

Long-Range Plan

San Juan River Basin Recovery Implementation Program

The logo for the San Juan River Basin Recovery Implementation Program is circular. It features a central illustration of a fish, likely a trout or salmon, swimming in a river. The fish is yellow and white with a dark dorsal fin. The river is blue and green. The logo is surrounded by a multi-colored border. The text "San Juan River Basin" is written in a curve at the top, and "Recovery Implementation Program" is written in a curve at the bottom. To the right of the logo is a rectangular photograph of a wide river flowing through a valley with green hills in the background.

San Juan River Basin
Recovery Implementation Program

October 2016

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INTRODUCTION

Background

The San Juan River Basin Recovery Implementation Program (Program) was initiated in October 1992 to protect and recover populations of two federally-listed endangered fish species in the San Juan River Basin (Basin) while water development proceeds in compliance with all applicable federal, state, and tribal laws. The two listed fish species are the Colorado Pikeminnow (*Ptychocheilus lucius*; formerly known as Colorado Squawfish) and Razorback Sucker (*Xyrauchen texanus*). Activities and actions within the Program serve as the "reasonable and prudent alternative" for projects in the Basin and help to ensure that those projects will not jeopardize the continued existence of the endangered species. It is anticipated that actions taken under the Program will benefit other native fishes in the Basin and prevent them from becoming endangered.

The goals of the Program are:

1. To conserve populations of Colorado Pikeminnow and Razorback Sucker in the Basin consistent with the recovery goals established under the Endangered Species Act of 1973, as amended, 16 U.S.C. §§ 1531 *et seq.* (ESA).
2. To proceed with water development in the Basin in compliance with federal and state laws, interstate compacts, U.S. Supreme Court decisions, and federal trust responsibilities to the Southern Ute Tribe, Ute Mountain Ute Tribe, Jicarilla Apache Nation, and Navajo Nation.

The Program was initiated with the signing of a Cooperative Agreement in 1992 after the rediscovery and documentation of successful spawning by Colorado Pikeminnow and the continued presence of Razorback Sucker in the San Juan River. Adult and young-of-year (YOY) Colorado Pikeminnow and adult Razorback Sucker were collected during 1987-1989 by biologists gathering detailed fish community data for use in potential Razorback Sucker reintroduction efforts (Platania et al. 1991). This discovery resulted in the reinitiation of Section 7 consultation through the Bureau of Reclamation (Reclamation) for the Animas-La Plata (ALP) Project; and subsequently, the Navajo Indian Irrigation Project (NIIP) underwent Section 7 consultation through the Bureau of Indian Affairs (BIA).

A 7-year research program, conducted during 1991-1997, provided a baseline of information that identified and characterized factors limiting the two endangered species. The research program was incorporated into the Recovery Program when it was formed in 1992. Culmination of the research program in 1997 marked the end of the research phase and the beginning of the implementation and management phase for the Program. In 1991, a Program Document (Document) was developed to provide the framework for Program implementation. The original Document was adopted in 1992 by the Cooperative Agreement signatories. The Document was modified by the Coordination Committee in 2006, 2010, and 2012 (Program 2012a). The Document outlines the Program's purposes, authorities, structure, and operating procedures including funding and budgeting. The Document details the purposes of the Program's committees and defines their composition, authorities, and duties. The Document also includes a description of the process for conducting Section 7 consultations and for reviewing sufficient progress. The Section 7 procedures specifically reference implementation of a long-range plan as the principal means for determination of ESA compliance for water projects in the Basin. The Program operates through committee processes that identify the actions needed to attain the Program goals. The committees include representatives of the signatories to the Cooperative Agreement (extended in 2006 to September 30, 2023), including state and federal agencies and Native American Tribes. Water development and conservation interests are also participants of the Program.

Purpose

The purpose of this Long-Range Plan (LRP) is to identify specific actions to be implemented in the Basin that will contribute to recovery of the Colorado Pikeminnow and Razorback Sucker in accordance with species recovery goals (U.S. Fish and Wildlife Service [Service] 2002a, 2002b). Recovery of both protected species will be accomplished within the context of conservation and management of the entire native fish assemblage and in a manner that does not compromise, impair, or diminish persistence of unprotected native fishes. The updated LRP is based on research information from past studies in the Basin and other regions and Program evaluation reports to identify multi-year research, monitoring, and recovery actions necessary to achieve the Program goals.

The first LRP was developed in 1995 by the Biology Committee and was intended primarily to guide the Program through the completion of a 7-year research program to identify and characterize factors limiting the two endangered species. The research phase of the Program was completed in 1997 and the LRP was updated and revised to provide guidance on the implementation and management phase of the Program. This LRP is a culmination of drafts and reports that updated the 1995 plan (Holden 2000; Miller 2006; Service 2010, 2012). New recovery actions identified are based on evaluation and review of the Program's progress, and recovery goals. The LRP is reviewed and updated annually. The relationship of the LRP to the various Program components is shown in Figure 1.

This LRP identifies actions and tasks to be accomplished, provides estimated period for carrying out these tasks and activities consistent with species recovery and appropriate for evaluating Program progress. This LRP identifies and describes the progression and priority of implementing identified recovery actions that are expected to result in recovery and delisting of the Colorado Pikeminnow and Razorback Sucker. Because actions identified in this LRP are linked to recovery goals and plans adopted by the Service (Service 2002a, 2002b), accomplishing the actions and tasks described in this LRP constitutes the milestones toward achieving recovery of the endangered fish species. As long as these actions and tasks are satisfactorily met and demonstrably, contribute toward recovery of the listed fishes, it is the mutual expectation of the participants that the Program serves as the foundation for a reasonable and prudent alternative for Section 7 consultations, but does not preclude the development of reasonable and prudent alternatives independent of the Program.

In order to define and describe specific program activities and projects for upcoming years, the Program develops an Annual Work Plan (AWP). The AWP identifies and describes activities to be conducted by the Program in a given year for conservation of the endangered species. The LRP guides the Program in the development of the AWP and helps link Program activities for continuity and consistency. Approval of the AWP and budgets by the Coordination Committee is based, in part, on consistency and compliance with the LRP and available funds.

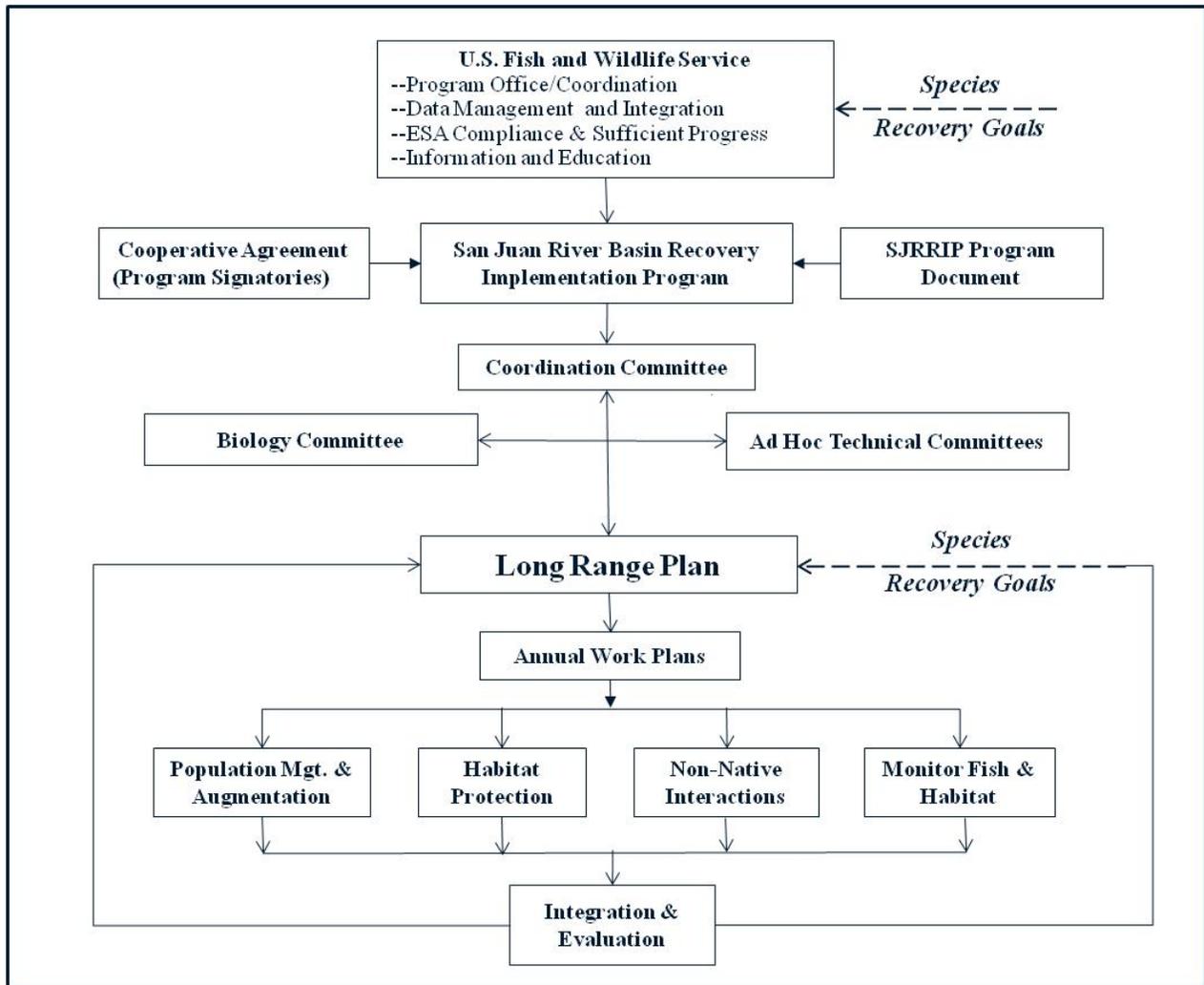


Figure 1. Components and relationships of the San Juan River Basin Recovery Implementation Program including the Long-Range Plan.

Authority

The Program became operational in October 1992 upon execution of a Cooperative Agreement signed by representatives of the Department of the Interior; the States of Colorado and New Mexico, and the Ute Mountain Ute and Southern Ute tribes; and the Jicarilla Apache Nation. The Bureau of Land Management became a participant in the Program in October 1993 as a condition of a Biological Opinion regarding oil and gas development in the Basin, and the Navajo Nation joined the Program in November 1996. In 2006, the 1992 Cooperative Agreement was extended through 2023.

Funding reliability is critical to the success of the Program to ensure that the Program is conducted on a continuous basis and that high priority recovery elements are funded every year. Prior to 2001, funding of the Program was provided by Reclamation, the BIA, and the Service. On January 24, 2000, Congress enacted Public Law 106-392 that authorized and directed Reclamation to fund this Program and the Upper Colorado River Endangered Fish Recovery Program. Public Law 106-392 authorized the Secretary of the Interior to use Colorado River Storage Project (CRSP) power revenues to fund annual base costs of both programs and to provide a cost-share, to be matched by state cost-shares, towards the costs of implementing capital recovery

projects under both recovery programs. The legislation also authorized federal appropriations to be made to contribute a federal cost-share towards implementation of the capital recovery projects. Public Law 112-270, signed into law on January 14, 2013, extended the authorization to expend CRSP power revenues for base (non-capital) funding for the two programs through 2019. If the availability of power revenues proves insufficient to meet the annual base funding, the Western Area Power Administration and Reclamation will request federal appropriations to meet these needs. In 2016, partners from both programs initiated efforts to extend the authorization to 2023.

DEMOGRAPHIC AND RECOVERY FACTOR CRITERIA

Recovery goals for Colorado Pikeminnow and Razorback Sucker identify demographic and recovery factor criteria needed to achieve recovery of the species in the Colorado River System (Service 2002a, 2002b). The recovery goals provide site-specific management actions; objective, measurable criteria; and estimates of time and costs as guidance for each of the recovery programs. The Upper Colorado River Endangered Fish Recovery Program implements and coordinates these management actions in the Upper Colorado River Basin in Colorado, Utah, and Wyoming, exclusive of the San Juan River Basin. This Program implements and coordinates these management actions in the San Juan River and its tributaries in Colorado, New Mexico, and Utah. The Service is currently in the process of updating the recovery plan for the Colorado Pikeminnow and will revise the recovery goals, as necessary, through that process and incorporate them into the new plan for the species. A draft recovery plan was sent to the Upper Colorado and San Juan Programs for a stakeholder review on December 5, 2014. The Service hosted two half-day webinars for the Recovery Programs in April and May of 2015, to discuss the draft plan and the comments received to date. Program participants were asked to submit written comments after the webinars by June 5, 2015. Based on comments received, the Service agreed to defer completion of an updated recovery plan until a population viability assessment (PVA) for the species was conducted. The PVA is scheduled to be completed by the spring of 2016.

In 2015, the Service implemented a methodology to conduct a species status assessment (SSA) framework to support many regulatory documents including species recovery planning. An SSA is intended to be a science document assessing species viability and does not determine policy or legal recommendations. The SSA methodology and framework will be used to summarize the status of Razorback Sucker, which will determine if a change in the status of the species is warranted by the Service. Completion of the SSA for the Razorback Sucker is expected to be completed end of the calendar year of 2016.

Demographic criteria and recovery factor criteria for the San Juan River Basin identified in the current recovery goals are summarized below. The demographic criteria identify the number of populations, numbers of individuals in each population, and the recruitment rates necessary for downlisting and delisting each species. The recovery factor criteria identify actions that should be taken to minimize or remove threats to each of the endangered fish species as identified for each of the five listing factors in Section 4(a)(1) of the ESA. As described in the species recovery goals, implementation of actions and achievement of criteria for downlisting and delisting of the Colorado Pikeminnow and Razorback Sucker are the responsibility of each of the conservation programs in charge of management of these species for their region of the Colorado River System. Hence, achievement of demographic and listing factor criteria in the San Juan River Basin is the responsibility of this Program. The demographic criteria and recovery factor criteria for each of the two endangered fish species are provided in this LRP to help identify specific actions and tasks that are considered necessary for downlisting and delisting these species.

Razorback Sucker

Demographic Criteria

Objective, measurable criteria for recovery of Razorback Sucker in the Colorado River Basin were developed for each of two recovery units, the Upper Basin and the Lower Basin¹ (Service 2002b). Recovery of the species is considered necessary in both the upper and lower basins. In order for the species to be considered for downlisting, each population must consist of fish that are recruiting into the adult population in the wild. When recruitment in the wild occurs, hatchery fish can be included in recovery demographic criteria and count towards recovery. Without viable wild populations, self-sustaining populations need to be established through augmentation with hatchery-produced fish. Once each self-sustaining population is established, the downlist monitoring period is five years and the delist period is an additional three years.

Downlisting

Downlisting can occur if, over a five-year period:

1. genetically and demographically viable, self-sustaining populations are maintained in the Green River subbasin and EITHER in the Upper Colorado River subbasin or the San Juan River subbasin such that: (a) the trend in adult (age 4+; >400 millimeter (mm) Total Length (TL)) point estimates for each of the two populations does not decline significantly; (b) the mean estimated recruitment of age-3 (300-399 mm TL) naturally produced fish equals or exceeds mean annual adult mortality for each of the two populations; and (c) each point estimate for each of the two populations exceeds 5,800 adults (5,800 is the estimated minimum viable population [MVP] needed to ensure long-term genetic and demographic viability);
2. a genetic refuge is maintained in Lake Mojave in the lower basin recovery unit;
3. two genetically and demographically viable, self-sustaining populations are maintained in the lower basin recovery unit (e.g., Colorado River mainstream and/or tributaries) such that: (a) the trend in adult point estimates for each population does not decline significantly; (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each population; and (c) each point estimate for each population exceeds 5,800 adults; and,
4. certain site-specific management tasks to minimize or remove threats have been identified, developed and implemented.

Delisting

Delisting can occur if, over a three-year period beyond downlisting:

1. genetically and demographically viable, self-sustaining populations are maintained in the Green River subbasin and EITHER in the Upper Colorado River subbasin or the San Juan River subbasin such that: (a) the trend in adult point estimates for each of the two populations does not decline significantly; (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean

¹ The Upper Basin includes the Green River, Upper Colorado River, and San Juan River subbasins, and the Lower Basin includes the Colorado River mainstem and its tributaries from Glen Canyon Dam downstream to the southerly International Boundary with Mexico.

- annual adult mortality for each of the two populations; and (c) each point estimate for each of the two populations exceeds 5,800 adults;
2. a genetic refuge is maintained in Lake Mojave;
 3. two genetically and demographically viable, self-sustaining populations are maintained in the lower basin recovery unit such that: (a) the trend in adult point estimates for each population does not decline significantly; (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each population; and (c) each point estimate for each population exceeds 5,800 adults; and,
 4. certain site-specific management tasks to minimize or remove threats have been finalized and implemented, and necessary levels of protection are attained.

Recovery Factor Criteria

Recovery factor criteria in the recovery goals describe site-specific management actions necessary to minimize or remove threats to the species and support wild self-sustaining populations. This LRP incorporates these actions to ensure that this Program is carrying out activities consistent with species recovery. Actions 2 and 5 do not apply to the San Juan River, but are included to show the full scale of actions necessary to address threats to the Razorback Sucker. The following actions are quoted from the Razorback Sucker recovery goals (Service 2002b):

1. Reestablish populations with hatchery-produced fish.
2. Identify and maintain genetic variability of Razorback Sucker in Lake Mohave.
3. Provide and legally protect habitat (including flow regimes necessary to restore and maintain required environmental conditions) necessary to provide adequate habitat and sufficient range for all life stages to support recovered populations.
4. Provide passage over barriers within occupied habitat to allow unimpeded movement and, potentially, range expansion.
5. Investigate options for providing appropriate water temperatures in the Gunnison River.
6. Minimize entrainment of subadults and adults at diversion/out-take structures.
7. Ensure adequate protection from overutilization.
8. Ensure adequate protection from diseases and parasites.
9. Regulate nonnative fish releases and escapement into the main river, floodplain, and tributaries.
10. Control problematic nonnative fishes as needed.
11. Minimize the risk of hazardous-materials spills in critical habitat.
12. Remediate water-quality problems.
13. Minimize the threat of hybridization with White Sucker.
14. Provide for the long-term management and protection of populations and their habitats beyond delisting (i.e., conservation plans).

Colorado Pikeminnow

Demographic Criteria

Objective, measurable criteria for recovery of Colorado Pikeminnow in the Colorado River Basin were developed for the Upper Colorado River Basin (Service 2002a). Recovery of the species is considered necessary only in the Upper Basin because of the status of the populations and because information on

Colorado Pikeminnow biology support application of the metapopulation concept to extant populations. The need for self-sustaining populations in the Lower Basin and associated site-specific management actions and tasks necessary to minimize or remove threats will be reevaluated during the recovery plan update and status reviews of the species.

Downlisting

Downlisting can occur if, over a five-year period, the Upper Basin metapopulation is maintained such that:

1. a genetically and demographically viable, self-sustaining population is maintained in the Green River subbasin such that: (a) the trends in separate adult (age 7+; >450 mm TL) point estimates for the middle Green River and the lower Green River do not decline significantly; (b) the mean estimated recruitment of age-6 (400-449 mm TL) naturally produced fish equals or exceeds mean annual adult mortality for the Green River subbasin; and (c) each population point estimate for the Green River subbasin exceeds 2,600 adults (2,600 is the estimated MVP needed to ensure long-term genetic and demographic viability);
2. a self-sustaining population of at least 700 adults (number based on inferences about carrying capacity) is maintained in the Upper Colorado River subbasin such that: (a) the trend in adult point estimates does not decline significantly; and (b) the mean estimated recruitment of age-6 naturally produced fish equals or exceeds mean annual adult mortality;
3. a target number of 1,000 age-5+ fish (>300 mm TL; number based on estimated survival of stocked fish and inferences about carrying capacity) is established through augmentation and/or natural reproduction in the San Juan River subbasin; and,
4. certain site-specific management tasks to minimize or remove threats have been identified, developed and implemented.

Delisting

Delisting can occur if, over a seven-year period beyond downlisting, the upper basin metapopulation is maintained such that:

1. a genetically and demographically viable, self-sustaining population is maintained in the Green River subbasin such that: (a) the trends in separate adult point estimates for the middle Green River and the lower Green River do not decline significantly; (b) the mean estimated recruitment of age-6 naturally produced fish equals or exceeds mean annual adult mortality for the Green River subbasin; and (c) each population point estimate for the Green River subbasin exceeds 2,600 adults;
2. either the Upper Colorado River subbasin self-sustaining population exceeds 1,000 adults **OR** the Upper Colorado River subbasin self-sustaining population exceeds 700 adults and San Juan River subbasin population is self-sustaining and exceeds 800 adults (numbers based on inferences about carrying capacity) such that for each population: (a) the trend in adult point estimates does not decline significantly; and (b) the mean estimated recruitment of age-6 naturally produced fish equals or exceeds mean annual adult mortality; and,
3. certain site-specific management tasks to minimize or remove threats have been finalized and implemented, and necessary levels of protection are attained.

