork	Willow Ck	Windy Gap	Wolford Mtn	Total AF
1998		31,736		20,803				11,516	64,054
1999	26,914	29,277		20,418	1,825	649		4,939	84,022
2000		47,187		19,064	3,858			11,072	81,181
2001		34,656		21,345	5,369			8,577	69,947
2002		-	2,053	10,975	3,757			308	17,093
2003		47,526	10,161	20,434	3,757			286	82,164
2004		119	13,654	15,981	2,678			-	32,431
2005		31,200	19,143	17,163	3,814			1,000	72,321
2006		25,358	10,812	20,045	5,712			10,842	72,769
2007		32,745	10,625	14,650	2,624			7,037	67,681
2008	849	61,433	15,997	20,423	9,389		764		108,855
2009	3,144	56,290	18,302	20,822	5,411			8,747	112,716
2010	992	57,813	20,617	20,825	5,113		893	8,413	114,666
2011		37,132	20,466	15,251	5,412			8,413	86,674
2012		-	14,616	20,596	5,412			5,320	45,944
2013	5,412	2,514	15,937	10,412				1,501	35,776
2014	5,413	59,342	19,317	15,413				3,000	102,485
2015	5,415	54,610	8,162	24,412	1,289*			4,712	97,311
2016	5,413	55,390	12,210	27,413	234*			5,766	106,192
Sum	53,552	664,329	212,072	356,444	64,131	649	1,657	101,449	1,454,282