Recovery Factor Criteria

Recovery factor criteria in the recovery goals describe site-specific management actions necessary to minimize or remove threats to the species and support wild self-sustaining populations. This LRP incorporates these actions to ensure that the Program is carrying out activities consistent with species recovery. Action 3 does not apply to the San Juan River subbasin, but is included to show the full scale of actions necessary to address threats to the Colorado Pikeminnow. The following actions are quoted from the recovery goals for the Colorado Pikeminnow (Service 2002a):

1. Provide and legally protect habitat (including flow regimes necessary to restore and maintain required environmental conditions) necessary to provide adequate habitat and sufficient range for all life stages to support recovered populations.
2. Provide passage over barriers within occupied habitat to allow adequate movement and, potentially, range expansion.
3. Investigate options for providing appropriate water temperatures in the Gunnison River.
4. Minimize entrainment of subadults and adults in diversion canals.
5. Ensure adequate protection from overutilization.
6. Ensure adequate protection from diseases and parasites.
7. Regulate nonnative fish releases and escapement into the main river, floodplain, and tributaries.
8. Control problematic nonnative fishes as needed.
9. Minimize the risk of hazardous-materials spills in critical habitat.
10. Remediate water-quality problems.
11. Provide for the long-term management and protection of populations and their habitats beyond delisting (i.e., conservation plans).

RECOVERY ELEMENTS AND ACTIONS

This LRP consists of the following six Program elements:

1. Management and Augmentation of Populations of Colorado Pikeminnow and Razorback Sucker.
2. Protection, Management, and Augmentation of Habitat.
3. Management of Nonnative Aquatic Species.
4. Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions.
5. Program Coordination and Assessment of Progress toward Recovery.
6. Information and Education

This LRP identifies activities believed necessary to recover the Colorado Pikeminnow and Razorback Sucker in the San Juan River Basin. The LRP describes what actions will be implemented, who will implement them, when they will be implemented, and why. Details of how actions and tasks will be carried out are left to supporting documents and plans, such as genetics management plans, augmentation plans, monitoring plans, and AWP. This LRP functions under the principles of adaptive management where annual updates and periodic revisions are necessary to ensure use of the best available scientific information in modifying or eliminating existing activities and formulating future Program activities.

The LRP is intended to facilitate evaluation of the Program's progress toward species recovery and development of sufficient progress reports for ESA Section 7 compliance. Furthermore, this LRP is designed to facilitate tracking of projects and associated budgets to assist the Program Coordinator and Reclamation's

budget office. Goals, actions, and tasks are identified that began in 1992, at the initiation of the Recovery Program. Numerous tasks have been completed and that information used to develop strategies for management actions, monitoring, and research. Including past Program activities in the LRP provides documentation and accounting of activities, time schedules, and successes and failures of each. This institutional knowledge of the Program will enable interested parties to review overall Program progress over time. Current goals, actions, and tasks are described in the narrative sections for each Recovery Element. Appendix A is used to track tasks and includes priorities, start and end times, primary responsibilities, and status. Priorities assigned to tasks reflect necessary actions identified in recovery goals. Completed tasks are included in Appendix B.

Recovery Elements 1, 2, and 3 include management actions to recover the two endangered fish, whereas Recovery Elements 4 and 5 include activities to monitor, evaluate, and assess if the management actions are achieving the intended purposes. Although the primary goal of this Program is to conserve populations of Colorado Pikeminnow and Razorback Sucker in the Basin consistent with species recovery goals, it is also important to ensure protection, restoration, and maintenance of the components of the physical and aquatic habitats that supports them. Environmental conditions that support the endangered species also provide suitable conditions for the native fish community and vice versa. Native fishes provide an important food source for the predaceous Colorado Pikeminnow, are important in maintaining ecological balance and food web dynamics, and serve as indicator species for a healthy ecosystem. The San Juan River Basin supports seven fish species native to the warm reaches of the drainage, including Roundtail Chub (*Gila robusta*), Colorado Pikeminnow, Speckled Dace (*Rhinichthys osculus*), Bluehead Sucker (*Catostomus discobolus*), Flannelmouth Sucker (*Catostomus latipinnis*), Razorback Sucker, and Mottled Sculpin (*Cottus bairdi*) (Holden 1999).

Description of Program Elements

The elements and associated tasks are designed to guide the Program through 2023 with annual updates as new information is obtained. This schedule is consistent with the Recovery Program goals that estimate recovery for the Colorado Pikeminnow and Razorback Sucker by the year 2023.

For each Recovery Element, a general explanation of the recovery activities and background are provided in the following narrative sections. Specific goals, actions, and tasks deemed necessary to achieve each element are identified in Appendix A tables. The goals under each element identify major targets that need to be achieved in order to fulfill the specified element; actions identified under each goal describe the principle actions; and the tasks describe the specific activities or projects. Appendix A tables include the identified tasks and provides a priority, the year(s) in which the activity is planned, the lead Program participant(s), and a status update for each task (updated annually). Tasks are moved to Appendix B when they are completed.

Element 1. Management and Augmentation of Populations of Colorado Pikeminnow and Razorback Sucker

This element ensures that the Program's augmentation protocols maintain genetically diverse fish species while producing and rearing Colorado Pikeminnow and Razorback Sucker to stock in the river system. Wild self-sustaining populations of Colorado Pikeminnow and Razorback Sucker have currently not been documented in the San Juan River Basin. Recovery goals for both species identify the need to establish self-sustaining populations through augmentation with hatchery-produced fish. The Program has adopted a genetics management plan (Crist and Ryden 2003) that identifies appropriate genetic lineages for use in hatchery programs and stocking efforts for the San Juan River. Augmentation plans for each of the two endangered species were originally developed by Ryden (2003a, 2003b) and updated as needed. Production,

rearing, and stocking of these fish need to continue to establish wild populations. The numbers and size of fish that need to be produced are identified in the species augmentation plans. Stocking protocols and fate of stocked fish are monitored and evaluated to determine the best strategies for enhancing survival and recruitment. Survival models are used to estimate and adjust stocking goals of augmentation plans and to ensure that sufficient numbers of genetically viable fish are being stocked.

Surveys in the late 1980s reported a few wild Colorado Pikeminnow and Razorback Sucker in the San Juan River (Platania 1990; Platania et al. 1991). Prior to initiation of the Program, the Service proposed stocking Razorback Sucker into the San Juan River in 1986 to restore the species to the river. The effort was not undertaken, but Colorado Pikeminnow and Razorback Sucker persistence in the river was documented. An experimental stocking program for Razorback Sucker began in 1994, under Program auspices, and experimental stocking of Colorado Pikeminnow began in 1996. In the early years of the stocking program, finding consistent sources of the two listed species for stocking, the right facilities, and the best methods were challenging and involved much trial and error. Since its inception, the Program continues to identify and develop strategies for producing and rearing both Colorado Pikeminnow and Razorback Sucker, including hatchery production and grow-out facilities.

Today, brood stocks of Colorado Pikeminnow and Razorback Sucker are held at Southwestern Native Aquatic Resources & Recovery Center (SNARRC) at Dexter, New Mexico where fish are spawned, hatched, and reared. Brood stocks of Colorado Pikeminnow are also held at the Colorado Division of Wildlife J.W. Mumma Native Species Hatchery at Alamosa, Colorado and brood stocks of Razorback Sucker are held at Ouray National Fish Hatchery – Grand Valley Unit (NFH-GVU) at Grand Junction, Colorado. The Program uses grow-out facilities to produce larger Razorback Sucker (>300 mm total length) for stocking to enhance survival. Since 1998, Navajo Agricultural Products Industry (NAPI) Ponds located on the NIIP have been used to grow-out Razorback Sucker from SNARRC for the stocking program. From 2007-2013, Uvalde National Fish Hatchery (Uvalde) in Uvalde, Texas was used to rear and stock 11,400 >300 mm Razorback Suckers to meet stocking goals. Low recaptures rates of Razorback Sucker stocked from Uvalde, prompted the Service and the Program to discontinue using this facility (Durst 2011). Final fish distributions from Uvalde occurred in October of 2013. In 2010, the Coordination Committee approved cost sharing with the Upper Colorado River Endangered Fish Recovery Program to construct, operate, and maintain Horsethief Canyon Native Fish Facility (HCNFF) at Ouray NFH's GVU. This facility became operational in 2012 and includes four 0.25-acre hatchery ponds for use by the Program to grow-out Razorback Sucker for the San Juan River stocking program. In addition to the fish produced by these facilities, excess fish from other facilities that raise Colorado Pikeminnow and Razorback Sucker are occasionally stocked into the San Juan River.

While the overall goals for Element 1, *Management and Augmentation of Populations of Colorado Pikeminnow and Razorback Sucker*, are the same for both the Colorado Pikeminnow and Razorback Sucker, i.e., Establish Genetically and Demographically Viable, Self-Sustaining Colorado Pikeminnow and Razorback Sucker Populations (Goal 1.1), Identify and Implement Strategies for Improving the Colorado Pikeminnow and Razorback Sucker Augmentation Program and Genetic Integrity (Goal 1.2), and Support Operations and Maintenance of Facilities to Support Colorado Pikeminnow and Razorback Sucker Stocking Programs (Goal 1.3), some actions and tasks vary by species.

Element 2. Protection, Management, and Augmentation of Habitat

This element identifies actions and tasks that address protection, management, and augmentation of the physical and aquatic habitats needed to support recovery of Colorado Pikeminnow and Razorback Sucker populations including suitable flows, range, the native fish community, and water quality. Following seven years of research on flows and habitat in the San Juan River Basin completed in 1997, the Biology Committee recommended a program of flow releases from Navajo Dam that would mimic the river's natural hydrograph, thereby improving habitat for native fishes including the Colorado Pikeminnow and Razorback Sucker

(Holden 1999). These flow recommendations were based on scientifically-established relationships between flow regime (frequency, timing, magnitude, duration, rate of change, and seasonality of water flow), river geomorphology, and habitat and life history of the two endangered fish species. Reclamation began operating Navajo Dam according to the flow recommendations in 1999 and implemented the flow recommendations using operations decision criteria established in the Final Environmental Impact Statement for operations of the Navajo Dam through 2014 (Reclamation 2006). Releases are made to provide sufficient water at times, in quantities, and for durations necessary to protect the endangered fish and their designated critical habitat while maintaining the other authorized purposes of the Navajo Dam. Biologists have been monitoring the effects of Program's activities, including flow management, for more than twenty years using standardized monitoring protocols established by Propst et al. (2000, 2006) for most of that period.

The authors of the 1999 flow recommendations noted that the flow recommendations were subject to review and revision through an adaptive management process based on monitoring data. Several scientific reports by the Biology Committee and other researchers concluded that prescribed flows from Navajo Dam may not have achieved the expected outcome in terms of channel complexity and fish habitat and maintenance identified in the 1999 flow recommendations (Miller 2006, Bliesner 2010, SWCA Environmental Consultants (SWCA) 2012). Upon reviewing 1999-2003 monitoring results, the Biology Committee determined that although the prescribed flows were successful in some regards, they have been largely unsuccessful in creating and maintaining the secondary channels and backwater habitat critical to reproduction of the endangered fish (Miller 2006). Bliesner (2010) reported that habitat complexity important to all life stages is diminishing. Several committee members also suggested during a 2012 habitat monitoring workshop (SWCA 2012) that encroachment onto the San Juan River floodplain by non-native plants is degrading habitat for endangered fish by "armoring" banks and simplifying the river channel. This bank armoring reduces habitat complexity often associated with higher numbers of Colorado Pikeminnow and Razorback Sucker. The lack of the intended habitat response to the flow recommendations may also be attributed to an apparent change in hydrologic conditions in the 1999 to 2013 period as compared to the longer term period since 1971 (Reclamation 2014). These results suggest that implementation of the initial flow recommendations using the 2006 operations decision criteria may not create and maintain enough habitat to achieve recovery goals for the endangered fish.

Task 2.2.1.2 in this LRP is included to insure the flow recommendations are reviewed and revised based on monitoring data, the new San Juan River Basin hydrologic model, updated climate change projections for stream flow, and expanded scientific knowledge of flow-ecology relationships. To initiate the process, the Program held an environmental flows workshop in February 2015 to review the 1999 flow recommendations, the implementation decision tree, and accumulated fish and habitat monitoring data and results. It was recognized that the basis of the existing flow recommendations (mimicry of the natural hydrograph) was still valid but a new method for implementing them was needed. During the workshop, consensus was reached on utilizing a new interim method for implementing the flow recommendations for 2015, to conduct a comprehensive review of the 1999 flow recommendations, and to continue to further develop the new process for longer term implementation of the flow recommendations (Alliant Environmental 2015). Another environmental flows workshop was held in April 2016 to reach final agreement on implementation of a new decision tree, determine attributes of spring peak releases and base flows, develop a monitoring program to evaluate flow hypotheses, and develop a structure for finalizing the new flow recommendations and operations.

Non-flow alternatives to create and maintain suitable habitats and restore channel complexity that work in conjunction with flows are being investigated including mechanical manipulation and removal of invasive riparian species at selected locations. Non-flow alternatives for creating and maintaining suitable habitat could also help offset possible effects of climate variability and to augment the beneficial effects of flow recommendations. In 2011, the Program partnered with The Nature Conservancy (TNC) on a New Mexico Environment Department River Ecosystem Restoration Initiative (RERI) project to use mechanical manipulation to restore secondary channels along the San Juan River. Construction on these Phase I sites were

completed in November 2011. The Program conducted physical and biological monitoring of the sites to assess functionality, sustainability, fish use, and nonnative vegetation encroachment rate. The information collected was used to determine feasibility, location, and design for additional sites. In 2014, TNC completed Phase II of the channel restoration project using private mitigation funds. This brings the total amount of secondary channels restored to 7.1 miles. Monitoring of larval and small-bodied native fish at the original six RERI sites continued in 2014 and both larval and small-bodied fish were captured in good numbers at the restored sites. To provide additional information on the persistence of aquatic habitats and to measure changes in habitat features, larval fish abundance and small-bodied fish abundance from prior to spring runoff to late fall, more intensive monitoring of the Phase II site and a nearby control site began in 2015.

Review of the current scientific literature and relevant case studies as part of a 2014 evaluation conducted by TNC indicates that both water market transactions and irrigation system improvements that integrate infrastructure modernization with operational changes can successfully reduce agricultural river diversions for the benefit of endangered fish. This study identified multiple opportunities to collaborate with agricultural, municipal, and industrial water users in the San Juan Basin to reduce river diversions through water use efficiency improvements, thereby supporting environmental flows.”

Cold water releases from Navajo Dam were identified as a factor potentially limiting reproduction and upstream distribution of the endangered fishes in the San Juan River (Bliesner and Lamarra 2000). Based on modeling of reservoir and release temperatures (Cutler 2006) and an assessment of longitudinal warming and fish temperature requirements (Lamarra 2007), the Biology Committee determined a temperature control device (TCD) at Navajo Reservoir was not warranted. At that time, impacts to spawning and rearing from cold releases from Navajo Dam into the San Juan River appeared to be minimal and it was thought that spawning was determined more by time-of-year than temperature cues. A TCD may provide seasonal range expansion above critical habitat but it is unknown if range expansion above critical habitat is necessary for recovery. Larval fish surveys conducted on the San Juan River since 1991 indicate that temperature has a greater impact on the spawning period (Brandenburg and Farrington 2009). As a result of the Program’s 2012 Habitat Monitoring Workshop, the Biology Committee determined that the extent of riverine habitat available as well as what is being used by the various life stages of the target species needs to be quantified so that management actions to extend that availability can be evaluated. The committee prioritized expanding habitat monitoring into the Animas River and above the Animas River confluence of the San Juan River focusing on temperature and blockages. Miller and Swaim (2016) documented long-term changes in distribution of temperature from high flows since 1993 and prolonged cold water conditions (temperature depression), however temperature depression did not negatively impact timing, number, and size of larvae.

Range fragmentation in the San Juan River impedes movement of fish and access to spawning areas and feeding grounds. Additional range for Colorado Pikeminnow and Razorback Sucker is being provided through modification of water diversions that allow fish to move upstream and downstream. This LRP identifies actions that provide fish passage at diversions that will enable fish to move freely for over 180 miles from the Lake Powell inflow upstream past the confluence of the Animas River. Some of the fish passage facilities selectively pass fish and help to diminish movement by problematic nonnative fishes to key habitats of native and endangered fishes. Eight major diversion structures on the mainstem San Juan River in New Mexico were identified, ranging from soil and boulder dikes to concrete and metal weirs over which the entire river flows. The most upstream of these structures are dikes and levees at the heads of the Citizens Ditch and the Hammond Canal. They are upstream of the Animas River confluence and outside of designated critical habitat for both species. These cooler reaches of river are not likely to be occupied by Colorado Pikeminnow and Razorback Sucker. Five structures, located downstream of Farmington, were identified by Masslich and Holden (1996) as impediments or partial impediments to fish movement. Fish access was restored at three sites by removing Cudei Diversion Dam at River Mile (RM) ~142 and constructing a passive fish passages at Hogback Diversion Dam at RM 159 in 2001, and constructing a selective fish passage at Public Service Company of New Mexico (PNM) Weir at RM 166.6 in 2003.

Two other potential impediments for fish passage occur in the mainstem San Juan River, Arizona Public Service Company (APS) Weir at RM 163.3 and Fruitland Diversion Dam at RM 178.5. Stamp et al. (2005) identified the need for fish passage at the APS structure and concluded a fish passage was not needed at Fruitland irrigation diversion structure, at that time, but recommended that it be re-evaluated after maintenance work is performed to confirm that the height or composition of the dam is not altered relative to the conditions documented in the study. These two sites are scheduled for reevaluation and modification in 2017.

A waterfall formed at Piute Farms in the lower San Juan River at the Lake Powell inflow (river mile 1.1) in 2003 when water levels of that reservoir declined below ~3,660 feet. This waterfall is an impediment to upstream movement of native and endangered fishes, but also impedes nonnative fishes from moving upstream from the reservoir. The Biology Committee discussed the need for an artificial barrier at the lower end of the San Juan River to exclude nonnative predators and/or potential competitors from recolonizing the river when water levels in Lake Powell rise and the waterfall is again inundated. Reclamation assessed the risk of this occurring and concluded that there is a 60 to 75% chance that the waterfall will be inundated for a total of 30 months (not necessarily continuously) between 2008 and 2030. The waterfall did become inundated for a short period in 2011 when the lake elevation rose above 3,660 feet between July 31 and August 9. It is unknown how many native and nonnative fishes moved into the river during that time; however, sampling crews have subsequently captured Razorback Suckers in the San Juan River that were captured, tagged, and released in Lake Powell (Durst and Francis 2016). Strategies for providing passage of native and endangered fishes from Lake Powell around the waterfall into the San Juan River have been evaluated (e.g., barriers, passive non-native fish removal, temporary weirs). If a barrier is determined to be necessary, measures for providing selective upstream passage for native species will be developed.

Designated Critical Habitat for the endangered fish in the San Juan River basin extends approximately 35 miles downstream into Lake Powell to Neskahai Canyon. Any Colorado Pikeminnow or Razorback Suckers existing in this portion of Lake Powell are considered to be part of the San Juan River fish assemblage. A two-year fish survey of the San Juan Arm of Lake Powell was initiated by the Program in 2011 to assess the extent of San Juan River fish lost over the waterfall especially as it relates to the Program's augmentation program to recover the listed species. During sampling in 2011 and 2012, 147 Razorback Suckers and 25 Colorado Pikeminnows that were released in the San Juan River were captured in the reservoir (Francis et al. 2015). Considering the limited amount of samples taken during the two years and limited amount of lake area that could be covered, it is assumed there are large numbers of Razorback Suckers present in Lake Powell. Biologists also documented active spawning grounds and Razorback Sucker reproduction and believe recruitment may be occurring. Inter-basin exchange of Razorback Suckers between the San Juan, Colorado, and Green Rivers was also documented. Considering limited slackwater or backwater habitats on the San Juan River, Lake Powell may be essential to recruitment and potential recovery of the species in this river basin (Francis et al. 2015). In 2014, the Upper Colorado Endangered Fish Recovery Program initiated sampling in the Colorado River Arm of Lake Powell and will repeat it in that location again in 2015. Additional sampling in areas of Lake Powell downstream from the San Juan and Colorado river arms of the lake is needed to help determine the extent of Razorback Sucker distribution within the lake. The information gained from all Lake Powell surveys will be used by the Program to determine future Program management actions regarding Lake Powell.