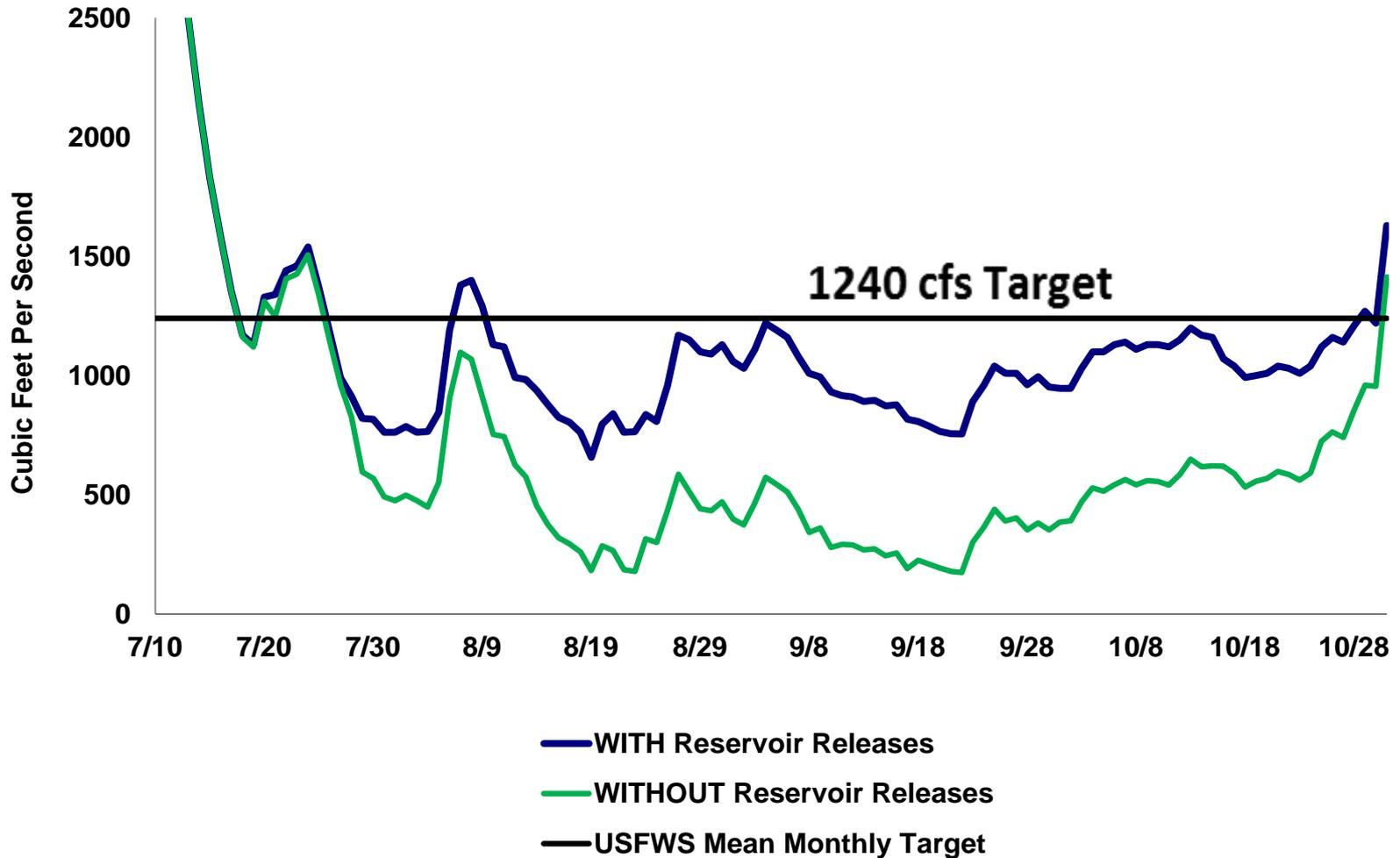
Average AF 76,541
 Total AF 1,454,282

* Williams Fork Reservoir trades water when Wolford can't, Wolford pays it back later in the same year.
 Williams Fork no longer has a pool for fish after the permanent 5412.5 acft moved to Granby.

Impact of Spring Reservoir Releases for the 15-Mile Reach (at Colorado River near Palisade Gage) 2016 CROS Release

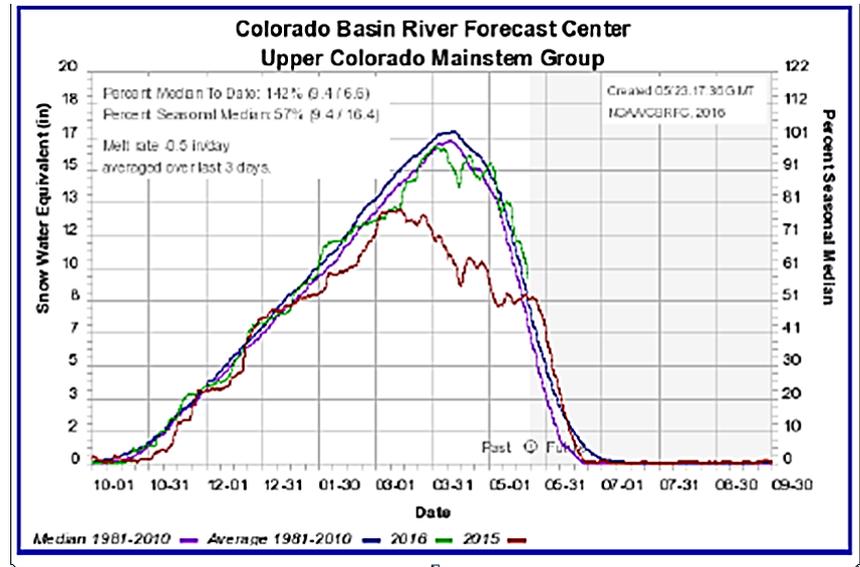
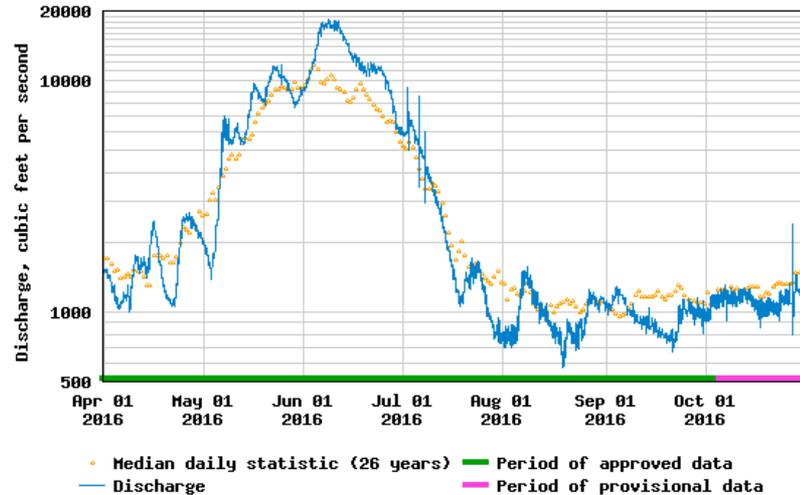


Summer 2016 Flows in the 15-Mile Reach of the Colorado River

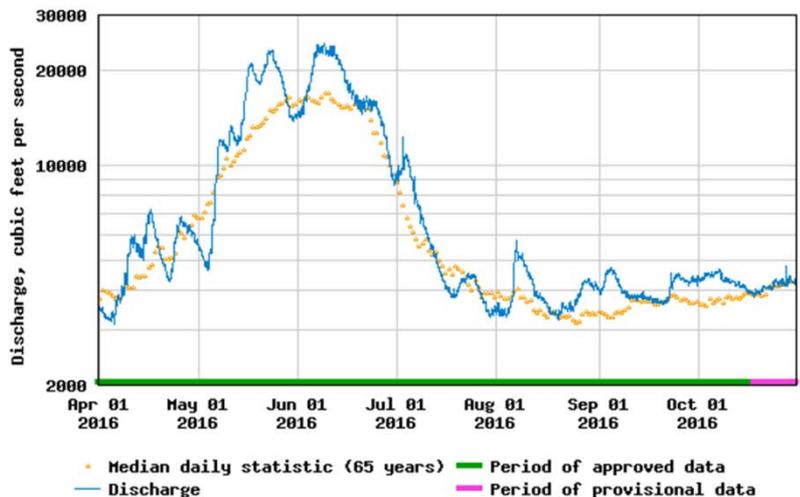




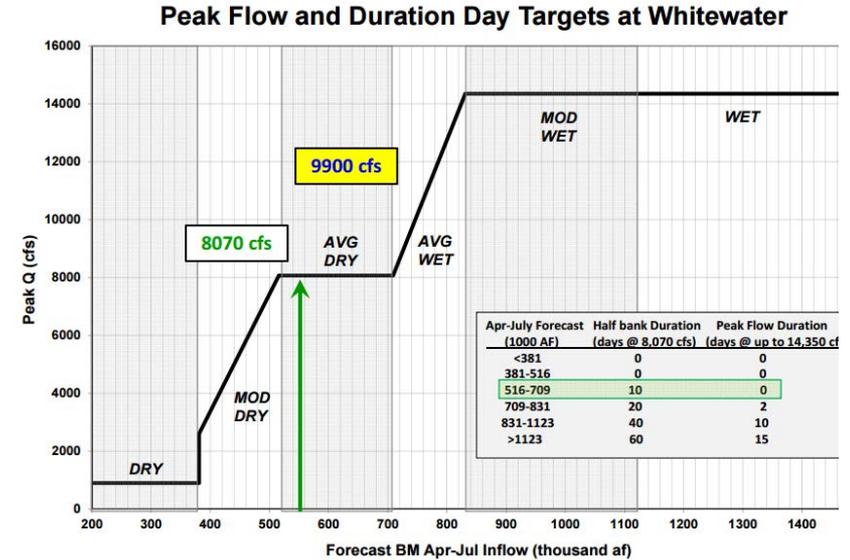
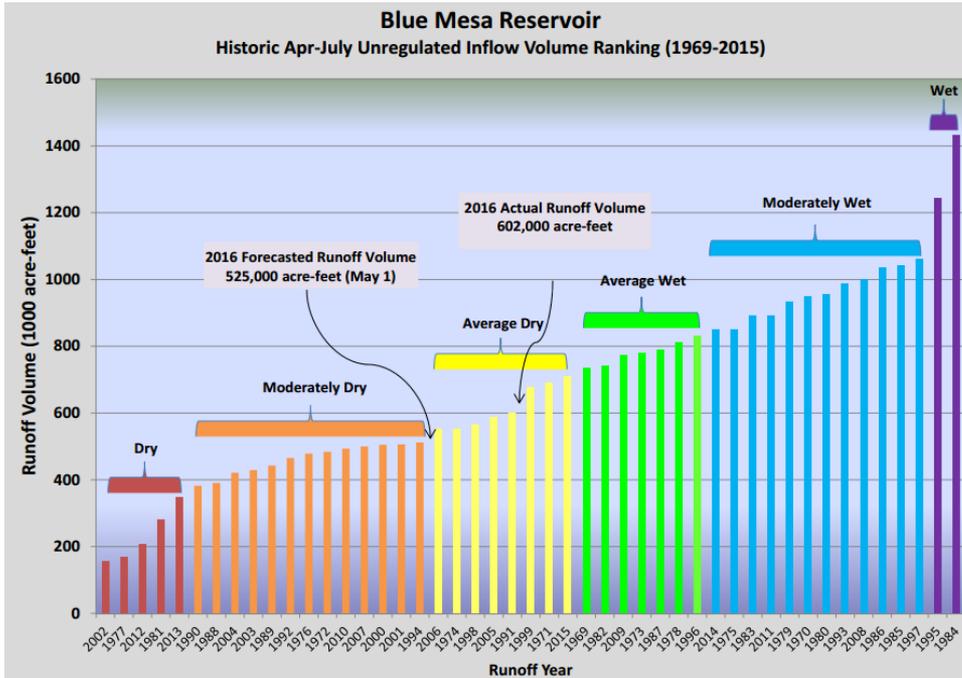
USGS 09106150 COLO RIVER BELOW GRAND VALLEY DIV NR PALISADE, CO