Entrainment of all life stages of native and endangered fishes in diversion structures is another potential impediment to recovery. In 2005, the Program funded the design of fish screens or a deflection weir for the Hogback diversion to reduce entrainment of endangered fishes in the Hogback Canal. A fish deflection weir was installed at the Hogback Canal in 2013. Principles for minimizing entrainment that are learned from the experimental Hogback Canal design will potentially be used to construct these features on other diversions and canals. An assessment of potential entrainment structures in the San Juan and Animas rivers will be conducted in 2015.

Based on data collection and an evaluation from the 7-year research period by Holden (2000), the Biology Committee concluded that water quality in the San Juan River was not a limiting factor to recovery of the endangered fishes or to restoration and maintenance of the native fish community. In a comprehensive review of water quality and contaminants in the San Juan River, Abell (1994) found a large quantity of information available on water contaminants and pollutants, primarily abiotic data, but very little data linking those contaminants to fish health. Abell found many of the studies could not be compared to each other due to varying methodologies and detection levels. She emphasized the need for agencies responsible for protecting and restoring Colorado Basin fish populations to work together to insure future sampling efforts complement each other to provide as complete a picture as possible of contaminants in the basin. In a synoptic study of contaminants data from the 7-year research period, Simpson and Lusk (1999) concluded that selenium was a contaminant risk for the Razorback Sucker. The Service has serious concerns with current levels of mercury and selenium found in the tissues of Colorado Pikeminnow and Razorback Sucker and in the Upper Colorado River Basin and believes a comprehensive contaminants monitoring and remediation plan is needed to identify sources and magnitude of water quality threats that are adversely affecting the endangered species. This type of effort will require pooling of resources within the Upper Colorado River Basin and the expertise of the Biology Committee, contaminant biologists, fish toxicologists, and management and policy experts.

The Program's goal is to recover both of the endangered fishes within the context of conservation and management of the entire native fish assemblage that supports them. Protection of native aquatic species is critical to the recovery of the Colorado Pikeminnow and Razorback Sucker. Although the Program has not identified any specific recovery actions to actively manage the native fish community, the restoration of backwater habitats and efforts to maintain or increase habitat complexity are active management tools for conserving all native fish species. The Program has been monitoring the native fish community since its inception to assess the status of the native fish community and to determine if specific management actions will be needed in the future to recover the listed species. The Program collaborates with other ongoing programs that are actively managing other native species. For example, three native species, Flannelmouth Sucker, Bluehead Sucker, and Roundtail Chub, have some level of state sensitive species status in each of the states they occur in (Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming). In 2006, a range-wide conservation agreement and strategy was signed by each of the six state agencies as well as federal and tribal agencies with the goal of implementing conservation measures and reducing threats to the species in order to conserve populations and prevent the need for federal listing under the Endangered Species Act. Conservation actions have included three species monitoring, research, propagation and stocking of Roundtail Chub, removal of invasive nonnative species, and habitat conservation and restoration.

To achieve this element, six recovery goals were established to: provide suitable habitat (*Goal 2.1*); provide suitable flows (*Goal 2.2*); provide increased range (*Goal 2.3*); minimize fish entrainment (*Goal 2.4*); provide suitable water quality (*Goal 2.5*), and manage the native fish community (*Goal 2.6*). Providing suitable habitat actions and tasks focus primarily on creating and maintaining habitat complexity to minimize loss and degradation of habitat and managing flows to create and maintain suitable habitat. An action is also included to evaluate and implement habitat restoration strategies to augment the function of flow to create and maintain suitable habitat. The actions and tasks related to providing suitable flows focus on implementing flow regimes beneficial to both listed species and the native fish community, providing flow recommendations and guidance for releases out of Navajo Dam, and maintaining a San Juan River hydrology model to evaluate flow recommendations and basin hydrology over time. Actions and tasks to increase range include construction and maintenance of Program structures at diversions to allow for fish passage in the San Juan River mainstem and tributaries. An action is also included to evaluate passage of San Juan River fish into Lake Powell in light of the waterfall that has formed and to assess the potential for non-native fish movement into the river if the waterfall becomes inundated. Actions and tasks to minimize fish entrainment identify diversion structures in the San Juan River mainstem and tributaries that need to be assessed and modified, if necessary, to prevent fish mortality. Water quality actions and tasks focus on identifying water quality and contaminant problems that could affect the listed fish and the native fish community, remediating those

problems, and minimizing the risk of hazardous materials spills. Actions and tasks to manage the native fish community currently focus on assessing the health of the native fish community as an important component of suitable habitat. Many of the tasks identified in Element 2 will be assessed through tasks under Element 4, *Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions*.

Element 3. Management of Nonnative Aquatic Species

This element identifies actions to reduce potentially negative interactions between the endangered fish species and problematic nonnative fish species. Over twenty species of nonnative fishes have been documented within the San Juan River Basin. Nonnative fishes can numerically dominate riverine habitats and communities, negatively interacting with native and endangered fish species, and contributing to their decline (Mueller 2005). The 2002 recovery goals for Colorado Pikeminnow and Razorback Sucker (Service 2002a, 2002b) identified predation and competition by nonnative fish species as a primary threat to these endangered species. The recovery goals state that the management of nonnative fishes should be implemented in two steps: (1) develop management programs to identify the levels of management needed to minimize or remove the threat for selected species in selected river reaches (requirement for downlisting), and (2) implement the identified levels of nonnative fish management (requirement for delisting). Nonnative fish management actions conducted by the Program are consistent with these actions.

The suite of nonnative fishes in the San Juan River includes warm-water sport fishes and non-sport fishes (Brandenburg and Gido 1999; Brooks et al. 2000). Rainbow Trout and Brown Trout comprise the tailwater trout fishery below Navajo Dam (Ahlm 1993; Larson and Ahlm 1994) and do not occupy the same river reaches as the endangered fishes, which are found farther downstream in warmer water. The non-sport fish include several species of minnows and suckers with little or no commercial or sport value. No known strategy will eliminate these unwanted species from the Basin and their populations need to be reduced to a level that minimizes or removes the threat of predation and competition to native species. Channel Catfish *Ictalurus punctatus* and Common Carp *Cyprinus carpio* have been identified as a detriment to the recovery of Colorado Pikeminnow and Razorback Sucker (Service 2002a, b) and are the primary focus of the Program's nonnative species removal program.

Mechanical removal of nonnative fishes in the upper and middle sections of the San Juan River began on a limited basis in 1998. Intensive removal efforts began in 2001 with focus on a section of river from PNM Weir to Hogback Diversion (RM 166.6 - 159.0). In addition to this section, intensive nonnative removal from Hogback Diversion to Shiprock Bridge (RM 158.8 – 147.9) has been conducted since 2003. Based on observed increases in Channel Catfish abundance (Ryden 2007, 2008), efforts were expanded in 2008 to include intensive removal from Shiprock Bridge to Mexican Hat, UT (RM 147.9 – 52.9) (Duran 2013). Nonnative removal in the lower San Juan River began in 2001. Since 2003, the focus has been on reducing Channel Catfish and other large-bodied nonnative fishes that occur in the river from Mexican Hat to Clay Hills, UT between river miles (RM 52.8-2.9). Additionally, opportunistic removal of nonnative fishes during research and monitoring activities has augmented this effort. Other removal measures that have been implemented include the operation of the selective fish passage at PNM Weir. Since the facility began operation in 2003, all nonnative fishes that pass through this structure are removed. Nonnative fish stocking and baitfish policies of affected states are evaluated and nonnative fishes are not being stocked in critical habitat of the endangered fishes in the San Juan River. Measurable objectives and quantitative methods for assessing and maintaining effectiveness of nonnative fish control are developed and implemented through this LRP.

Sport fishes are important to recreational and commercial interests throughout the southwestern United States; however, management of sport fishes sometimes conflicts with conservation of native fish species (Clarkson et al. 2005). The San Juan River does not receive a great deal of fishing pressure other than the blue ribbon trout fishery in the tailwaters of Navajo Dam. Nevertheless, appropriate sport fish management is

necessary and important to minimize conflicts and ensure conservation of native and endangered fish species. The States of Utah and New Mexico currently have open bag limits on Channel Catfish and striped bass in the San Juan River. The State of Colorado allows daily bag limits of 10 fish of each species. Although recreational fishing pressure on the San Juan River is limited, maintenance of these regulations will aid the Program in the goal of limiting nonnative fish distribution and abundance. Navajo Nation sport fishing regulations are also included in meeting this goal.

The Biology Committee held a nonnative fish control workshop in 2010 to evaluate and modify the nonnative fish management program. A strong message that came out of the workshop was the importance of prevention in managing nonnative species. Nonnative introductions are not limited to fish as all introduced nonnative aquatic species have the potential to become an invasive species. Overall, introduced or stocked aquatic species undermine and hamper recovery actions. For the San Juan River, a waterfall at Lake Powell currently keeps nonnative fishes from entering the river from that source but other reservoirs in the basin could be sources. Lake Nighthorse, an off-stream reservoir on Basin Creek in the Animas River watershed near Durango, CO, was completed in 2011 as part of the ALP project. Water is pumped uphill from the Animas River and impounded in the reservoir by Ridges Basin Dam. The outlet structure was designed with an energy dissipating sleeve valve inside the discharge pipe to prevent survival and release of fish into the San Juan River Basin (Bark et al. 2013). Fathead Minnow and crayfish (*Orconectes spp.*) were present in Basin Creek before the reservoir filled (White, J., CPW, personal communication 2012). Since the reservoir filled Mottled Sculpin (*Cottus bairdi*), Iowa Darter (*Etheostoma exile*), White, Bluehead, and Flannelmouth Suckers have been documented in the reservoir (Bark et al. 2013). Researchers examined survival of nonnative fish species and embryos, post-larvae and fingerling age classes through the energy dissipating sleeve valve at increments of atmospheric pressure associated various lake elevations as the reservoir filled from 2009-2011. In general, survival of all age classes and species decreased as the reservoir filled and the atmospheric pressure increased but intact eggs could not be destroyed at any of the reservoir. Reclamation is developing a management plan which will include stocking of only trout and salmon species and additional monitoring of releases. The Program needs to be vigilant about preventing introductions of all nonnative species. Nonnative species that are already in the system but not currently a problem need to be tracked because any number of events could potentially trigger a problem.

To achieve this element, two goals have been established to manage nonnative species that could impact the Program's ability to recover the endangered fish species in the San Juan River. These include controlling problematic nonnative fishes (*Goal 3.1*) and preventing the introduction and establishment of other nonnative invasive species (*Goal 3.2*). The actions and tasks under Goal 3.1 focus on full implementation of the nonnative fish control strategy initiated in 2008, evaluation of methods, assessment of effects on the fish community, and development of targets for nonnative fish removal. Goal 3.2 includes actions and tasks that focus on establishing policies and agreements with states and tribes to manage sport fish and bait species in the San Juan River in a manner compatible with endangered fish recovery and to identify potential invasive nonnative species and control their introduction and escapement into the main stem, floodplain, and tributaries. Included are tasks to assess the effects of non-native fish from Lake Powell and from other sources on the fish community in the San Juan River and to track all nonnative species in the basin to the extent possible.

Element 4. Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions

Monitoring San Juan River native and nonnative fish populations and their habitat is necessary to evaluate management actions and to assess the Program's progress toward achieving recovery of the two endangered fish species. The Biology Committee developed a standardized fish monitoring plan and protocols in 2000 that describes the sampling design and strategies to be used in monitoring Colorado Pikeminnow and Razorback Sucker and their habitat as part of the entire fish community (Propst et al. 2000). The monitoring program also provides a basis of new information to be used to update management and conservation activities

as part of the Program's adaptive management process. The monitoring plan and protocols were updated in 2006 (Propst et al. 2006) and through a series of monitoring workshops held by the Biology Committee in 2009, the monitoring plan and protocols were evaluated and updated again in 2012 (Program 2012b). The new fish and habitat monitoring plan includes updated and expanded monitoring protocol sections and a section that addresses annual and long-term data synthesis and integration.

Ongoing monitoring of stocked and wild Colorado Pikeminnow and Razorback Sucker is necessary to evaluate the success of the augmentation strategy and make adjustments, as necessary, to achieve the Program's goal of establishing self-sustaining populations of both species. Bestgen et al. (2009) used methods similar to those he used in the Green and Colorado River subbasins to analyze the survival of stocked Razorback Suckers in the San Juan River using mark-recapture data. He showed season of stocking and size at stocking was related to increased survival. Durst's mark-recapture data analyses resulted in changes to the stocking program regarding hatchery source for Razorback Sucker and age at stocking for Colorado Pikeminnow (Durst 2011, 2013). The results of analyses using mark-recapture data are useful for improving stocking procedures to increase the survival of both species and these analyses are repeated regularly. Continued annual monitoring of the endangered fish populations in the San Juan River is also important for documenting reproduction and recruitment, an indicator of a self-sustaining population. Once populations are established, reliable and precise population estimates will be conducted to determine when the downlist and delist criteria specified in the species recovery goals are being achieved. Because recovery goals require wild populations, criteria are needed to supplement catch rate estimators with mark-recapture population estimates of wild-produced adults and juveniles. The recovery goals for the Colorado Pikeminnow and Razorback Sucker include the Green, Colorado, and San Juan rivers; therefore, this Program and the Upper Colorado River Endangered Fish Recovery Program are closely linked. Population estimate monitoring is currently being done for Colorado Pikeminnow and Humpback Chub in the upper Colorado and Green rivers. Relationships between catch rate estimators and mark-recapture population estimates of fish in the upper basin may be helpful in developing these criteria for the San Juan River. Implementation of mark-recapture estimators will require a comprehensive assessment of logistics, personnel, equipment, and funds.

Other native and nonnative fish populations are being monitored to better understand the status and trends of these species and their inter-relationships with the endangered fish species. To the extent possible, river-wide habitat monitoring is closely coordinated and integrated with fish community monitoring to allow assessment of changing habitat availability and fish use in response to management actions and population recovery. Standardized habitat monitoring for the San Juan River was included in the 2000 monitoring plan and was reviewed and revised for the 2012 version. The plan is designed to monitor and evaluate river-wide habitat changes through time. A focused habitat monitoring workshop was held in January 2012 to evaluate, refine, and improve the river-wide habitat monitoring and mapping work on the San Juan River to insure the Program implements methodologies that are conducive to answering outstanding questions. The Program started conducting physical and biological monitoring at specific sites along the river where secondary channels were restored in 2011 to assess functionality, sustainability, fish use, and nonnative vegetation encroachment rate. The information collected showed both larval and small-bodied native fish in good numbers and was used to determine feasibility, location, and design for additional sites completed in 2014. Additional intensive monitoring at the restored sites will provide information on the persistence of aquatic habitats and measure changes in habitat features, larval fish abundance and small-bodied fish abundance from prior to spring runoff to late fall for use in restoring more sites in the future.

Annual and long-term data synthesis and integration is a critical component of the Program's fish and habitat monitoring plan. To adequately evaluate the management actions, the data from all monitoring, management, and research activities are collectively synthesized as a comprehensive data set. The monitoring data are analyzed for each individual protocol during annual data analysis by the principal investigator for each protocol. This annual data analysis uses statistics appropriate for each protocol to test relevant hypotheses and examine data temporally and spatially. The integrated data from individual protocols are used to address

questions that require data synthesized across protocols. Some synthesis questions can be addressed with the annual monitoring data whereas other questions require datasets over multiple years or specific research efforts. Prioritization of questions relevant to Colorado Pikeminnow and Razorback Sucker recovery in the San Juan River is critical to carrying out annual and long-term data integration exercises.

To achieve this element, five goals have been established to monitor fish populations (*Goal 4.1*), to monitor habitat use and availability (*Goal 4.2*), monitor and evaluate habitat restoration strategies and projects (*Goal 4.3*), to integrate and synthesize monitoring data and other information to evaluate fish community and ecosystem responses to recovery actions (*Goal 4.4*) and to identify and conduct research and monitoring in support of recovery actions (*Goal 4.5*). The focus is on implementation of a long-term, standardized monitoring program that was developed to track the presence, status, and trends of endangered fish populations and the native fish community and to monitor existing and restored habitat. In addition, data from all monitoring, management activities and research are integrated and synthesized annually to assess the status of the fish community, evaluate ecosystem responses to the management actions, and support broader, long-term data and information needs. Actions and tasks are included that use adaptive management concepts to evaluate and assess results and methods to refine current methodologies and develop and implement new monitoring and research strategies. A primary purpose of the actions and tasks under Element 4 is to collect and evaluate data in such a way that the Program's progress toward achieving recovery of Colorado Pikeminnow and Razorback Sucker in the San Juan River can be adequately tracked and assessed.

Element 5. Program Coordination and Assessment of Progress toward Recovery

The U.S. Fish and Wildlife Service is responsible for administering the San Juan River Basin Recovery Implementation Program. To fulfill this responsibility, the Service appoints a Program Coordinator who is responsible for overall Program planning, coordination, and management, information integration and review, and facilitation of contracting funding and management. Reclamation appoints a Funds Manager to maintain and distribute base and capital funds and administer contracts. The Program Coordinator, Program staff, and the Program's technical committees developed this LRP to facilitate achievement of recovery of the endangered fish species of the San Juan River Basin. There are two major components under this element, Program coordination and data integration and evaluation to assess the Program's progress toward achieving recovery.

Program Coordination

The Program Coordinator works with the Program's technical committees to identify and expedite individual projects that are needed to accomplish the LRP tasks for each of the Recovery Elements. The Program Coordinator, together with the Program's technical committees, drafts AWP's consisting of high priority individual projects, and forwards these to the Coordination Committee for review and approval. The Program Coordinator is responsible for maintaining records showing distribution and expenditures of all annual and capital funds expended under the AWP by each funding source. The Program Coordinator is responsible for ensuring that the Program operates according to the Program Document; including the preparation of this LRP, the AWP's, budgets, and annual progress reports. In all these tasks, the Program Coordinator is assisted by the technical committees to ensure that appropriate work products are reviewed by the technical committees and all work products are approved by the Coordination Committee. The Program Coordinator annually compiles Program reports for transmittal to the involved agencies and to the Coordination Committee.

Assessment of Progress toward Recovery

Ongoing development, integration, and evaluation of information are essential for assessing progress toward species recovery as well as for guiding future Program direction. An important first step of the Program was implementation of a research phase to document distribution and abundance of resident fishes, characterize species life histories, and identify limiting factors. A 7-year research program, conducted from 1991 through 1997, provided a baseline of information and identified and characterized factors limiting the Colorado Pikeminnow and Razorback Sucker (Holden 2000). The research program was incorporated into the Recovery Program when it was formed in 1992. An array of potential limiting factors have been investigated, including water quality, spawning habitat, nursery habitat, recruitment, hybridization, truncated range, capture-related stress, nonnative fishes, habitat quantity and diversity, flow regime, food, population size, disease, movement barriers, thermal regime, and entrainment in diversion structures. Although numerous activities have been implemented by the Program to address these factors, much remains to be learned about the life history of the endangered fishes, their relationships with other native and nonnative fishes, their habitat associations, and components of their environment that directly and indirectly influence their welfare.

Many of the actions and tasks identified in the initial 7-year research phase of the Program have been completed and the work has contributed to understanding the San Juan River Basin. However, because contemporary Colorado Pikeminnow and Razorback Sucker populations in the San Juan River were extremely small, there is still the need to identify and characterize limitations to the establishment and maintenance of self-sustaining populations. Once a potential limiting factor is identified and characterized through monitoring and research, efforts are made to implement activities that will eliminate or mitigate its impacts. These activities may not always successfully eliminate threats and mitigation alternatives may be developed.

The knowledge gained from the initial and future research coupled with other Program activities is valuable in evaluating progress toward species recovery and guiding future Program direction through annual revisions of the LRP. Annual data collection and analyses included under Element 4, provide the information base for assessing the Program's progress toward achieving recovery. Long-term, broader-based integration and synthesis of this information is also vital to interpreting results of research and management so that informed decisions can be made on future management actions and strategies. The Program Office will use the information and results obtained under Element 4 to prepare a biennial, written "Sufficient Progress" assessment of the Program's progress towards recovery. This report, as mandated in the Program Document, will assess the Program's ability to provide ESA compliance for water development and management activities and identify any corrective actions needed to ensure future ESA compliance.

To achieve this element, three goals have been established to facilitate Program planning and management (*Goal 5.1*), ensure integration and synthesis of data and information to evaluate progress toward recovery (*Goal 5.2*), and facilitate contract and funding management (*Goal 5.3*). Accomplishment of *Goal 5.2* relies heavily on activities included in Element 4 such as establishing and maintaining a comprehensive Program database, annual monitoring data analyses, and synthesizing and evaluating information from all activities and studies.