USGS 09163500 COLORADO RIVER NEAR COLORADO-UTAH STATE LINE



GUNNISON RIVER

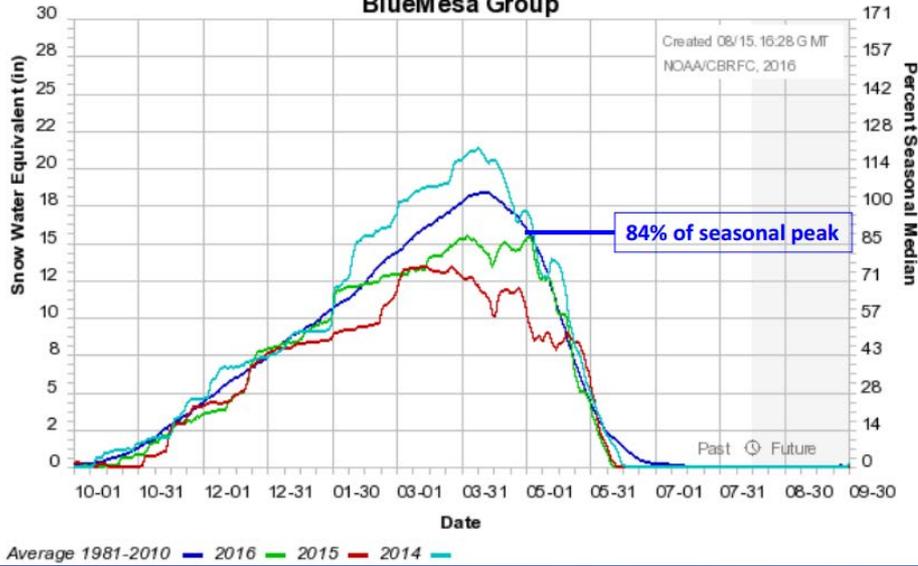


Baseflow Targets

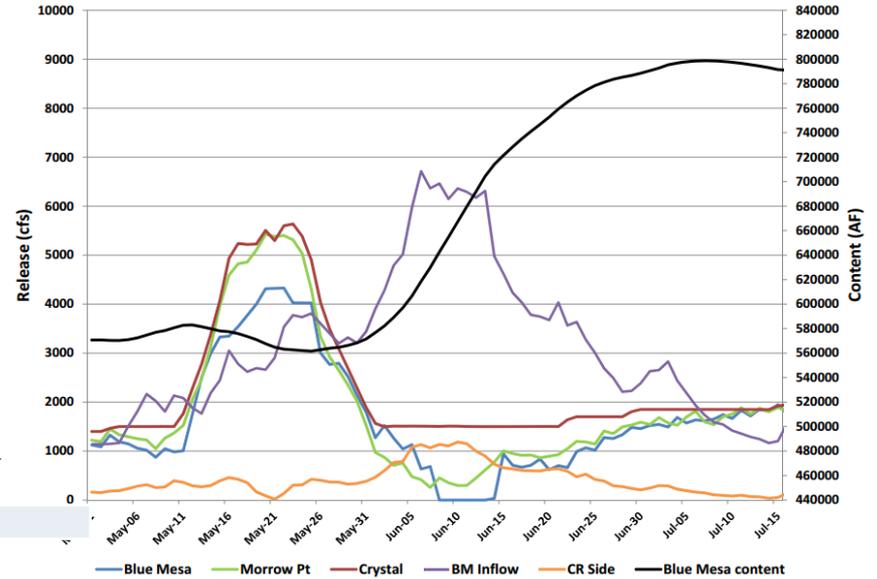
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	1050	1050	1050	1050	1050	1500	1500	1500	1050	1050	1050	1050
Mod Wet	1050	1050	1050	1050	1050	1500	1500	1500	1050	1050	1050	1050
Avg Wet	1050	1050	1050	1050	1050	1500	1500	1050	1050	1050	1050	1050
Avg Dry	1050	1050	1050	1050	1050	1500	1500	1050	1050	1050	1050	1050
Mod Dry*	750	750	750/790	750/890	750/890	1050	1050	1050	750/890	750/790	750/790	750
Dry*	750	750	750/790	750/890	750/890	1050	1050	750/890	750/890	750/790	750/790	750

*During March through November in Moderately Dry and Dry type years, additional releases will be made as necessary to provide flows above the 750 cfs anticipated to be diverted by the Redlands Water and Power Company, for the fish ladder and fish screen as shown.

Colorado Basin River Forecast Center BlueMesa Group



Aspinall Unit Operations



USGS 09152500 GUNNISON RIVER NEAR GRAND JUNCTION, CO.



6.0 LITERATURE CITED

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APPENDIX: CRITICAL HABITAT ANALYSIS
September 8, 1994

BACKGROUND

The final rule determining critical habitat for the four endangered fishes was published in the Federal Register on March 21, 1994, and the final designation became effective on April 20, 1994. As stated in the Section 7 Agreement and in the RIPRAP, the Recovery Program is intended to serve as the reasonable and prudent alternative to avoid the likely destruction or adverse modification of critical habitat, as well as to avoid the likelihood of jeopardy to the continued existence of the endangered fishes resulting from depletion impacts of new projects and all existing or past impacts related to historic water projects with the exception of the discharge by historic projects of pollutants such as trace elements, heavy metals, and pesticides. Once critical habitat was designated, the Service reviewed the RIPRAP, and in coordination with the Recovery Program's Management Committee, developed modifications to fulfill this intent.