Element 6. Information and Education

The Upper Colorado River Endangered Fish Recovery Program and the San Juan River Basin Recovery Implementation Program each have a multi-stakeholder structure in which federal and state agencies work with public and private entities to recover endangered fish species in a manner that is consistent with federal, state, and tribal water laws. Although their structure and goals are similar, these recovery programs operate independently, working with their own program partners and governing committees to fulfill requirements detailed in their respective cooperative agreements. Nevertheless, the similarities in these programs provide for effective communication and public outreach under a coordinated effort. The funding for

capital construction and ongoing operation and maintenance (O&M) for the Upper Colorado River and San Juan River Basin Recovery Programs is also tied together in Federal legislation (Public Laws 106-392, 107-375, 109-183, 111-11 and 112-270).

Using a shared approach, the two recovery programs coordinate their outreach efforts and work with other organizations throughout the Colorado River Basin to ensure common audiences receive consistent, current, and accurate information about the endangered fishes and efforts to recover them. These audiences include the general public, elected officials, Indian Tribes, landowners, anglers, river rafters and guides, environmental organizations, water and power developers, teachers, students, and Program participants. Although the geographic coverage of these recovery programs differs within the Upper Colorado River Basin, the majority of affected parties are interested in the recovery efforts taking place for both programs.

An annual publication is produced that highlights accomplishments of both programs. The Program Highlights publication serves as a briefing document for 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 newsletter and freestanding exhibits (in both small and large formats) promote both the Upper Colorado and San Juan programs. Shared outreach efforts help ensure accurate, consistent information about the endangered fish species and recovery programs is disseminated. A shared effort has also proven to be more cost-effective for publication production costs and exhibit fees.

To achieve this element, a goal was established to increase public awareness and support for the endangered fishes and the recovery program (*Goal 6.1*). Actions and tasks focus on providing information about the recovery program to the public and coordinating with the Upper Colorado River Endangered Fish Recovery Program to conduct an effective outreach program.

Tasks That Address Recovery Goals

This LRP addresses the species recovery goals through specific tasks that detail actions necessary to quantify demographic criteria and remove or minimize species threats (Table 1). For example, the LRP identifies tasks that reestablish endangered populations with hatchery fish in a systematic manner and tasks for monitoring population abundance. Numerous tasks help to provide and legally protect habitat, especially flows, and also provide for fish passage, as well as minimize entrainment. A series of ongoing tasks continue to be evaluated, including protection from overutilization and diseases and parasites, as well as water-quality remediation and minimizing the risk of hazardous materials spills. Control of problematic nonnative fish, regulating their escapement, and minimizing the threat of hybridization for Razorback Sucker are also important activities of this Program and the subject of several tasks.

Table 1 also provides a brief description of the status of the Program's progress toward achieving the recovery goals criteria. For more detailed information on results and activities, see the narrative descriptions for each Recovery Element and the status sections for individual tasks in the Appendix A tables.

Table 1. LRP goals, actions, and tasks, by number, that address recovery goals criteria for each species and status.

Recovery Goals Criteria	LRP Goals, Actions, and Tasks	Status
Reestablish populations with hatchery-produced fish	1.1; 1.1.1; 1.2; 1.3; 1.1.2 (Colorado Pikeminnow); 1.1.3 (Razorback Sucker)	Stocking programs to reestablish populations of both species have been ongoing since the Program's inception. These efforts are successfully increasing the number of fish of both species.

Recovery Goals Criteria	LRP Goals, Actions, and Tasks	Status
Ensure adequate protection from diseases and parasites	4.1.7	Fish captured during annual monitoring are inspected for disease and parasites, field notes taken, and findings included in annual reports. To date, no significant problems have been observed. Appropriate actions will be taken if problems are detected.
Minimize threat of hybridization	4.1.6 (Razorback Sucker only)	Fish captured during annual monitoring are inspected for hybridization, field notes taken, and findings included in annual reports. To date, no significant problems have been observed. Appropriate actions will be taken if problems are detected.
Minimize risk of hazardous-materials spills	2.5; 2.5.1; 2.5.3	An assessment of potential hazardous material threats was conducted by TNC. A final report is expected in 2016. Based on threats identified, a plan for remediating potential hazardous materials spills will be developed.
Remediate water-quality problems	2.5; 2.5.1; 2.5.2	Initial investigations revealed a suite of water quality issues on the San Juan River, but more information is needed to better determine the effects on Colorado Pikeminnow and Razorback Sucker populations. The Service has the lead in facilitating this effort and is working in coordination with other agencies to develop strategies for research and monitoring and to develop a basin-wide strategy to accomplish this task.
Provide and legally protect habitat	2.1; 2.1.1; 2.1.2; 2.2; 2.2.1-2.2.4	Navajo Dam has been operated in accordance with flow recommendations developed by the Program since 1999. Releases are made to provide sufficient water at times, in quantities, and for durations necessary to protect the endangered fish and their designated critical habitat while maintaining the other authorized purposes of the Navajo Dam. The 1999 flow recommendations will be reviewed and revised starting in 2015. The Program is also partnering with TNC to restore side channel and backwater habitats. Several sites along the river have been restored and are being monitored by the Program for persistence and functionality. Legal protection of habitat has not been identified as a problem at this time so is not being pursued by the Program.
Provide passage over barriers	2.3; 2.3.1; 2.3.1.3-2.3.1.7; 2.3.2; 2.3.2.1-2.3.2.3	Range fragmentation in the San Juan River impedes movement of fish and access to spawning areas and feeding grounds. Eight major diversion structures on the mainstem San Juan River were identified, ranging from soil and boulder dikes to concrete and metal weirs over which the entire river flows. Fish passage has been restored at three of the sites. The other five sites as well as additional sites on the Animas River are being evaluated to determine what type of passage may be needed.

Recovery Goals Criteria	LRP Goals, Actions, and Tasks	Status
Minimize entrainment at diversion structures.	2.4; 2.4.1; 2.4.1.1-2.4.1.5; 2.4.2; 2.4.2.1-2.4.2.2	Entrainment and/or impingement of all life stages of native and endangered fishes at diversion structures are a potential impediment to recovery. Five structures on the San Juan River and two on the Animas River have been identified that could potentially entrain fish. A deflection weir to reduce entrainment of endangered fishes in the Hogback Canal was constructed in 2013 and its effectiveness being evaluated. In 2015, the Program will issue a RFP for an assessment of potential entrainment sites in the San Juan and Animas rivers.
Control problematic nonnative fishes	3.1;3.1.1; 3.1.1.1-3.1.1.7	The Program has been implementing an extensive riverwide nonnative fish management program to remove nonnative fish annually since 2008. The effort has drastically reduced carp numbers and is altering the population structure of Channel Catfish. The Program annually reviews results of monitoring and analyses and makes adjustments to methods to increase exploitation rates of catfish and improve effectiveness of the nonnative fish removal program.
Regulate nonnative fish releases and escapement	3.2; 3.2.1-3.2.3	A draft sport fish stocking policy for the San Juan River Basin has been developed and is being reviewed for signature by the States of New Mexico, Utah, Colorado, and the Tribes. This along with other efforts to prevent introduction of nonnative species will become part of a comprehensive nonnative species management plan for the Program.
Demographic criteria	4.1;4.1.1-4.1.4.; 4.4; 4.4.1-4.4.4; 5.2; 5.2.1-5.2.2	Monitoring and research data collected from San Juan River Basin is analyzed annually by the Program to assess progress toward achieving the demographic criteria that identifies the number of populations, numbers of individuals in each population, and the recruitment rates necessary for downlisting and delisting each species.

Ongoing Actions

A series of ongoing reports and other activities are identified in this LRP. The reports are designed to provide cohesive and periodic updates on specific issues and are distinct from project reports that describe the findings of a particular study. These reports are provided to the Coordination Committee, the Program Coordinator, Reclamation, and the technical committees and are listed in Table 2. Also listed in Table 2 are workshops to be held, as necessary, to help coordinate Program activities, evaluate recovery activities, and provide technical assistance to biologists on population estimators and monitoring.

Table 2. Ongoing reports and workshops identified in this Long-Range Plan.

Identified Task	Report or Workshop	Schedule/Interval	Status/Action(s) Required
5.2.1.1	Standardized database; for all stocked and recaptured Colorado Pikeminnow and Razorback Sucker in order to	Annual entry of data with appropriate documentation.	Program Office maintains and annually updates the database; Principal Investigators annually provide data to

Identified Task	Report or Workshop	Schedule/Interval	Status/Action(s) Required
	determine the fate of stocked fish.		Program Office by Dec. 31; consolidated data redistributed by Jan. 31.
4.1.1.2	Annual Fish Monitoring Report; to ensure that the best sampling design and strategies are employed.	Annual reports by Biology Committee; compiled by Program Office; posted on Program website	Principal Investigators provide draft reports by March 31 and present results at annual meeting in May. Final reports provided to Program Office by June 30.
5.2.1.2	Data synthesis and integration report; evaluates progress toward minimizing limiting factors, details ongoing Program activities, and assesses current status of native and endangered fish populations.	Annually but may vary in timing due to competing fiscal resources, project scheduling, or significant new information.	Program Office and Principal Investigators conduct focused data integration to address high priority data needs identified by the Biology Committee. Draft reports by March 31 and present results at annual meeting in May. Final reports due by June 30
4.1.1.1	Standardized Fish Monitoring Plan; to assess the presence, status, and trends of Colorado Pikeminnow and Razorback Sucker.	Standing report is revised as necessary by the Program Office and Biology Committee.	Program Office and Biology Committee will continually evaluate the Program's Comprehensive Monitoring Plan and Protocols. The Plan was updated in 2012.
4.2.1.1	Standardized Habitat Monitoring Plan; to assess habitat and flow relationships.	Standing report is part of the Program's Monitoring Plan and Protocols; revised as necessary.	Program Office and Biology Committee updated the Program's Habitat Monitoring Protocols in 2012.
2.2.1.2 2.2.2.1 4.4.4.4	Flow recommendations update report; evaluates and updates flow recommendations and response of native and endangered fishes to flow recommendations.	Environmental Flows Workshop #1 was held in Feb. 2015; Environmental Flows Workshop #2 has not been scheduled yet.	Completion of Reclamation's next generation of the SJRB Hydrology Model is expected in 2015. A technical workshop was held in Feb. 2015 to modify methods for implementing the 1999 flow recommendations. A comprehensive review and revision of the 1999 flow recommendations is expected to begin in 2015.
4.1.1.3	Monitoring Plan Workshop; to coordinate sampling design, data collection, and desired precision and detection levels for detecting responses.	As necessary.	Series of three monitoring workshops were held by the Biology Committee in 2009.
4.2.1.2	Habitat Monitoring and Mapping Workshop; to refine and improve habitat evaluation methods.	As necessary.	Workshop to address this issue was held in January 2012. Program Office and Biology Committee using workshop results to refine current methods and develop new ones.
4.1.4.4	Population Estimation Workshop; to evaluate population estimators used in other systems to identify the most reliable and suitable estimator(s) for Colorado Pikeminnow and Razorback Sucker.	As necessary.	A population estimate workshop was held in 2007.
3.1.1.5	Non-native fish control workshop; to evaluate the non-native fish management program.	As necessary.	A non-native fish workshop was held in May 2010. Another workshop will be held in late 2016 or early 2017 to evaluate the revised study design initiated in FY16.

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APPENDICES

APPENDIX A. Tasks, priorities, responsibilities, dates, and descriptions for elements of the Long-Range Plan

The following Recovery Element Tables 1-6 are included:

1. Management and Augmentation of Populations and Protection of Genetic Integrity
2. Protection, Management, and Augmentation of Habitat
3. Management of Nonnative Species
4. Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions
5. Program Coordination and Assessment of Progress toward Recovery
6. Information and Education

The following are criteria used as guidance for “Recovery Goals Priority” in the *P* column of the following tables:

Low (<i>L</i>)	The task is not linked to site-specific management actions of recovery goals and is not necessary for species recovery.
Medium (<i>M</i>)	The task is indirectly linked to site-specific management actions and may be supportive of species recovery.
High (<i>H</i>)	The task is linked or related to a site-specific management action cited in recovery goals and may be necessary to achieve species recovery goals.
Critical/Compliance (<i>C</i>)	The task reflects a site-specific management action cited in recovery goals or biological opinions as a compliance measure and is considered necessary to achieve species recovery (formerly Highest).

Status Categories: Ongoing, Annually, Pending, To Be Determined (TBD), As Needed, As Requested, On Hold, Completed

The following are abbreviations used in the following Tables:

ASIR	American Southwest Ichthyological Researchers
BC	Biology Committee
BIA	Bureau of Indian Affairs
BHS	Bluehead Sucker
BOR	Bureau of Reclamation
CC	Coordination Committee
CPM	Colorado Pikeminnow
ERI	Ecosystems Research Incorporated
FMS	Flannelmouth Sucker
FWS	U.S. Fish and Wildlife Service
GJ	Grand Junction
HCNFF	Horsethief Canyon Native Fish Facility
MEC	Miller Ecological Consultants
NFWF	National Fish and Wildlife Foundation
NMDGF	New Mexico Game and Fish Department
NN	Navajo Nation

PO	Program Office
RBS	Razorback Sucker
RERI	New Mexico River Ecosystem Restoration Initiative
Program	San Juan River Basin Recovery Implementation Program
SOW	Scopes of Work
SNARRC	Southwestern Native Aquatic Resources & Recovery Center
TNC	The Nature Conservancy
UNFH	Uvalde National Fish Hatchery

Table A1. Element 1— Management and Augmentation of Populations of Colorado Pikeminnow and Razorback Sucker.

<i>P</i>	Tasks	Start Date	End Date	Who	Status	Status of Activity												
Goal 1.1 Establish Genetically and Demographically Viable, Self-Sustaining CPM and RBS Populations.																		
Action 1.1.1 Develop plans for rearing and stocking CPM and RBS.																		
<i>H</i>	1.1.1.1 Review and update augmentation plan for CPM and adjust stocking goals as needed.	2010	2020	FWS, BC, PO	Ongoing	Time frame for current CPM stocking plan is 2010-2020. Review and update of 10-year stocking goals needs to occur before 2020.												
<i>H</i>	1.1.1.2 Review and update augmentation plan for RBS and adjust stocking goals as needed.	2009	2016	FWS, BC, PO	Ongoing	Time frame for current 8-year stocking plan is 2009-2016. A draft Augmentation Plan has been created and will be finalized in 2016 to guide stocking beginning in 2017.												
Action 1.1.2 Produce, rear, and stock sufficient numbers of CPM to meet stocking goals of augmentation plan.																		
<i>C</i>	Task 1.1.2.1 Annually produce and rear at least 400,000 age-0 CPM (50–55 mm TL) at SNARRC.	2010	2020	SNARRC	Annually	Under the current CPM stocking plan for the San Juan River, augmentation efforts focus on culturing and stocking ≥400,000 age-0 CPM annually from 2011-2020 or as directed by the Program. SNARRC currently maintains a broodstock of 647 adult fish. In 2015, a total of 402,087 age-0 fish were stocked into the San Juan River as follows: <table border="1" style="margin-left: 20px;"> <tr> <td>11/3</td> <td>125,800</td> <td>50-60mm</td> <td>River Park</td> </tr> <tr> <td>11/3</td> <td>126,500</td> <td>50-60mm</td> <td>Berg Park</td> </tr> <tr> <td>11/3</td> <td>149,787</td> <td>50-60mm</td> <td>PNM Weir</td> </tr> </table> (Scope of Work (SOW 16-8))	11/3	125,800	50-60mm	River Park	11/3	126,500	50-60mm	Berg Park	11/3	149,787	50-60mm	PNM Weir
11/3	125,800	50-60mm	River Park															
11/3	126,500	50-60mm	Berg Park															
11/3	149,787	50-60mm	PNM Weir															
<i>C</i>	Task 1.1.2.2 Stock at least 400,000 age-0 CPM annually into the San Juan River	2010	2020	NMFWCO, SNARRC	Annually	In 2015, 402,087 YOY (2015 year class) CPM were stocked at three locations on the San Juan River. (SOW 16-7).												
<i>M</i>	Task 1.1.2.3 Opportunistically stock available CPM in excess of those described above.	2010	2020	NMFWCO, BC, PO	Annually	Evaluation on a case by case basis will occur when opportunistically acquired fish become available to the Program in the future.												
Action 1.1.3 Produce, rear, and stock sufficient numbers of RBS to meet stocking goals of augmentation plan.																		
<i>C</i>	Task 1.1.3.1 Produce and rear RBS at SNARRC for stocking to grow-out facilities.	2009	2016	SNARRC	Annually	The RBS stocking plan for the San River is for SNARRC to maintain a captive broodstock population large enough to produce RBS for annual stocking. A broodstock of 1,176 adult fish of Lake Mohave origin is currently being maintained and managed as identified in SNARRC’s RBS Genetics Management and Captive Propagation Plan (2004). In 2015, a total of 7,000 age-1 RBS were stocked into two NAPI ponds on April 8, 2015:												

P	Tasks	Start Date	End Date	Who	Status	Status of Activity			
						4/8	3,500	190-225mm	East Avocet Pond
						4/8	3,500	190-225mm	Hidden Pond
						All fish are PIT tagged 30-45 days prior to hauling and stocking into the NAPI ponds. (SOW 16-9).			
C	Task 1.1.3.2 Produce RBS in three NAPI grow-out ponds (3,000-3,500 fish per pond, > 200 mm TL) and stock into the San Juan River.	2009	2016	NN, NMFWCO	Annually	7,000 Razorback Suckers averaging 180 mm were stocked into two NAPI Ponds in April 2014. The third pond (West Avocet) was allowed to dry and undergo renovations to improve and restore pond condition. Passive harvest occurred in September and active harvest was conducted on October 27 & 28, 2015. Overall, 3,048 RBS averaging 336 mm were stocked into the San Juan River at various locations. (SOW 16-10)			
C	Task 1.1.3.3 Produce > 2,000 RBS per year (>300 mm TL) at Horsethief Canyon Native Fish Facility (HCNFF), which is part of the larger Ouray National Fish Hatchery – Grand Valley Unit (ONFH-GVU) in Grand Junction, CO.	2013	2016	FWS ONFH-GVU	Annually	Ponds became operational in summer 2012. The third year stockings of RBS from HCNFF occurred in the fall of 2015. A total of 2,060 RBS were stocked as follows: 605 (mean TL = 403.2 mm) at Bloomfield, NM on October 10; 689 (mean TL = 338.7 mm) at Boyd Park on October 29; 486 (mean TL = 387 mm) at PNM on November 3; and 380 (mean TL = 400.5 mm) at Montezuma Creek, UT on November 3. The SJRBRIP was charged this year for harvesting, PIT-tagging, or transport/stocking in FY-15 (SOW 15-6). The next cohort -- to produce > 2,000 RZ of target size (> 300 mm TL) -- to be stocked in 2016 (SOW 16-6). (See Task 1.3.1.4)			
C	Task 1.1.3.4 Stock at least 91,200 RBS (> 300 mm TL) during eight year stocking period or 11,400 per year.	2009	2016	NN, CRFP, NMFWCO	Annually	In 2015, 5,608 >300 mm TL RBS were stocked at various locations in the San Juan and Animas rivers in NM & 1 site in UT (Montezuma Creek). 2,160 RBS were delivered from Ouray/Horse Thief Canyon-GVU (2013 YC), and 3,448 from NAPI ponds (2014 YC). Overall, 96,272 fish have been stocked by year seven of the eight year stocking effort: a surplus of 5,072 fish with one more year of stocking still remaining. A new Augmentation Plan has been drafted to guide stocking efforts beginning in 2017. (SOW 16-7).			
M	Task 1.1.3.5 Opportunistically stock available RBS in excess of the 11,400 described above.	2009	2016	NMFWCO, BC, PO	Annually	No RBS were opportunistically stocked in 2015. Stocking target of 11,400 RBS/year not fulfilled, but have already exceeded 91,200 RBS/8 years (96,272 since 2009, so met the overall goal in 6 years). No excess available in 2015. Evaluation on a case by case basis will occur if opportunistic fish become available to the Program in the future.			

Goal 1.2—Identify and Implement Strategies for Improving the CPM and RBS Augmentation Program and Genetic Integrity.

Action 1.2.1 Implement methods to evaluate status and success of stocked CPM and RBS.

<i>P</i>	Tasks	Start Date	End Date	Who	Status	Status of Activity
<i>H</i>	Task 1.2.1.1 Maintain a standardized database for all stocked and recaptured CPM and RBS in order to determine the fate of stocked fish.	2009	2023	PO	Ongoing	The CPM and RBS PIT tag databases have been updated to reflect 2015 stocking, capture, and recapture efforts conducted by various Program projects. The database currently contains 57,301 CPM and 163,395 RBS records, respectively (SOW16-37). Efforts are on-going to integrate Program data into the online database STReAMS.
<i>H</i>	Task 1.2.1.2 Identify, describe, and implement strategies for improving survival and retention of stocked CPM and RBS, including acclimation prior to stocking, size of fish stocked, time and location of stocking, physiological conditioning, and predator avoidance.	2009	2023	FWS, NMFWCO	Ongoing	Developed and implemented an experimental stocking design for RBS to better understand the effects soft vs. hard release and stocking site has on retention/survival. Recapture data will be used to evaluate those effects. Stocking locations at PNM Weir (Fruitland ,NM) and upstream at Verde del Rio Park (Bloomfield, NM) on the San Juan River, plus Boyd and Berg Parks on the Animas River in Farmington, NM were used to reduce densities at stocking sites and to expand stocking range for YOY CPM. (SOW 15-7)
<i>L</i>	Task 1.2.1.3 Identify and implement a method for tracking genetics of CPM and RBS in the San Juan River to determine if and to what extent wild-produced individuals depart from genetic structure of parental stock (hatchery derived).	2003	2023	FWS	As needed	No action taken yet as wild-produced individuals remain rare.
Goal 1.3— Support Operations and Maintenance of Facilities to Support CPM and RBS Stocking Programs.						
Action 1.3.1. Support production and grow-out facilities.						
<i>H</i>	Task 1.3.1.1 Support operation and maintenance of hatchery facilities at SNARRC for CPM and RBS production.	1994	2016/2020	PO, FWS	Annually	Program provided funding for these projects via SOW 15-9 (RBS) and SOW 15-8 (CPM)
<i>H</i>	Task 1.3.1.3 Support operation and maintenance of NAPI grow-out ponds.	1994	2023	NN, FWS	Annually	Program provided funding for this project via SOW 15-10
<i>H</i>	Task 1.3.1.4 Support operation, and maintenance of Horsethief Canyon Native Fish Facility (HCNFF), part of the larger Ouray National Fish Hatchery – Grand Valley Unit (ONFH-GVU) in Grand Junction, CO.	2013	2023	FWS ONFH-GVU	Annually	Program provided funding for this project via SOW 15-6.
Action 1.3.2 Implement a PIT tag marking program to insure all stocked and/or encountered endangered fish are fitted with PIT tags to track individual CPM and RBS in support of evaluation and assessment activities.						
<i>H</i>	Task 1.3.2.1 Procure adequate numbers of PIT tags for marking endangered fish.	1998	2023	BOR	Ongoing	PIT tags were procured by BOR for 2015 (SOW 15-11). FWS-CRFP in Grand Junction distributed PIT tags to Dexter NFH, HCNFF, and field researchers in 2014.

<i>P</i>	Tasks	Start Date	End Date	Who	Status	Status of Activity
<i>H</i>	Task 1.3.2.2 Install and maintain remote PIT tag detectors in the river to passively track fish presence/absence and movement.	2012	2023	BOR	Ongoing	Permanent passive PIT tag detectors were installed at TNC Phase II restoration sites west of Shiprock, NM, Hogback Fish Weir (RM 159), and PNM fish passage (RM 167) in 2014. A permanent detector was installed across half of the river at PNM Diversion. Coverage across the entire river will potentially be done after a year to see if the partial structure stays in place. Mobile detectors were also deployed at several locations in the river.

Table A2. Element 2 — Protection, Management, and Augmentation of Habitat

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
Goal 2.1 Provide Suitable Habitat to Support Recovery of CPM and RBS Populations						
Action 2.1.1 Create and maintain habitat complexity to minimize loss and degradation of habitat for the endangered fish in the SJR						
<i>C</i>	Task 2.1.1.1 Support implementation of TNC’s Conservation/Habitat Planning Project.	2011	2015	TNC, PO	Ongoing	In 2014, the Phase II channel restoration was completed at a complex site located between RM 134 and RM 137 using private mitigation funds. Restoration methods included: 1) re-establishing the secondary channel inlet (i.e. connection with the river) and cleaning out secondary and tertiary channels; 2) mechanical clearing and chemical treatment of Russian olive and saltcedar along banks; and 3) replacement-planting of willow poles. A total of 4.7 miles of channel restoration and 17 acres of exotic vegetation removal were completed.
Action 2.1.2 Implement habitat restoration strategies to augment the function of river flow to create and maintain suitable habitat.						
<i>H</i>	Task 2.1.2.1 Develop and implement a plan for feasible habitat restoration strategies and implement such plan as funding becomes available.	2015	2016	BOR, BC, FWS, NN	Pending	This will likely be a topic for a workshop in the future once additional information is collected on the persistence of restored aquatic habitats and use by larval and small-bodied fish from prior to spring runoff to late fall, the retrospective analysis is completed, and the flow revision workshop is completed.
Action 2.1.3 Procure products, equipment, and materials in support of Goal 2.1 – 2.6						
<i>H</i>	Task 2.1.3.1. Obtain river videography	1999	2023	P.I.s	Annually	Habitat imagery (videography) was not obtained 2014. Lidar imagery was used for habitat mapping in 2014. Videography will be obtained in 2015, if possible (SOW 16-16).
<i>H</i>	Task 2.1.3.2 Support operation and maintenance of San Juan River stream gages as necessary to monitor flows in the river.	1999	2023	BOR, PO	Annually	The Program funded USGS to provide 12 additional flow measurements at four SJR gages in NM (Archuleta, Farmington, Shiprock, and Four Corners (SOW 15-13).
Goal 2.2—Provide Suitable Flows to Support Recovery of CPM and RBS Populations.						
Action 2.2.1 Develop flow regimes to provide adequate flow and function to maintain habitat for CPM and RBS.						
<i>C</i>	Task 2.2.1.1 Implement flows that provide suitable habitat for endangered fishes and other native fishes in the San Juan River.	1999	2023	BOR, FWS, BC	Ongoing	Reclamation operates Navajo Dam according to the Recovery Program’s Flow Recommendations using operations decision criteria developed in 2006. Minimal modifications were made to the criteria during an environmental flow workshop in February 2015.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 2.2.1.2 Develop and implement a process for evaluating and revising flow recommendations.	2015	2016	BOR, FWS, BC	Pending	The process for revising flow recommendations will be based on monitoring data, the new San Juan River Basin hydrologic model, updated climate change projections for stream flow, and expanded scientific knowledge of flow-ecology relationships. To initiate the process, the Program held an environmental flow workshop in February 2015 to make minimal modifications to the existing process for implementing the flow recommendations to partially address apparent weaknesses in the decision criteria as a result of the drier hydrologic conditions that have occurred in the basin in the last decade. During the workshop a process was also developed for conducting a comprehensive review and revision of the 1999 flow recommendations starting in 2015.
Action 2.2.2 Develop and maintain a hydrology model to evaluate flow recommendations in the context of water supply and demand in the Basin.						
<i>C</i>	Task 2.2.2.1 Develop, evaluate, and refine a San Juan Basin hydrology model that provides a scientifically sound and biologically relevant representation of the San Juan River.	1995	2023	BOR, FWS	Ongoing	Completion of San Juan Basin Hydrology Model (SJRHM) Generation III is expected in 2015 (SOW 15-12).
<i>M</i>	Task 2.2.2.2 Conduct peer review of the hydrology model by qualified specialists not affiliated with the Program.	2015	2015	PO	Pending	An independent peer review will be conducted of SJBHM Generation III when it is completed in 2015.
<i>H</i>	Task 2.2.2.3 Provide model analysis for the evaluation of flow recommendations.	1999	2023	BOR, FWS	As requested	No runs were requested in 2014.
Action 2.2.3 Coordinate with BOR on Navajo Dam operations.						
<i>H</i>	Task 2.2.3.1 Provide input and recommendations to Fish and Wildlife Service and Reclamation on alternate dam operations when extreme hydrologic conditions prevent flow recommendations from being met.	1999	2023	BC, PO	Ongoing	The 2014 water year was the sixth straight year with below-average (30-year) hydrology in the San Juan River Basin. The April-July inflow to the reservoir was only 58% of average. Additionally, the reservoir went into the year with much below average storage. However, the Flow Recommendation Decision Tree did recommend that a 1-week spring peak release occur in late May. After discussion with the Program, it was agreed that the spring peak release be forgone for 2014 in favor of recovering the reservoir and sustaining the ability to meet target baseflows. Operations at Navajo continued to be run very tightly, releasing the minimum required to meet the target baseflow while attempting to recover storage in the reservoir.
<i>H</i>	Task 2.2.3.2 Make determination of perturbation for Navajo Dam operations.	2000	2023	BOR, BC	Annually	Reclamation provided a determination of perturbation to the BC for their review on Feb. 19, 2015. 2013 was not a perturbation year (not enough qualifying storm events in calendar year 2012); 2014 was a perturbation year (due to the monsoons that occurred in calendar year 2013); 2015 is a perturbation year (due to storm events occurring in calendar year 2014).

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
Action 2.2.4 Provide and protect flows in the San Juan River consistent with flow recommendations.						
<i>C</i>	Task 2.2.4.1 Develop and implement mechanisms for protecting water required to meet flow recommendations.	1999	2023	BOR	Ongoing	BOR actively coordinates with the appropriate parties to achieve the Program’s second goal of “proceeding with water development in the Basin in compliance with federal and state laws, interstate compacts, Supreme Court decrees, and federal trust responsibilities to the tribes.”
<i>C</i>	Task 2.2.4.2 Develop contingency strategies to meet the functions provided by flow recommendations during extended periods of droughts.	2014	2017	BOR, FWS, BC	Pending	In 2014, Reclamation proposed modifying the existing process for implementing the flow recommendations to partially address apparent weaknesses in the decision criteria as a result of the drier hydrologic conditions that have occurred in the basin during 1999 to 2013 period as compared to the longer term period since 1971. To reduce the risk of shortages and improve implementation of the flow recommendations, the BC recommended a “standard target elevation” of 6,063 with a flexibility range to reduce to 6,050 for biological flexibility and to forego a one week peak release in 2015.
<i>M</i>	Task 2.2.4.3 Collaborate with agricultural, municipal, and industrial water users in the San Juan Basin to promote water use efficiency savings and water market transactions that support environmental flows.	2015	2023	FWS, BOR, BC, TNC	Ongoing	A 2014 TNC review of the current scientific literature and case studies indicated that both water market transactions and irrigation system improvements that integrate infrastructure modernization with operational changes can successfully reduce agricultural river diversions for the benefit of endangered fish. The study identified multiple opportunities to collaborate with agricultural, municipal, and industrial water users in the San Juan Basin to reduce river diversions through water use efficiency improvements, thereby supporting environmental flows.
Goal 2.3—Provide Increased Range to Support Recovery of CPM and RBS Populations.						
Action 2.3.1 Identify blockages to fish passage at diversion structures in the San Juan River and provide and maintain fish passage where needed.						
<i>C</i>	Task 2.3.1.5 Investigate the need for fish passage at the Arizona Public Service Company (APS) Weir and provide and maintain fish passage, if deemed necessary.	2016	2018	BOR, FWS	Pending	The need for fish passage at the APS Irrigation Diversion structure was identified in 2005 by Stamp et al. A fish passage at APS Weir will be constructed as part of the mitigation requirements for the Four Corner Power Plant and Navajo Mine Energy Project. Implementation of the mitigation measure (RPM #4 of the 2015 BO) began in 2016. The FCCP and NMEP Project will cost-share with the Program to completed the project. 2017 capital funds are budgeted for planning, engineering, and constructing of the fish passage.
<i>C</i>	Task 2.3.1.6 Investigate the need for fish passage at the Fruitland Diversion and provide and maintain fish passage, if deemed necessary.	2016	2018	BOR, FWS, NN	Ongoing	Planning and engineering work on the Fruitland Diversion Dam renovation project got underway at the end of 2015. The Program is coordinating with project planners to construct a fish passage and screens as part of the renovation project. 2017 capital funds

P	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
						are budgeted for the fish passage and screens. Completion of construction is expected in April 2018.
H	Task 2.3.1.7 Investigate the need for passage of native and endangered fish from Lake Powell around the waterfall into the San Juan River and provide and maintain fish passage, if deemed necessary.	2016	TBD	FWS, BOR, BC	Pending	The BC is investigating what it would take to put a fish passage at the waterfall. A scoping document, <i>Evaluating Passage Options at the San Juan River Waterfall</i> , was developed and discussed by the BC at their Feb. 2016 meeting. The proposed approach would begin with internal investigation by Reclamation engineers and geotechnical people from the Denver office and would be a one year project. The approach is currently under consideration by the BC and Program Office.
Action 2.3.2 Identify impediments to fish passage in San Juan River tributaries to increase range.						
H	Task 2.3.2.1 Investigate the need for fish passage at the Animas Pump Station #2 and provide and maintain fish passage, if deemed necessary.	2007	TBD	BOR, FWS, BC	Ongoing	Francis (2007) investigated fish passage and canal entrainment of native sucker populations in the Animas River. He found the Animas Pump Station #2 was a seasonal barrier to fish passage and Farmer's Ditch Diversion on the Animas was a significant barrier to native sucker movement.
H	Task 2.3.2.2 Investigate the need for fish passage at the Farmer's Ditch Diversion and provide and maintain fish passage, if deemed necessary.	2007	TBD	BOR, FWS, BC	Ongoing	See above.
H	Task 2.3.2.3 Investigate the need for fish passage at other diversion structures in the Animas River and provide and maintain fish passage, if deemed necessary.	2007	TBD	BOR, FWS, BC	Ongoing	See above
Action 2.3.3 Operate and maintain fish passages at diversion structures in the San Juan River.						
C	Task 2.3.3.1 Operate and maintain fish passage at the Public Service Company of New Mexico (PNM) Weir.	2003	2023	FWS, NN	Ongoing	Program provides long-term funding for operation of a selective fish passage at PNM weir. Repairs and/or upgrades are being made to inflow gates and screens to alleviate upstream sediment deposition problem. PIT tag antennas were also installed in 2014 to evaluate fish passage efficiency. (SOW16-14)
Goal 2.4— Minimize fish entrainment at diversion structures in the San Juan Basin.						
Action 2.4.1 Identify diversions that could potentially entrain endangered fish in the San Juan River and remediate where necessary.						
C	Task 2.4.1.2 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Arizona Public Service Company (APS) Weir.	2016	2018	BOR, BC, PO, FWS	Ongoing	In 2015, an assessment of entrainment hazards will be conducted in the San Juan and Animas rivers from Mexican Hat, Utah upstream to the Highway 64 crossing of the San Juan River, approximately 10 miles east of Bloomfield in the San Juan River and to Durango in the Animas River. APS Weir entrainment will be addressed in conjunction with Four Corner Power Plant and Navajo Mine Energy Project implementation of mitigation

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
						measure RPM #4 of the 2015 BO. See Task 2.3.1.5.
<i>C</i>	Task 2.4.1.3 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Fruitland Canal.	2015	2018	BOR, BC, PO, FWS	Ongoing	Planning and engineering work on the Fruitland Diversion Dam renovation project got underway at the end of 2015. The Program is coordinating with project planners to construct a fish passage and screens as part of the renovation project. 2017 capital funds are budgeted for the fish passage and screens. Completion of construction is expected in April 2018.
<i>H</i>	Task 2.4.1.4 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Jewett Valley Ditch.	2015	2016	BOR, FWS, BC, PO	Pending	No endangered fish were collected in this canal by Renfro et al. (2006) during surveys in 2005. Jewett Ditch will be included in the diversion assessment in 2016 (see Task 2.4.1.2).
<i>H</i>	Task 2.4.1.5 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the San Juan Generating Station.	2015	2016	BOR, BC, PO, FWS	Pending	San Juan Generating Station will be included in the diversion assessment in 2016 (see Task 2.4.1.2).
<i>H</i>	Task 2.4.1.6 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Farmer's Mutual Ditch.	2015	2016	BOR, BC, PO, FWS	Pending	No endangered fish were collected in this canal by Renfro et al. (2006) during surveys in 2005. Farmer's Mutual Ditch will be included in the e diversion assessment in 2016 (see Task 2.4.1.2).
Action 2.4.2 Identify diversions that could potentially entrain endangered fish in San Juan River tributaries and remediate where necessary.						
<i>H</i>	Task 2.4.2.1 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at Animas Pump Station #2.	2015	2016	BOR, BC, PO, FWS	Pending	Animas Pump Station #2 on the Animas (RM 11.9) will be included in the diversion assessment in 2016 (see Task 2.4.1.2).
<i>H</i>	Task 2.4.2.2 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Farmer's Ditch Diversion.	2015	2016	BOR, BC, PO, FWS	Pending	Farmers Ditch Diversion on the Animas (RM 21.9) will be included in the diversion assessment in 2016 (see Task 2.4.1.2).
<i>H</i>	Task 2.4.2.3 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at diversion structures in the Animas River.	2015	2016	BOR, BC, PO, FWS	Pending	Francis (2007) investigated entrainment of native suckers in diversion canals in the Animas River. Although a specific study to estimate entrainment losses was not conducted, he concluded YOY suckers may be entrained in canals and pump stations. Animas River diversions and ditches will be included in the diversion assessment in 2016 (see Task 2.4.1.2).
Action 2.4.3 Operate and maintain fish entrainment prevention structures at diversions in the San Juan River.						
<i>C</i>	Task 2.4.3.1 Operate and maintain a fish deflection weir at the Hogback Diversion.	2013	2023	BOR, BC, PO, FWS, NN	Ongoing	A fish deflection weir at Hogback Diversion was completed in FY2013. PIT tag antennas were installed on the structure in 2014 and tests conducted to test for effectiveness. Additional tests are planned. See Tasks 4.5.2.2 for test results.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
Goal 2.5—Provide Suitable Water Quality to Support Recovery of CPM and RBS Populations.						
Action 2.5.1 Describe water quality and identify potential problems to native and endangered fish.						
C	Task 2.5.1.1 Coordinate with other agencies to evaluate water quality of the San Juan River Basin and identify potential effects to native and endangered fish.	1999	2023	FWS, BOR, BC	Ongoing	FWS is coordinating with other agencies; strategies for research and monitoring are being developed.
C	Task 2.5.1.2 Compile and synthesize historic water quality information on the San Juan River to identify water quality parameters that may be detrimental to native and endangered fish species (e.g., mercury, selenium, polycyclic aromatic hydrocarbons [PAHs]).	1994	2023	FWS, BOR, BC	Ongoing	See above
C	Task 2.5.1.3 Conduct an evaluation of water quality as potential limiting factors to recovery.	1994	2023	FWS	Ongoing	See above.
Action 2.5.2 Remediate Water Quality Problems						
C	Task 2.5.2.1 Develop and implement a comprehensive contaminants monitoring plan to identify water quality threats to the endangered species.	2010	TBD	FWS	Pending	The FWS is working with other agencies to develop a basin-wide strategy to accomplish this task.
C	Task 2.5.2.2 Identify effects of contaminants on recovery of endangered fish.	2010	2023	FWS, BC	Ongoing	See above.
C	Task 2.5.2.3 Provide assistance in developing recommended water quality criteria for problematic contaminants for consideration by state and federal water quality regulatory agencies when those agencies adopt enforceable water quality standards.	2010	TBD	FWS	Ongoing	See above.
Action 2.5.3 Minimize the risk of hazardous-materials spills in critical habitat.						
C	Task 2.5.3.1 Identify and remediate potential sources of hazardous materials in areas of designated critical habitat (e.g., petroleum-product pipelines within the 100-year floodplain, riverside retention ponds).	2012	TBD	FWS, TNC	Pending	First step: TNC will complete its identification of potential hazardous material threats in 2015 (SOW 09-16). Second step: Develop plan for remediating potential hazardous materials spills (includes Tasks 2.5.3.2-2.5.3.4).
C	Task 2.5.3.2 Review and recommend modifications to state and federal hazardous-materials spills emergency-response plans to ensure adequate protection for CPM and RBS populations from hazardous-materials spills.	TBD	TBD	FWS, PO	Ongoing	See above

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>C</i>	Task 2.5.3.3 Assess the need for and install emergency shut-off valves on problematic petroleum-product pipelines within the 100-year floodplain of critical habitat to minimize the potential of spills.	TBD	TBD	FWS, PO	Ongoing	Same as above.
<i>C</i>	Task 2.5.3.4 Develop Best Management Practices for heavy equipment use within the 100 year floodplain.	TBD	TBD	FWS, PO	Ongoing	Same as above.
Goal 2.6— Manage the Native Fish Community to Assist in Recovery of the Endangered Species.						
Action 2.6.1. Develop, implement, and evaluate the most effective strategies for maintaining the native fish community upon which the endangered species depend.						
<i>H</i>	Task 2.6.1.1. Use active capture techniques to assess native fish abundance.	1999	2023	P.I.'s	Annually	Refer to Element 4 for monitoring and evaluation of fish and habitat activities.
<i>H</i>	Task 2.6.1.2. Conduct annual review of native fish abundance and potential implications to recovery of the endangered fish.	1999	2023	P.I.'s	Annually	Refer to Element 4 for monitoring and evaluation of fish and habitat activities.
<i>H</i>	Task 2.6.1.3 Develop a comprehensive management plan in conjunction with the non-native fish management plan and the endangered species augmentation plans and recovery goals.	2000	2023	PO, BC, FWS, NMDGF, UDWR	Ongoing	The Program's Monitoring Plan And Protocols (Feb 2012) are being used to implement standardized fish monitoring to assess the presence, status, and trends of CPM, RBS, and fish community.