The Service's review concluded that many of the actions in the existing RIPRAP would not only contribute to allowing the Recovery Program to continue to serve as the reasonable and prudent alternative to avoid the likelihood of jeopardy to the continued existence of the endangered fishes, but also would avoid the likely destruction or adverse modification of critical habitat for the endangered fishes. Specifically, the RIPRAP already included several of the following kinds of habitat-related actions for each subbasin (except the Dolores River): instream-flow acquisition, legal protection, and delivery from modified reservoir operations; fish passage restoration; and flooded bottomland restoration. Thus, the critical habitat modifications to the RIPRAP were not extensive. They were primarily intended to provide further definition to recovery actions already in the RIPRAP and to provide increased certainty that the Recovery Program can continue to serve as the reasonable and prudent alternative for projects subject to Section 7 consultations. Since many historic projects will be required to reinitiate Section 7 consultation with the Service due to the critical habitat designation, the Service encouraged Recovery Program participants to complete these RIPRAP actions as quickly as possible to facilitate fish recovery.

Destruction or adverse modification of critical habitat is defined at 50 CFR 402.02 as a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Section 7 consultation is initiated by a Federal agency when its action may affect critical habitat by impacting any of the primary constituent elements or reducing the potential of critical habitat to develop those elements. The primary constituent elements defined in the final rule as necessary for survival and recovery of the four Colorado River endangered fishes include, but are not limited to, 1) water (quantity and quality), 2) physical habitat (areas inhabited or potentially habitable, including river channel, bottom lands, side channels, secondary channels, oxbows, backwaters, and other areas); and 3) biological environment (food supply, predation, and competition). The Service reviewed the RIPRAP to determine if

it addressed these constituent elements and to identify existing and new actions that will contribute to the RIPRAP serving as a reasonable and prudent alternative to the likely destruction or adverse modification of critical habitat. Then, in coordination with the Management Committee, the Service recommended additions needed to address all of the constituent elements, to better define the expected result of the recovery action, and to increase the certainty that the constituent elements of critical habitat would be protected.