Table A3. Element 3 — Management of Nonnative Aquatic Species.

P	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
Goal 3.1—Control Problematic Nonnative Fishes.						
Action 3.1.1 Develop, implement, and evaluate the most effective strategies for reducing problematic nonnative fish.						
C	Task 3.1.1.1 Mechanically remove nonnative fish to achieve objectives.	2002	2023	NMFWCO, UDWR	Annually	<p><u>Upper San Juan River</u> - Nonnative fish removal has been ongoing, riverwide, since 1996. Intensive nonnative fish removal from RM 166.6 to 159 began in 2001 but did not continue in 2015. Due to low catch rates in recent years in this section, effort was shifted to areas of higher Channel Catfish abundance. A five-day trip was completed from RM 147.9 to 94 in lieu of the two three-day trips that were scheduled from RM 166.6 to 159. This shift in effort resulted in 116 Channel Catfish and one Common Carp being removed in 38.7 hours of electrofishing. Intensive nonnative fish removal from RM 158.6 to 147.9 began in 2003 and continued through 2015. A total of three trips were conducted in this section in 2015 resulting in 1,463 Channel Catfish and 40 Common Carp being removed in 77.2 hours of electrofishing. In an attempt to maximize efforts, the March trip in this section that typically had lower Channel Catfish catch rates compared to the summer trips, was moved to August. Due to the Gold King Mine spill, the two trips that were scheduled for August were conducted in October and November. Channel Catfish catch rates in this section have fluctuated over time and have not shown a decline in CPUE. Common Carp are infrequently collected during nonnative removal trips in this section. Since intensive nonnative removal began in this section, catch rates for Common Carp have significantly decreased. Intensive nonnative fish removal from RM 147.9 to 53 began on a limited basis in 2006 and effort was increased beginning in 2008 and continued through 2015. A total of four trips, eight electrofishing passes, to remove nonnative fishes were completed in this section in 2015 resulting in 21,118 Channel Catfish and 35 Common Carp being removed in 599.1 hours of electrofishing. Lincoln-Peterson population estimates were calculated for Channel Catfish in this section resulting in a point estimate for juvenile fish (200-299mm TL) of 22,491 fish and a point estimate for adult fish (>300mm TL) of 31,863. Catch rates from Common Carp continue to be less than one fish per hour for the seventh consecutive year. Common Carp mean CPUE in this section was the lowest observed catch rate for Common Carp riverwide since the initiation of monitoring in 1996. (SOW 16-17)</p> <p><u>Lower San Juan River</u> - Nonnative fish removal activities have been ongoing in the lower San Juan River since 2002. This year we shifted some effort to the middle section of the San Juan River from Montezuma Creek to Mexican Hat to determine if it would be more effective at removing catfish. Five nonnative removal trips were conducted in 2015 from RM 53 to 3 and three nonnative removal trips were conducted from RM 93.5 to 53. From RM 53 to</p>

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
						3, eight Black Bullhead, four Yellow Bullhead, 5587 Channel Catfish, three Rainbow Trout, one White Sucker, and six Common Carp were removed. From RM 93.5 to 53, 12 Black Bullhead, 373 Channel Catfish, and two Common Carp were removed. Catch rates for Common Carp have remained relatively low since 2004. Catch rates for Channel Catfish have remained steady over the past few years, but the size structure has changed with a majority of the fish being juveniles (<300 mm). Lincoln Peterson population estimates were conducted on Channel Catfish in this section of river and resulted with an estimate of 19,486 (SOW 16-18).
<i>C</i>	Task 3.1.1.2 Remove nonnative fish at selective fish passage structures.	2003	2023	NN, FWS	Annually	Nonnative fish were removed at PNM selective fish passage structure (see Task 2.3.1.4). The passage operated 230 days between March 15 and October 30, 2015 (passage was closed for 77 days of the 230 days, due to automatic screen cleaner installation, Gold King Mine Spill, and two severe rain events that caused debris buildup at the inlet). 11,272 total fish were captured. 10,393 native fish were transported upstream of the weir including 32 CPM and 38 RBS. 879 non-native fish were captured and removed from the river at the PNM fish passage facility (SOW 16-14).
<i>H</i>	Task 3.1.1.3 Remove nonnative fish during all Program research and monitoring activities.	1999	2023	P.I.s	Ongoing	This is a SOP for the Program but no specific reporting requirements are in place. "Adult Monitoring" reports numbers of nonnative removed annually by that study. It provides a yearly snapshot of the relative number of nonnative fish in the SJR in relation to both T&E and common, sympatric large-bodied natives. It also reports the location (by age-class & 10-RM section) of Channel Catfish in the SJR to help inform the best locations for performing nonnative fish removal in the subsequent year.
<i>C</i>	Task 3.1.1.4 Conduct annual review of success of nonnative fish control strategy.	1999	2023	FWS, UDWR, BC	Annually	Success of riverwide nonnative fish removal is reviewed annually by P.I.'s and BC (SOW 15-17 Upper and 15-18 Lower). See above.
<i>C</i>	Task 3.1.1.5 Organize and conduct workshops, as necessary, to develop a comprehensive non-native species management plan, including measurable river wide objective to determine effects of removal effort on native and nonnative fishes.	2010	2014	NMFWCO, BC, PO	In progress	The BC held a workshop in 2010 to evaluate the non-native fish control program. Data and information from the workshop and annual nonnative fish removal is being used to develop a comprehensive non-native species management plan for the Program. See Task 4.4.3.3.
<i>H</i>	Task 3.1.1.6 Establish target criteria for reduction of problematic nonnative fish species to estimate time, effort, and cost for controlling nonnative fishes.	2012	2023	BC, FWS	Ongoing	See above.
<i>H</i>	Task 3.1.1.7 Evaluate and implement effective alternative nonnative fish reduction methods.	2012	2023	FWS, BC	Ongoing	See above.

Goal 3.2—Prevent introduction and establishment of other nonnative invasive species.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
Action 3.2.1 Ensure that sport fishing regulations and enforcement are consistent with endangered fish recovery.						
<i>M</i>	Task 3.2.1.1 Review sport fishing regulations and revise, as necessary, to ensure consistency with endangered fish recovery.	1999	2023	States, NN, PO,BC	Ongoing	See Tasks 3.2.2.1 and 3.2.2.2.
<i>M</i>	Task 3.2.1.2 Collaborate with state and tribal agencies to enforce fishing regulations.	1999	2023	States, NN, PO,BC	Ongoing	See Tasks 3.2.2.1 and 3.2.2.2.
Action 3.2.2 Develop and implement policies and agreements among stakeholders on nonnative game fish management to prevent introduction of invasive species						
<i>C</i>	Task 3.2.2.1 Develop and implement a sport fish stocking policy among the states and tribes.	2009	2015	States, NN, PO,BC	In Progress	NMDGF provided the BC a flowchart illustrating proposed process for evaluation of stocking proposals. CPW will respond with minor recommended revisions.
<i>H</i>	Task 3.2.2.2 Execute agreements among the states and tribes to prevent the spread of nonnative invasive species.	2009	2015	States, NN, PO,BC	In Progress	This will occur after the Stocking Procedures are re-drafted (NMDGF has proposed to lead this).
Action 3.2.3 Identify potential invasive nonnative species and control their introduction and escapement into the main river, floodplain, and tributaries.						
<i>L</i>	Task 3.2.3.1 Consolidate all information for a comprehensive report and risk assessment of waterfall inundation and associated immigration of nonnative fish from Lake Powell including options and recommendations for potential management actions.	TBD	TBD	PO, BC	On Hold	Information is being collected. No management actions are being proposed at this time. See Task 2.3.1.7
<i>C</i>	Task 3.2.3.2 Develop a plan to control non-native fish entering the SJR from Lake Powell and be prepared to implement when the lake refills.	TBD	TBD	PO, BC	As needed	If a barrier/passage is determined to be necessary, a plan will be developed. See Task 2.3.1.7
<i>H</i>	Task 3.2.3.3 Identify major sources of nonnative fish from tributaries and off-channel features to minimize reinvasion of riverine habitats by problematic species.	TBD	2023	BC	Ongoing	This will be part of a comprehensive non-native species management plan.
<i>C</i>	Task 3.2.3.4 Implement measures to reduce escapement of nonnative fish from tributaries and off-channel features, as necessary.	2009	2023	PO, BOR, FWS	As needed	Measures are being implemented at the recently constructed Lake Nighthorse on the Animas River. Nonnative fishes occur in the reservoir and they could potentially be released into San Juan River Basin. Tests have shown the sleeve valve on the outlet structure does not prevent 100% escapement as originally anticipated, especially for early life history stages. The management plan for the reservoir will only allow the stocking of trout and salmon species and include additional monitoring of releases. No other measures are being implemented, at this time, to reduce escapement of nonnative fish from tributaries and off-channel features.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 3.2.3.5 Coordinate with other programs, agencies, and activities to track occurrences of nonnative species in the San Juan River Basin and, if a potential invasive species problem is identified, develop and implement preventive actions as appropriate.	1999	2023	PO, BC, States	Ongoing	Channel Catfish is currently the primary nonnative species of concern in the San Juan River. All nonnative fishes encountered during the Program’s nonnative fish removal efforts are removed. No other invasive species problem has been identified in the San Juan River at this time.

Table A4. Element 4 — Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
Goal 4.1—Monitor Fish Populations of the San Juan River.						
Action 4.1.1 Develop a Standardized Monitoring Plan for fish.						
<i>M</i>	Task 4.1.1.1 Develop and revise, as needed, a Standardized Fish Monitoring Plan to assess the presence, status, and trends of CPM, RBS, and fish community.	2000	2023	PO, BC, FWS, NMDGF, UDWR	Ongoing	The Program’s Monitoring Plan and Protocols (Feb 2012) are being used to implement standardized fish monitoring. In 2016, the PO was tasked with developing a concept paper for conducting pop estimates in both the river and the lake. This will include consideration of how we can use PIT tag data for pop estimates and how to deal with differences observed between tag and electrofishing results.
<i>H</i>	Task 4.1.1.2 Analyze and evaluate monitoring data and produce Annual Fish Monitoring Reports to ensure that the best sampling design and strategies are employed.	2000	2023	PO, BC, P.I.’s	Annually	Annual reports are posted on the Program website each year: http://www.fws.gov/southwest/sjrip/index.cfm
<i>H</i>	Task 4.1.1.3 Organize and conduct Monitoring Plan Workshops, as necessary, to coordinate sampling design, data collection, and desired precision and detection levels for detecting responses.	2000	2023	PO, BC	As needed	Monitoring workshops were last held in 2009. See Task 4.1.1.1.
Action 4.1.2 Implement a Standardized Monitoring Plan to track the presence, status and trends of endangered fish populations.						
<i>H</i>	Task 4.1.2.1 Conduct larval fish sampling to determine if reproduction is occurring, locate spawning and nursery areas, and to gauge the extent of annual reproduction.	1998	2023	P.I.s	Annually	<p>During 2015, five larval fish survey trips were conducted on the San Juan River between river miles 147.9 (Shiprock, NM) and 2.9 (Clay Hills Crossing, UT). A total of 293 collections were made encompassing 8,886.4 m2 of nursery habitat. These collections resulted in the capture of 18,014 specimens.</p> <p>A total of 24 larval CPM were collected between river miles 94.8 and 57.2. Back-calculated spawning dates for CPM ranged from 10 to 14 July 2015. Spawning by CPM has been documented for the past three consecutive years and in six of the last seven years.</p> <p>For the eighteenth consecutive year, spawning by adult RBS was documented in the San Juan River. A total of 1,205 larval RBS were collected between river miles 139.5 and 3.3. Estimated densities of larval RBS in 2015 were higher than any preceding survey year. Back-calculated spawning dates for RBS ranged from 19 March to 4 May 2015 (SOW 16-21).</p>

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 4.1.2.2 Conduct juvenile and small-bodied fish sampling to determine if young fish are surviving and recruiting into the population and locate the areas and habitat used for rearing.	1998	2023	P.I.s	Annually	In 2015, New Mexico Department of Game and Fish conducted small-bodied fishes monitoring during two trips which took place September 7 – 11 and 17 – 29. Monitoring took place from the Animas River confluence (RM 180.5, Reach 6) downstream to Clay Hills, Utah (RM 2.9, Reach 1). For the fourth consecutive year, an additional 16 river miles (beginning at RM 196.1) above the Animas River confluence were also sampled. All secondary channels restored by TNC in 2011 and nearby reference channels were visited during the September 17 - 29 trip, but only 2 restored channels and 1 reference channel were sampled because most were not flowing. A total of 1662 fish were captured during monitoring, approximately 80% of which were native. Nineteen CPM were captured, including the first age-0 (18 mm) wild fish ever captured during small-bodied fishes monitoring. The wild age-0 CPM was captured in a large backwater located at RM 133.5. No age-0 or juvenile Razorback Sucker were captured in 2015, although 3 adults (> 405 mm total length) were captured. No Roundtail Chub or Mottled Sculpin were captured in 2015. Analyses of these data will be reported to the Recovery Program in 2016 (SOW 16-20).

P	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
H	Task 4.1.2.3 Conduct adult fish sampling to estimate densities of fish (CPUE) and estimates of population size (mark-recapture estimates).	1998	2023	P.I.s	Annually	<p>Adult Monitoring was conducted RM 195-2.9 in the fall of 2015. Scaled CPUE for RBS and the SJR 1+ overwinter periods showed a significantly increase over time (2003-2015) whereas CPM did not. Adult CPM were collected in 2015 for the 5th year in a row, showing that Adult Monitoring is able to detect their presence if CPM are in the river. To determine when the Program should switch to riverwide pop. estimates, Adult Monitoring indicates we are getting close with the numbers collected of adult RBS (may already be there for adult RBS base on numbers) and CPM between 300-399 mm TL. However, these fish are all (or almost all) the result of stocking efforts and widespread recruitment of wild-produced CPM and RBS is still relatively rare. Common Carp have become very rare in our collections in the intensive removal reaches (likely due to nonnative fish removal efforts). Channel Catfish remain widespread (RM 166.6-8.0) in 2015 with CPUE for Channel Catfish not significantly decreasing or increasing in the last 16 years. Despite the introduction of high numbers of stocked CPM (predators) and RBS (competitors) and repeated intensive electrofishing trips throughout the year, populations of native FMS and BHS have not changed significantly and remain common, widespread, and stable. In the spring of 2015, 15 miles of the Animas River above the confluence of the San Juan R. were sampled. The catch consisted of mainly native suckers, along with Brown Trout, Rainbow Trout, White Suckers, Speckled Dace, and 10 Common Carp. Ten RBS were found in the Animas that had been stocked in or around the Animas R that had not been detected since stocking. No Catfish were collected during 2015 sampling above the San Juan R. (SOW 16-19)</p>
H	Task 4.1.2.4 Conduct fish studies in the SJR Arm of Lake Powell as needed to assess presence/absence of SJR endangered fish populations	2011	2015	P.I.s, FWS, PO, BC	Ongoing	<p>Two years of RBS survey (2011-2012; SOWs 11-28 and 12-28) on the SJ Arm of Lake Powell showed the importance of 33 Lake Miles below the waterfall to the species and Spencer’s Camp and Neskahi Canyon areas for spawning. A total of 147 RBS captured, 36% of which were without PIT tags suggesting potential recruitment. A detectable native fish community was present with CPM (n=25), FMS (n=173), and BHS (n=2) making up 2.1% of the trammel net total catch. Of 69 larval samples collected, one native fish was collected in 2011, a RBS metalarvae (20.7 mm TL).</p> <p>The Colorado arm of Lake Powell is currently being surveyed by the UCR Program (2014-2018) with funding from outside the recovery programs.</p>

P	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
H	Task 4.1.2.5 Deposit, process, and secure SJR fish specimens, field notes, and associated data at an organized permanent repository.	1987	2023	P.I.s	Annually	Since 1987, the Museum of Southwestern Biology (MSB), Division of Fishes at the University of New Mexico (UNM), in Albuquerque has served as the primary repository for collections of fishes (eggs, larvae, and adults) and field notes taken for the Program. In addition to curation and deposition, species identification and data are verified, entered into an electronic catalog, and geo-referenced in ArcView. (SOW 16-22).
H	Task 4.1.2.6 Collect scales, otoliths, and/or fin rays from fish captured during monitoring and nonnative fish removal activities for future analyses.	2012	2023	P.I.s	Annually	<p>Scales were collected from unmarked RBS in the SJR in 2011-2013 and forwarded to ASIR for use in the study to determine natal origin using microchemical analyses (see Task 4.5.2.3). It was determined that fin rays were a more reliable non-lethal material than scales for conducting microchemical analyses.</p> <p>In 2014, a new technique for collecting fin rays was implemented that allowed fin ray segments to be removed from closer to the base of the fin. This technique ensured that the cores of fin rays were present in samples so that natal signatures could be analyzed. Fin rays from wild caught RBS were collected on the SJR between RM 161.0 and 69.0. Between June and Sept., 89 RBS fin ray segments were collected for microchemical analyses. Otoliths were collected from 11 fish, 9 with known natal origins and 2 with unknown natal origins. Whole RBS were collected from the NAPI ponds and Ouray NNFH-GVU for fin ray and otolith microchemical analyses.</p>
Action 4.1.3 Collect data on the endangered fish and native and nonnative fish communities during other Program management activities, when possible						
H	Task 4.1.3.1 Collect data on the endangered fish and native fish community during nonnative fish control activities to aid in tracking the presence, status and trends of endangered fish populations.	1998	2023	FWS, BC, UDWR	Annually	<p><u>Upper San Juan River</u> - Work is conducted under the nonnative removal work by FWS (Region 2 and Region 6) and UDWR (SOW's 13-17 and 13-18). CPM and RBS have been collected during intensive nonnative fish removal projects since their initiation in 2001. In 2015, nonnative fish removal crews sampling from RM's 158.6 to 53 collected a total of 655 (580 unique) CPM and 1,590 (1,308 unique) RBS. Of the CPM, 40 adult fish (>450mm TL) were collected in 2015. This is the highest number of adult CPM collected since the initiation of this project. The majority of RBS collected in 2015 had been in the river < 5 years; however, 26 fish were collected that have been in the river for >10 years. All rare fish data are summarized in an Excel database and submitted to the Program Office for inclusion into the comprehensive rare fish database (SOW 16-17 Upper).</p> <p><u>Lower San Juan River</u> - A total of 174 CPM and 186 RBS were captured during nonnative removal efforts in 2014. The CPM collected consisted primarily of fish that had been stocked in the last two years with sizes ranging from 71 mm to 505 mm. The RBS collected ranged in size from 224 mm to 507 mm. All data collected on endangered fish was summarized in Excel spreadsheets and submitted to the Program Office for inclusion into the database. (SOW 16-18).</p>

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 4.1.3.2 Collect data on the endangered fish and native fish community during PNM selective fish passage operations to aid in tracking the presence, status and trends of endangered fish populations.	2003	2023	FWS, NN	Ongoing	The Navajo Nation operated the PNM fish passage for 250 days in 2015 (see Task 2.3.1.4). A total of 10,393 native fish were passed through the passage facility in 2015. The most dominate species were FMS and BHS, 38 RBS and 32 CPM were passed through the facility. (SOW 16-14)
Action 4.1.4 Obtain reliable population estimates of CPM and RBS.						
<i>H</i>	Task 4.1.4.2 Use mark-recapture population estimators, when available, in conjunction with catch rate estimators, to provide reliable estimates of adults, subadults, survival, and recruitment consistent with recovery goals criteria to gauge recovery of CPM and RBS.	1998	TBD	FWS, BC, P.I.s	Ongoing	The Program is using catch rate estimators to do population estimates at this time. While not mark-recapture population estimators, the BC determined that population estimates developed with data from Adult Monitoring (which is a single-pass effort) and other Program data collection efforts will be used until the Program transitions from catch rate indices to mark-recapture population estimators for subadult and adult CPM and RBS. See 4.1.2.3.
<i>H</i>	Task 4.1.4.3 Analyze mark-recapture data with methods used by Bestgen et al. (2009) to estimate survival rates of RBS.	2009	TBD	PO, BC	Ongoing	These analyses are repeated every 3-5 years; the most recent being in 2014.
<i>H</i>	Task 4.1.4.4 Conduct Population Estimation Workshops, as necessary, to evaluate population estimators used in other systems to identify the most reliable and suitable estimator(s) for CPM and RBS.	1999	2023	PO, BC	As needed	No workshops are planned at this time.
Action 4.1.5 Evaluate status and success of stocked CPM and RBS.						
<i>H</i>	Task 4.1.5.1 Determine survival and recruitment of stocked CPM and RBS to assess stocking success and to determine when to implement mark-recapture population estimates.	2009	2023	FWS, BC	Ongoing	2015 results from analysis done on “Adult Monitoring” data indicate that we are getting close with the number of adult RBS (we are actually probably there for adult RBS numbers-wise) and CPM between 300-399 mm TL are being seen in the river. However, almost (or almost all) of the fish captured in the river are the result of stocking efforts and we are still lacking widespread recruitment of wild-produce CPM and RBS.
Action 4.1.6 Evaluate the risk of hybridization among sucker species.						
<i>M</i>	Task 4.1.6.1 Quantify the extent of hybridization among native suckers to determine if stocking large numbers of hatchery RBSs into the San Juan River will reduce genetic diversity and viability of RBS and/or FMS.	2002	2023	BC, P.I.s	Ongoing	Observational surveys are conducted in conjunction with annual monitoring. Hybridization between native Suckers appears to be low at present. P.I.’s include a brief description of any fish anomalies observed in their annual reports to track the occurrence of hybrids. If, and when, the frequency of occurrence appears to increase, a focused reassessment will be conducted.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>M</i>	Task 4.1.6.2 Quantify the extent of hybridization between native suckers with nonnative White Suckers to determine if hybridization is reducing genetic diversity and viability of native suckers (i.e., RBS, FMS, BHS).	2002	2023	BC, P.I.s	Ongoing	Observational surveys are conducted in conjunction with annual monitoring. Hybridization between native suckers and nonnative White Suckers is present but the rate of hybridization is relatively low and appears to be mostly limited to the upper sections of the river around Farmington, NM. P.I.'s include a brief description of any fish anomalies observed in their annual reports to track the occurrence of hybrids. If, and when, the frequency of occurrence appears to increase, a focused reassessment will be conducted.
<i>M</i>	Task 4.1.6.3 Identify and implement necessary actions to minimize hybridization among native suckers and nonnative suckers.	TBD	TBD	BC, P.I.s	As needed	At present, the risk appears to be minimal and no specific management actions are warranted. See Tasks 4.1.6.1 and 4.1.6.2.
Action 4.1.7. Monitor health of fish in the San Juan River to ensure adequate protection from diseases and parasites.						
<i>C</i>	Task 4.1.7.1 Track health of fish in the San Juan River to ensure adequate protection from diseases and parasites.	1998	2023	PO, P.I.s	Ongoing	Ocular inspections of general fish health and condition are conducted during fish handling and capture activities on the San Juan River. Indications of poor health of endangered fishes are logged and reported.
<i>C</i>	Task 4.1.7.2 Investigate potential health problems, identify causes, and recommend corrective actions if any indications of poor health are of concern.	1998	2023	P.O., BC, P.I.s	As needed	No specific health problems have been identified that require action at this time. The Program will continue to identify and, when appropriate, actively investigate potential health problems.
Goal 4.2—Monitor Habitat Availability and Use.						
Action 4.2.1 Develop a standardized monitoring program for habitat.						
<i>M</i>	Task 4.2.1.1 Develop and revise Standardized Habitat Monitoring Plan.	1999	2023	BC	Ongoing	A revised Monitoring Plan And Protocols was completed Feb 2012.
<i>M</i>	Task 4.2.1.2 Organize and conduct Habitat Monitoring and Mapping Workshops, as necessary, to refine and improve habitat evaluation methods.	1999	2023	PO, BC	As needed	A focused habitat monitoring workshop was held in January 2012.
Action 4.2.2 Implement a standardized monitoring program for habitat.						
	Task 4.2.2.1 Map habitat at different flows as described in the Standardized Habitat Monitoring Plan	1999	2023	P.I.s	Ongoing	Standardized Habitat protocols are being implemented (SOW 15-28).
<i>H</i>	Task 4.2.2.2 Monitor long-term habitat response of the river channel to flow recommendations.	1999	2023	BC	Ongoing	Standardized Habitat protocols are being implemented (SOW 15-28).

P	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
C	Task 4.2.2.3 Monitor water quality in the San Juan River (see Action 2.4.1.).	1999	2023	FWS, BIA, BOR	Ongoing	The Program monitors water temperature continually at 8 locations (SOW 15-28), but no longer routinely conducts water quality sampling. The BIA has been sampling water quality at 10 sites in the San Juan Basin since 1991. Parameters analyzed annually include: Al, Cl, Ni, nitrates, nitrites, orthophosphates, and sulfates. Parameters analyzed quarterly include: As, Cu, Pb, Mg, Hg, Na, Se, Zn, alkalinity, hardness, TDS, TSS, and turbidity. All data is available upon request.
H	Task 4.2.2.4 Monitor stream flows	1999	2023	USGS, P.I.s	Annually	USGS streamflow gaging stations on the SJR are providing flow data (SOW 15-13).
C	Task 4.2.2.5 Monitor water temperature	1999	2023	MEC, ERI, USGS	Annually	In 2015, the USGS added real time water temperature monitoring in the San Juan River at Archuleta, Farmington, Four Corners, and the Animas at Farmington. The USGS currently has real-time water temperature monitoring at the Bluff (Mexican Hat) gage (SOW 16-16). The database will be updated and maintained as in past years. Temperature is also monitored at three locations during larval fish sampling (SOW 16-21).
Action 4.2.3 Identify, characterize, and quantify suitable habitat.						
H	Task 4.2.3.1 Assess data collected to identify and describe flow-habitat relationships.	2012	2023	PO, BC	Ongoing	Program is monitoring various aspects of habitat and flow (<i>SOW 15-28 Habitat Temperature Monitoring</i>). BC held a Habitat Monitoring Workshop in 2012. A retrospective habitat analysis of geomorphology and floodplain vegetation using existing data was conducted in 2013 with report due in 2014 (Task 4 of Habitat Temperature Monitoring SOW). In 2015, monitoring of the TNC's Habitat Restoration Project Phase II sites and a nearby control site will begin (SOW 15-31).
C	Task 4.2.3.3 Determine the extent various flow releases from Navajo Dam have on the seasonal and longitudinal distributions of endangered fishes and other native and nonnative fish.	2013	TBD	PO, BC	Ongoing	See Task 4.2.3.1 above.
M	Task 4.2.3.4 Characterize channel geomorphology and river channel dynamics to better understand flow-habitat relationships.	2013	TBD	PO, BC	Ongoing	See Task 4.2.3.1 above.
Action 4.2.4 Identify and refine habitat/fish relationships.						
H	Task 4.2.4.1 Identify and quantify principal river reaches and attributes of habitats important to each life stage of endangered fish.	2010	2023	FWS, BC	Ongoing	The BC reviewed data collected, to date, during annual researchers meetings to gain additional insight into habitat/fish relations.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 4.2.4.2 Relate geo-referenced fish capture data to habitat data, as needed.	1999	2023	P.I.s, PO	Ongoing	Starting in 2010, monitoring crews started recording GPS coordinates for all captures and recaptures during monitoring and nonnative fish removal activities. Geo-referenced fish capture data and habitat data are used by researchers, as needed, to meet specific information needs.
<i>H</i>	Task 4.2.4.3 Determine, to the extent possible, habitat/fish relationships, the level of data needed to accomplish this, and the cost of collecting the data.	1999	2023	FWS, BC	Ongoing	See Task 4.2.3.1 above.
Goal 4.3— Monitor and Evaluate Habitat Restoration Strategies and Projects						
Action 4.3.1 Evaluate and implement habitat restoration strategies to augment the function of river flow to create and maintain suitable habitat.						
<i>C</i>	Task 4.3.1.1 Use data and information gathered from habitat assessments as the foundation for identifying and evaluating the need to implement other recovery actions, including but not limited to, habitat modification (flow or mechanically induced) and population augmentation.	1999	2023	FWS, BC	Ongoing	Flow recommendations were implemented and evaluated using the standardized methodology that guides the Program’s annual and long-term monitoring activities (Program 2012b). Monitoring of TNC’s Phase I and II habitat restoration sites is ongoing (SOW 15-31).
<i>H</i>	Task 4.3.1.2 Evaluate construction of backwater habitats to serve as low-velocity nursery habitat if lack of backwater habitat is found to be limiting recovery.	2011	2015	BOR, PO, BC NN, TNC	Ongoing	Monitoring for fish presence and functionality to serve as low-velocity nursery habitat is continuing at TNC’s Phase I and II habitat restoration sites (SOW 15-31).
<i>H</i>	Task 4.3.1.3 Evaluate selective nonnative vegetation removal in conjunction with high flow conditions for habitat creation and maintenance.	2013	2015	BOR, BC, FWS, NN	Ongoing	The Program is working on this task through development of SJBHM Gen III, TNC’s Conservation/Habitat Planning Project and associated monitoring, and the retrospective habitat analysis.
<i>M</i>	Task 4.3.1.4 Evaluate large-scale nonnative vegetation control, as feasible and necessary.	2013	2015	BOR, BC, FWS, NN	Ongoing	Same as above.
<i>H</i>	Task 4.3.1.5 Evaluate non-flow alternatives that would work in conjunction with flows to meet the functions provided by flow recommendations.	2011	2015	BOR, FWS, BC	Ongoing	Same as above.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 4.3.1.6 Monitor TNC's restoration sites	2011	2023	BC, PI's	Annually	<p>Phase I sites were monitored during various flows between November 2011 and February 2013. By February 2013 at 500 cfs, two of the six restored channels contained water and maintained an upstream connection with the primary channel, and a third channel is expected to flow at 700 cfs. Fish presence in restored sites was monitored in 2012; RBS larvae were collected at two of the six RERI sites and all sites contained suitable nursery habitat between April and August 2012. In 2013, Program monitoring crews collected good numbers of larval and small bodied native fish at the RERI sites including CPM and RBS.</p> <p>Monitoring of larval and small-bodied native fish in the original 6 RERI sites continued in 2014 and both larval and small-bodied fish were captured in good numbers at the restored sites. To provide additional information on the persistence of aquatic habitats and to measure changes in habitat features, larval fish abundance and small-bodied fish abundance from prior to spring runoff to late fall, more intensive monitoring of the Phase II site and a nearby control site will begin in 2015. Re-sprouting Russian olive and saltcedar at the 6 RERI sites were treated with herbicide in 2014. (SOW 15-31)</p>
Goal 4.4— Integrate And Synthesize Monitoring Data And Information To Evaluate Fish Community And Ecosystem Responses To Recovery Actions.						
Action 4.4.1 Describe life history parameters of wild CPM and RBS.						
<i>C</i>	Task 4.4.1.1 Document and quantify reproduction, survival, and recruitment.	1992	2023	FWS, BC	Ongoing	This task is addressed by Program scientists and the BC through the annual review of fish monitoring data collected.
Action 4.4.2 Develop fish community and ecosystem response strategies and implement appropriate monitoring and research strategies to evaluate ecosystem response.						
<i>H</i>	Task 4.4.2.1 Develop a centralized database that incorporates all data from standardized monitoring and integrate into the Program database.	2007	2023	PO, BC	Ongoing	Data from the large-bodied monitoring projects are updated through 2015 (SOW16-37). The small-bodied and larval monitoring data is currently being updated to include data through 2015. Temperature data has been integrated through 2015 from ASIR, KB, and MEC. Temperature data beyond 2015 is house by USGS is associate with gage stations. Habitat data has been summarized from 1992-2007. See Tasks 1.2.1.1 and 5.2.1.1.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 4.4.2.2 Use previous and current data collected during ongoing investigations to characterize dynamics of native fishes and their response to management activities intended to improve status of listed species.	1992	2023	PO, UNM, P.I.s., BC	Ongoing	The “2015 Integrated PIT tag database summary of CPM and RBS in the San Juan River” will be completed per the timeline detailed in the Program’s Annual Cycle. A manuscript detailing a modelling effort is currently being prepared “Predicted response of the San Juan River Channel Catfish population to managed exploitation.” An analysis was conducted and presented at the February 2016 BC meeting titled, “Flow and temperature effects on relative weight of San Juan River fishes.” The assessment of the Razorback Sucker augmentation program is on-going “Survival and movement of stocked Razorback Sucker in the San Juan River, NM and UT.” A note was submitted and accepted to The Southwestern Naturalist titled, “Razorback Sucker transbasin movement through Lake Powell, Utah.” (SOW 16-37 and 16-23).
<i>M</i>	Task 4.4.2.3 Update SJR population model and use with other existing data to evaluate fish community response to recovery actions.	2006	2023	PO, BC	As needed	An update to the San Juan River population model was completed in 2014 (Miller and Lamarra 2014). A Dec. 2014 workshop was held to review the updated model. It is currently in review by the BC and Program peer reviewers. The model should be operational in 2015 to assist in evaluating possible responses by fish species to management actions.
<i>H</i>	Task 4.4.3.1 Develop and implement an integrated fish and habitat monitoring plan that includes an annual process for assessing and modifying monitoring activities so that current status of native and endangered fish populations and habitat can be assessed and progress toward recovery can be determined.	1999	2023	PO, BC	Ongoing	See Tasks 4.4.1.1, 4.4.2.2 and 4.4.2.3.
Action 4.4.3 Use data from monitoring and management actions and research information to evaluate and modify recovery activities, as necessary, to ensure progress toward recovery.						
<i>C</i>	Task 4.4.3.1 Identify, describe, and implement strategies for improving long-term survival and recruitment of CPM and RBS including but not limited to nonnative fish removal, enhancing habitat and food resources, enhancing genetic diversity and viability, and mitigating barriers to range fragmentation.	1999	2023	PO, BC	Ongoing	Program is using adaptive management strategies to accomplish this task. See Tasks 4.4.1.1, 4.4.2.2, and 4.4.2.3.
<i>H</i>	Task 4.4.3.2 Use data and information gathered from fish surveys, hatchery augmentation, and survival studies to describe best strategies for establishing wild populations of endangered fish to maintain a healthy native fish community.	1999	2023	PO, BC	Ongoing	Information was assimilated and evaluated to assess stocking success and establishment of wild populations of CPM and RBS. See Tasks 4.4.1.1, 4.4.2.2, and 4.4.2.3.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 4.4.3.3 Use data and information gathered from nonnative fish efforts to evaluate effects of nonnative fish control on distribution, abundance, and demographics (e.g., fish size, age, sexual maturity) of the endangered fish populations, the native fish community, and nonnative fish populations.	2008	2023	FWS, BC	Ongoing	The BC held a workshop in 2010 to evaluate the nonnative fish control program and made adjustments. Information was assimilated and evaluated to accomplish this task. A nonnative workshop will be held in late 2016 or early 2017 to evaluate the revised study design initiated in FY16. See Task 3.1.1.5.
<i>C</i>	Task 4.4.3.4 Use data and information gathered from habitat assessments as the foundation for evaluating the effectiveness of the flow recommendations and operations decision criteria for Navajo Dam in providing suitable habitat for the endangered fish.	1999	2023	FWS, BC	Ongoing	Flow recommendations are being implemented 1999-present. The Program collects habitat and fish data and information through its annual monitoring program. The Flow Recommendations revision process began in 2015 and will be completed in 2016.
Action 4.4.4. Review and evaluate San Juan River stream flow in light of hydrology variability.						
<i>H</i>	Task 4.4.4.1 Conduct a comprehensive analysis of hydrologic variability in the San Juan River.	2014	2017	BOR, FWS	Pending	BOR completed Colorado River Basin Water Supply and Demand Study in 2012. This study includes the SJR Basin. A comprehensive analysis of hydrologic variability will occur during the flow recommendation revision in 2015 and 2016. Gen4 of the San Juan Basin Hydrology Model will be used to evaluate various hydrologic scenarios.
<i>H</i>	Task 4.4.4.2 Evaluate the possible and most probable impacts of hydrologic variability on future water availability.	2014	2017	BOR, FWS	Pending	See above.
<i>H</i>	Task 4.4.4.3 Evaluate ability of the river to meet the functions provided by the flow recommendations during extended periods of drought.	2014	2017	BOR, FWS, BC	Pending	See above.
Goal 4.5— Identify and Conduct Research and Monitoring in Support of Recovery Actions						
Action 4.5.1 Annually identify potential project/activities/questions/information needs (ongoing list).						

P	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
H	Task 4.5.1.1 Annually, following review of the previous year’s findings and data integration, identify and prioritize new projects, activities, questions, and information needs to be addressed in future work plans.	2000	2023	BC, FWS, CC, PO	Ongoing	The following information needs were identified: <ul style="list-style-type: none"> • Information needs in support of flow recommendation review • Survey of potential entrainment structures in the San Juan and Animas rivers • Temperature modeling out of Navajo Dam and downstream • 2D modeling of floodplain using Lidar to capture overbank flows • Radiotelemetry Study • Tributary Sampling • Conduct Inventory of all potential problematic reservoirs (i.e., potential sources of nonnative species) • Enhanced/expanded larval studies • Determine negative impacts of the known contaminants (e.g., Hg and Se) effects on the native fishes of the San Juan River • Develop methodologies for integrating recapture data from different sampling methods for making population estimates (e.g., electrofishing, remote PIT tag readers)
Action 4.5.2 Implement project/activities as necessary to obtain needed information.						
	Task 4.5.2.2 Develop and conduct a study/monitoring plan to assess the effectiveness of the Hogback fish weir in preventing entrainment of endangered and native fish.	2014	2015	BOR	Ongoing	Passive PIT tag readers were installed at Hogback Fish Weir in 2014 to track movement of tagged fish. Untagged and juvenile/larvae will not be detected by these readers. The fish weir’s ability to minimize entrainment was evaluated in 2015. Tagged CPM and RBS were released in or near the structure and detections by the readers recorded. Less than 3% of the small and subadult CPM and RBS were entrained in the channel
	Task 4.5.2.3 Determine how to distinguish stocked fish from naturally produced fish.	2013	2023	ASIR	Ongoing	During 2015, fin rays were collected from Razorback Suckers captured in the San Juan River between river miles 178.0 and 10.2. Between February and September, 57 fin rays were collected from wild, untagged (i.e. no PIT tag), Razorback Suckers for microchemical analysis. An additional 11 fin rays were collected in 2015 from untagged Razorback Suckers at the waterfall in the San Juan Arm of Lake Powell and 36 fin rays, previously collected in the San Juan Arm of Lake Powell for aging, were delivered to ASIR for microchemical analysis. The microchemical reference library for sources of Razorback Suckers in the San Juan River (Uvalde NFH, SNARRC, Ouray NFH-GVU, NAPI ponds, and SJR) has been completed (SOW 16-30).