MODIFICATIONS

1. Instream Flow Protection: Modifications were made under this recovery element to protect the water quantity constituent element.
 - a. Adjudication of the instream-flow appropriations to be filed by the Colorado Water Conservation Board (on the Yampa, Little Snake, White, Colorado, and Gunnison rivers) was added since these instream-flow appropriation filings will not be legally protected until they are adjudicated in water court. Adjudication may take up to three years after filing, depending on the amount of litigation.
 - b. To provide more immediate habitat improvements in the Grand Valley area via instream flows, a modification was made under water acquisition for the 15-mile reach to enter into an interim agreement for uncommitted water remaining in Ruedi Reservoir after Round II water sales are completed or commitments to contracts are agreed to. If flow recommendations for the 15-mile reach are met from other sources during this interim agreement (thereby causing the additional water from Ruedi to exceed the flow recommendations), Ruedi would be relieved of this additional obligation. At the end of the interim agreement (whether the flow recommendations have been met or not), Reclamation may pursue additional water sales; however, these sales would be subject to review under Section 7 of the Endangered Species Act.
2. Habitat Restoration: Modifications were made under this recovery element to protect the physical habitat constituent element.
 - a. Access to historically inundated floodplain habitats is believed to be very important to recovery of the razorback sucker and Colorado pikeminnow. Although the Recovery Program has begun a program to evaluate and restore flooded bottomland areas, the fish's riverine habitat has been and continues to be so channelized by levees, dikes, rip-rap, and tamarisk, that broader floodplain restoration and protection (e.g., through mechanisms such as landowner incentives, conservation easements, and perhaps zoning) is needed. Recovery Program participants were not sure exactly how such mechanisms might be implemented, so an issue paper on restoration and protection of the floodplain has been developed. The issue

paper first addressed what restoration and protection measures are needed and then how they might be accomplished. After completion of the issue paper, viable options were identified and a restoration strategy developed for selected geographic areas (e.g. Grand Valley and Ashley Valley). Floodplain restoration activities may be implemented by the Recovery Program or by Recovery Program participants individually. Responsibilities of other agencies were identified in the issue paper, and actions were implemented consistent with authorities outside the Recovery Program.

- b. The Recovery Program has been evaluating agricultural diversion structures in the Yampa River and has discovered that although not all of these structures impede Colorado pikeminnow passage, annual bulldozing in critical habitat in the river required to maintain many of these structures may destroy or adversely modify fish habitat. Upgrading these structures so that they are more secure would eliminate the need for annual bulldozing and consequent adverse modification of critical habitat.
 - c. Fish passage structures are planned for a number of diversion dams in the Upper Basin in the current RIPRAP. However, without screens or "entrainment preclusion structures," adult fish, especially razorback sucker, may go into the diversion canals. To keep fish in the more secure river habitat, a modification was made to include an entrainment preclusion structure on the proposed passage structure at the Grand Valley Project diversion (Roller Dam). Also, the need for an entrainment preclusion structure at Redlands diversion dam will be evaluated after construction of the fish ladder there.
3. Reduction of Negative Impacts of Nonnative Fishes and Sportfish Management Activities: Modifications were made under this recovery element to protect the constituent element of the fishes' biological environment.
- a. Competition with and predation by introduced species is widely assumed to have played a role in the decline of the endangered fishes. The Recovery Program has been and continues to assess options to reduce negative impacts of problematic nonnative species, sportfish management, and angling mortality. Although we cannot yet fully predict the results of implementing some of these management options, we need to begin to implement the most viable ones. Therefore, actions have been added to implement (in cooperation with the States) viable measures which will decrease negative impacts of certain nonnative fishes, sportfish management, and angling mortality. Specific actions were added to selectively remove northern pike from the Yampa River and northern pike and centrarchids from the Gunnison River and possibly Paonia Reservoir.