Table A5. Element 5 — Program Coordination and Assessment of Progress toward Recovery.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
Goal 5.1—Facilitate Program Planning and Management.						
Action 5.1.1 Provide Ongoing Program Management.						
<i>H</i>	Task 5.1.1.1 Coordinate and schedule meetings and activities of the CC and the technical committees, as necessary.	1992	2023	PO	As Needed	In 2014, the Program Office organized 3 CC meetings/conference calls, 6 BC meetings/conference calls, the Annual Program Meeting, and the Annual Hydrology Meeting.
<i>H</i>	Task 5.1.1.2 Annually review and update the LRP to reflect new information, new projects and Program progress.	1995	2023	PO, BC, CC	Annually	The 2014 LRP was approved by the CC May 23, 2014.
<i>H</i>	Task 5.1.1.3 Convene annual Program coordination meetings to review the preceding year’s monitoring, recovery and research data; assess progress toward recovery; and provide recommendations to modify the LRP.	1995	2023	PO, BOR	Annually	Program’s 2014 Annual Meeting was held on May 22, 2014.
<i>H</i>	Task 5.1.1.4 Develop list of prioritized actions and projects for the AWP that most benefit recovery of the endangered fish populations.	1995	2023	BC, PO	Annually	2015 SOWs were provided to the Program Office by March 31, 2014. A draft AWP with priority projects was provided to the committees in May 2014.
<i>H</i>	Task 5.1.1.5 Develop and issue Requests for Proposals (RFPs) and request SOWs for projects that most benefit recovery of the endangered fish populations.	1995	2023	PO, BOR	Annually	See above.
<i>H</i>	Task 5.1.1.6 Assemble and review annual SOW to identify most suitable projects for funding and implementation.	1995	2023	PO, BOR	Annually	2015 AWP was approved by the CC September 10, 2014.
Action 5.1.2 Oversee and Conduct Endangered Species Act Compliance.						
<i>H</i>	Task 5.1.2.1 Administer Program and review BOs consistent with the Program’s Principles.	1995	2023	PO	Ongoing	Annually conducted by the Program Office.
<i>H</i>	Task 5.1.2.2 Monitor and ensure implementation of Program actions identified as RPAs and RPMs in BOs.	1995	2023	PO	Ongoing	See above.
Goal 5.2— Ensure Integration and Synthesis of Information to Evaluate Program Progress Toward Recovery.						
Action 5.2.1 Synthesize and evaluate information from all studies for Program to evaluate progress toward recovery.						
<i>H</i>	Task 5.2.1.1 Establish and maintain a Program database of information collected under the various Program projects including all rare fish collections.	1995	2023	PO	Annually	Program Office maintained the Program’s database (SOW 15-33). The Program Office database manager is also working with the UCREFRP to develop a centralized common database of Upper Colorado River Basin data. The website, https://streamsystem.org , is under construction.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 5.2.1.2 Conduct annual Program reviews and develop annual reports that integrate monitoring and research data and results to track and assess yearly Program progress toward recovery.	1995	2023	PO, BC	Annually	2013 Final Reports posted on Programs website: http://www.fws.gov/southwest/sjrip/
<i>H</i>	Task 5.2.1.3 Conduct a biennial comprehensive review and assessment of Program progress towards recovery (i.e., Sufficient Progress Report).	2014	2015	PO, CC, FWS	Every two years	The biennial “Sufficient Progress” Report is in draft and being reviewed by the FWS. It will be completed and reviewed by the CC in 2016 and signed by the FWS in 2015.
Action 5.2.2 Ensure new information is identified and developed, as necessary to achieve Program goals and Assess Progress Toward Recovery.						
<i>C</i>	Task 5.2.2.1 Coordinate and oversee development of revisions to the SJRB Hydrology Model and the Program’s flow recommendations.	2008	2015	PO, BOR	In progress	Hydrology Model Generation III will be completed in 2015; flow recommendations revisions will begin in 2015.
<i>C</i>	Task 5.2.2.2 Develop positive population response criteria for the CPM and RBS for 2012-2016 to meet recovery demographic criteria for downlisting and delisting specified in recovery goals/plans adopted by the Service.	2012	2015	FWS, PO, BC	In progress	As of 2011, the Program met only 2 of 5 CPM positive population response criteria for 2007-2011. The Service is in the process of evaluating past criteria and developing new criteria for the period 2012 and beyond.
<i>C</i>	Task 5.2.2.3 Identify and evaluate limiting factors and determine necessary research to identify actions that will minimize or remove these limiting factors	2002	2015	FWS	Ongoing	See 2002 Recovery Goals for CPM and Razorback Sucker. The species recovery plans are being updated and limiting factors will be re-evaluated through that process.
<i>C</i>	Task 5.2.2.4 Use monitoring and research information to evaluate and use adaptive management strategies to modify recovery activities, as necessary, to ensure progress toward recovery.	2012	2023	FWS	Annually	Program activities are adjusted/modified based on current monitoring and research information.
<i>H</i>	Task 5.2.2.5 Develop interim recovery benchmarks for recovering the CPM and RBS by 2023 that are tied to monitoring data and are consistent with the species recovery plans and goals, Positive Population Criteria, Sufficient Progress Assessment, LRP, and Program Document.	2014	2016	FWS, BC	In progress	The Service will develop recovery benchmarks in coordination with the BC. Interim benchmarks will be developed for (1) implementation of management actions identified in the recovery goals (e.g., minimize threats); (2) recovery demographic criteria in the recovery goals to downlist and delist CPM and RBS; and (3) positive population response criteria developed to document and gauge demographic improvements for both species. Once developed, the benchmarks can be used during the Service’s biennial comprehensive review and assessment of Program progress towards recovery (i.e., Sufficient Progress Report).
Action 5.2.3 Ensure Scientific Integrity of Program Information and Coordination with other Associated Programs, Projects, and Studies.						
<i>H</i>	Task 5.2.3.1 Maintain a standardized process for peer review by qualified specialists in appropriate technical disciplines for significant Program science projects and reports.	1997	2023	PO, BOR	Annually	The Program Office maintains a standardized process for peer review (SOW 15-35).

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
<i>H</i>	Task 5.2.3.2 Coordinate with activities of the Upper Colorado River Endangered Fish Program and other related programs and promote participation by Program partners.	1992	2023	PO, BC	Annually	The Program Office coordinated closely with the UCR Recovery Program and other related programs in 2014.
Goal 5.3—Facilitate Contract and Funding Management.						
Action 5.3.1 Ensure appropriate and legal contract and funding practices.						
<i>C</i>	Task 5.3.1.1 Maintain and distribute annual base and capital funds allocated under the AWP by each funding source.	1992	2023	BOR, PO	Annually	The Program Office worked closely with the Bureau of Reclamation in 2014 to maintain and distribute all annual base and capital funds allocated under the AWP by each funding source (SOW 15-34)
<i>H</i>	Task 5.3.1.2 Administer Program contracts and provide an accounting of Program funds expended at the end of each federal fiscal year.	1992	2023	BOR, PO	Annually	Reclamation provided an accounting of Program funds (SOW 15-34).
<i>H</i>	Task 5.3.1.3 Manage Capital Improvement Program to maintain records showing the distribution and expenditures of capital funds under the AWP by each funding source, and provide an accounting of funds expended at the end of each federal fiscal year.	1992	2023	BOR, PO	Annually	Reclamation managed the Capital Improvement Program and worked with the Program Office to maintain those.

Table A6. Element 6.—Information and Education.

<i>P</i>	Tasks	Start Date	End Date	Who	Category	Status of Activity (focus on previous year)
Goal 6.1 Increase Public Awareness and Support for the Endangered Fishes and the Recovery Program.						
Action 6.1.1 Provide information to the public on the Recovery Program.						
<i>H</i>	Task 6.1.1.1 Provide information through news articles, press releases, radio and television ads, and other media in Farmington, Durango, Albuquerque, and others in the area to inform the public of Program activities.	1992	2023	PO	Ongoing	SOW 15-33
<i>H</i>	Task 6.1.1.2 Provide notification of meeting times, dates, locations, and draft agendas for committee meetings to interested parties 30 days in advance of the meeting.	1992	2023	PO	Ongoing	SOW 15-33
<i>H</i>	Task 6.1.1.3 Maintain a Recovery Program Website.	2000	2023	PO	Ongoing	http://www.fws.gov/southwest/sjrip/
<i>H</i>	Task 6.1.1.4 Develop Program brochure.	2012	2013	PO	Ongoing	Educational posters and brochures of the Native Fishes of the San Juan River and Progress Towards Recovery were produced in 2014. They convey key scientific information about the biology of all the native fish species, and the extensive efforts to recover CPM and RBS within this drainage. They are being distributed throughout the SJR Basin. Posters and brochures are available from the Program Office.
Action 6.1.2 Coordinate public outreach with Upper Basin Recovery Program.						
<i>H</i>	Task 6.1.2.1 Develop and maintain a formal outreach support agreement between the San Juan River Basin Recovery Implementation Program and the Upper Colorado River Endangered Fish Recovery Program.	1999	2023	PO	Annually	SOW 15-33
<i>H</i>	Task 6.1.2.2 Develop and exchange information and materials to incorporate into PowerPoint presentations, newsletters, Program highlights and Program displays.	1999	2023	PO	Ongoing	SOW 15-33
<i>H</i>	Task 6.1.2.3 Participate in selected outreach efforts at local, state, and regional water development conferences.	1999	2023	PO	Ongoing	SOW 15-33

Appendix B. Completed Long-Range Plan Tasks *(from 2009 LRP Elements 1-7)*

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Goal 1.1—Describe Biotic and Abiotic Baseline Conditions.					
Action 1.1.1 Determine the relative abundance and distribution of endangered fishes, as well as other native and nonnative fishes in the San Juan River Basin.					
Task 1.1.1.1 Conduct ichthyofaunal surveys of mainstem, tributary streams, and secondary channels to determine fish species associated with these habitats.	Medium (Completed)	FWS, NMGF, BC	1987	1997	Ichthyofaunal surveys were during 1987-1989 (Platania 1990) to determine the size of the remaining CPM population and to characterize the fish population of the San Juan River. Additional surveys were done during the 7-year research program.
Task 1.1.1.2 Conduct radio telemetry investigations to help define species distributions, movements, spawning sites, and habitat use.	Medium (Completed)	FWS	1991	2000	Although this task was completed (Ryden 2000; Miller and Ptacek 2000), more radiotelemetry work may be necessary to better understand habitat use and movement of newly established populations of CPM and RBS.
Task 1.1.1.3 Monitor the distribution and abundance of wild fish populations in the San Juan River to document status and trends.	High (Completed)	BC	1991	1997	Results of the 7-year research program were assimilated (Holden 2000) and strategies for research and monitoring were developed.
Action 1.1.2 Describe life history parameters of wild CPM and RBS.					
Task 1.1.2.2 Locate and describe areas of reproductive activity and nursery habitats to better understand species spawning needs.	High (Completed)	FWS, BC, NMGF	1991	1997	Reproduction should be documented from capture of ripe and gravid fish, drifting larvae, and age-0 fish. Wild adult CPM were radio-tracked during 1991-1997 (Ryden 2000) and in 1993-1994 to assess habitat use (Miller and Ptacek 2000). Results of the 7-year research program were assimilated (Holden 2000) and strategies for research and monitoring were developed
Task 1.1.2.3 Describe and quantify habitats selected by various life stages of CPM and RBS.	High (Completed)	FWS, NMGF	1991	1997	Capture locations of CPM and RBS should be described and quantified and river flows documented. Results of the 7-year research program were assimilated (Holden 2000) and strategies for research and monitoring were developed

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Action 1.1.3 Describe and evaluate flow, habitat, and other abiotic relationships.					
Task 1.1.3.1 Describe, model and evaluate different flow regimes.	High (Completed)	FWS, BOR	1995	1997	Requested releases have been evaluated for response of habitat (Pucherelli and Clark 1990; Pucherelli and Goettlicher 1992; Goettlicher and Pucherelli 1994; Bliesner and Lamarra 2002) and fish (Propst et al. 1999).
Task 1.1.3.2 Determine response of geomorphology and habitat to flow with the use of habitat mapping and river geomorphology.	High (Completed)	FWS, NMGF	1995	1997	Relationships have been developed between channel geomorphology, mesohabitats, and river flow to identify flows that maximize habitat of various life stages of CPM and RBS (Archer and Crowl 2000b; Archer et al. 2000; Bliesner and Lamarra 2000, 2007; Gido and Propst 1999; Lamarra 2004; Miller and Ptacek 2000). River reaches with simple, moderate, and complex channels have been mapped for geomorphic features and mesohabitats.
Task 5.2.3.6 Refine and standardize habitat classification for consistent use with fish sampling and habitat mapping.					A standard habitat classification system is needed that can be used for fisheries, hydrology, and geomorphology.
Action 1.1.4 Identify and evaluate limiting factors and determine necessary research to identify actions that will minimize or remove these limiting factors.					
Task 1.1.4.1 Compile, evaluate, and synthesize historic water quality information on the San Juan River to identify water quality parameters that may be detrimental to native and endangered fish species (e.g., mercury, selenium, polycyclic aromatic hydrocarbons [PAHs]).	Highest	BC, BOR	1991	1997	Based on data collection and evaluation during the 7-year research period, the BC concluded that water quality in the San Juan River was not a limiting factor to recovery of the endangered fishes or to restoration and maintenance of the native fish community. Years of monitoring and research have not clearly linked water contaminants and pollutants with adverse effects to the CPM and Razorback Sucker (Abell 1994). In a synoptic study of contaminants data from the 7-year research period, Simpson and Lusk (1999) concluded harm from selenium as a contaminant issue for the Razorback Sucker.
Task 1.1.4.2 Determine and quantify	High	FWS, NMGF	1991	1997	Primary habitats used by wild fish have been

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
mesohabitat types and channel forms used by native and endangered fish.	(Completed)				documented (Archer and Crowl 2000b; Archer et al. 2000; Bliesner and Lamarra 2000, 2007; Gido and Propst 1999; Lamarra 2004; Miller and Ptacek 2000).
Task 1.1.4.3 Evaluate effects of nonnative fish on native and endangered species and identify the most problematic nonnative species.	Highest (Completed)	FWS, NMGF	1996	1999	Initial evaluation of nonnative fish in the San Juan River has been completed (Brooks et al. 2000; Propst and Hobbes 2000).
Task 1.1.4.4 Estimate numbers of wild CPM and RBS in the San Juan River Basin and evaluate prospects for reestablishment of populations with and without hatchery augmentation.	High (Completed)	FWS, NMGF, BC	1991	1997	Numbers of wild CPM and RBS were found to be low in the San Juan River (Holden 2000).
Task 1.1.4.5 Survey health of fish in the San Juan River to ensure adequate protection from diseases and parasites.	Highest (Completed)	FWS	1998	2000	Fish health surveys were conducted on the San Juan River during 1992-1997 (Landye et al. 2000).
Action 1.1.5 Synthesize and integrate information to describe baseline conditions and to guide future actions.					
Task 1.1.5.1 Synthesize, integrate, and evaluate the 7-year research program.	High (Completed)	FWS, NMGF		2000	A 7-year research program was conducted 1991-1997 (Holden 2000). This effort helped to provide baseline information for the ichthyofauna of the San Juan River. During this program effort, methods were sometimes modified to meet the exigencies of the San Juan River, to incorporate new information and technologies, and to improve efficiency and quality of data collected.
Goal 1.2—Develop New Information as Necessary.					
Action 1.2.3 Assemble information from nonnative fish capture information.					
Task 1.2.3.1 Use data and information gathered from nonnative fish efforts to describe best strategies for minimizing negative impacts to native and endangered fish species.	Highest (Initial phase completed)	FWS, NMGF	2000	2005	A pilot study and ongoing investigations have been conducted to implement and evaluate the best strategies for controlling nonnative fish. Ongoing evaluation is needed, including assessment of new technologies for controlling nonnative fishes.
Goal 2.1—Establish a Genetically and Demographically Viable, Self-					

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Sustaining CPM Population.					
Action 2.1.1 Develop plans for rearing and stocking CPM.					
Task 2.1.1.1 Develop a genetics management plan to guide artificial propagation and ensure genetic diversity and viability of CPM.	Highest (Completed)	FWS, DNFH		2003	A Genetics Management Plan for CPM and RBS was developed in 2003 (Crist and Ryden 2003).
Task 2.1.1.2 Develop an augmentation plan for CPM to provide a strategy for producing, rearing, and stocking fish.	Highest (Completed)	FWS		2003	An Augmentation Plan for CPM was developed in 2003 (Ryden 2003a).
Action 1.1.2 Produce, rear, and stock sufficient numbers of CPM to meet stocking goals of augmentation plan.					
Task 1.1.2.1 Annually produce and rear at least 300,000 age-0 (50–55 mm TL) and 3,000 age-1 CPM at SNARRC.	Highest (Completed)	FWS, DNFH	2000	2009	At least 300,000 age-0 (50–55 mm TL) CPM will be produced and reared annually at the SNARRC for an 8-year period, 2002–2009. Analyses showed no survival advantage to stocking age-1 CPM. Goal revised in 2010 to produce, rear, and stock 400,000 age-0 CPM.
Task 1.1.2.2 Annually stock >300,000 age-0 CPM.	Highest (Completed)	FWS, DNFH	2000	2009	At least 300,000 age-0 (50–55 mm TL) CPM will be released annually from the SNARRC, into the San Juan River for an 8- year period, 2002–2009. See above.
Task 1.1.2.3 Annually stock 3,000 age-1 CPM.	Highest (Completed)	FWS, DNFH	2000	2009	A total of 3,000 age-1 CPM will be stocked and PIT tagged annually in the San Juan River through 2009. No age-1 CPM will be stocked beginning in 2011.
Goal 2.2—Establish a Genetically and Demographically Viable, Self-Sustaining RBS Population.					
Action 2.2.1 Develop plans for rearing and stocking RBS.					
Task 2.2.1.1 Develop a genetics management plan to guide artificial propagation and ensure genetic diversity and viability of RBS.	Highest (Completed)	FWS, BC		2003	A Genetics Management Plan for CPM and RBS was developed in 2003 (Crist and Ryden 2003).
Task 2.2.1.2 Develop an augmentation plan for RBS to provide a strategy for producing, rearing, and stocking fish.	Highest (Completed)	FWS, BC		2003	An experimental stocking program for RBS was conducted 1994-1997. An Augmentation Plan for RBS was developed in 1997 (Ryden 1997) for a 5-

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
					year period, 1997-2001, and recommended stocking 73,482 RBS; only 5,890 were stocked for a lack of hatchery and grow-out facilities. An addendum to the plan was developed in 2003 (Ryden 2003b) to extend the program for 8 years, 2004-2011, and recommended stocking 91,200 age-2 RBS (> 300 mm TL) or 11,400 annually.
Goal 1.2—Evaluate CPM and RBS Augmentation Program and Genetic Integrity.					
Action 1.2.2 Evaluate methods to improve CPM and RBS stocking successes.					
Task 1.2.2.2 Assimilate the genetics information on CPM and RBS to describe best strategies for establishing and maintaining genetically viable wild populations of endangered fish.	Highest (Completed)	FWS, BR		2003	<ul style="list-style-type: none"> Genetics management plan for the endangered fishes of the San Juan River (Crist and Ryden 2003) SNARRC Species Augmentation Plans
Goal 2.4— Minimize fish entrainment at diversion structures in the San Juan Basin.					
Action 2.4.1 Identify diversions that could potentially entrain endangered fish in the San Juan River and remediate where necessary.					
Task 2.4.1.1 Design, construct, and maintain a fish deflection weir at the Hogback Diversion.	2005	2015	BOR, BC, PO, FWS, NN	Ongoing	A fish deflection weir at Hogback Diversion was completed in FY2013. PIT tag antennas were installed on the structure in 2014 and tests conducted to test for effectiveness. Of the 803 fish stocked for the experiment, 18 fish or 2.2% became entrained in the canal (i.e., lost from the river); however, overall detection was low. Additional tests are planned.
Goal 3.1—Provide Suitable Flows to Support Recovery of CPM and RBS Populations.					
Action 3.1.1 Develop flow regimes to provide adequate base flow and function to maintain habitat for CPM and RBS.					
Task 3.1.1.1 Identify and develop flow recommendations for the San Juan River.	Highest (Completed)	BC		1999	Flow Recommendations for the San Juan River were developed and implemented in 1999 (Holden 1999).

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Goal 3.3—Provide Increased Range to Support Recovery of CPM and RBS Populations.					
Action 3.3.1 Provide and maintain fish passage at diversion structures.					
Task 3.3.1.1 Identify and evaluate fish barriers in the San Juan River.	Highest (Completed)	BC		1996	Fish barriers were identified and evaluated in 1996 by Masslich and Holden (1996).
Task 3.3.1.2 Remove Cudei Diversion to provide fish passage.	Highest (Completed)	BIA, NN		2001	The Cudei Diversion was removed in 2001. The Cudei Diversion is owned by the Navajo Nation.
Task 3.3.1.3 Provide and maintain fish passage at the Hogback Diversion.	Highest (Completed)	BIA, NN		2002	Fish passage at Hogback Diversion was completed in 2002. The Hogback Diversion is owned by the Navajo Nation. No maintenance is anticipated.
Task 3.3.1.4 Provide and maintain selective fish passage at the Public Service Company of New Mexico (PNM) Weir.	Highest (Completed)	FWS, NN		2003	Fish passage at Public Service Company of New Mexico (PNM) Weir was completed in 2003.
Action 3.3.2 Evaluate fish passage for native and endangered fish species to and from Lake Powell in light of a natural waterfall at low reservoir elevations.					
Task 3.3.2.1 Identify extent of problem from natural waterfall on passage of native and nonnative fish from Lake Powell into the San Juan River.	High (Completed)	FWS, BOR, BC	2009	2010	The extent that the natural waterfall in the lower San Juan River impedes fish migration should be determined. BOR assessed the risk for predators recolonizing the river when water level in Lake Powell rises to a level that the waterfall is inundated. They concluded that there is a 60 to 75% chance the waterfall will be inundated for a total of 30 months (not necessarily continuously) between 2008 and 2030. Probabilities for longer inundation are available (6-26-07 CC Meeting).
Goal 3.4—Provide Suitable Water Quality to Support Recovery of CPM and RBS Populations.					
Action 3.4.2 Evaluate effects of river temperature on native and endangered fish.					

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Task 3.4.2.1 Determine if cold water releases from Navajo Dam into the San Juan River impede endangered fish reproduction or limit endangered fish populations downstream of the Animas River.	High (Completed)	BC		2006	Based on the reports, <i>SJR Fishes Response to Thermal Modification – A White Paper Investigation</i> (Lamarra 2007) and Cutler (2006) <i>Navajo Reservoir and SJR Temperature Study</i> , the BC determined a temperature control device (TCD) was not warranted. Impacts to spawning and rearing from cold releases from Navajo Dam into the SJR appeared to be minimal. Spawning is determined by time-of-year more than temperature cue. A TCD may provide seasonal range expansion above critical habitat but is unknown if range expansion above critical habitat is necessary for recovery. More information is needed (BC Meeting, May 17-18, 2007).
Goal 4.1—Control Problematic Nonnative Fishes as Needed.					
Action 4.1.1 Develop, implement, and evaluate the most effective strategies for reducing problematic nonnative fish.					
Task 4.1.1.1 Identify and prioritize the most problematic nonnative fish species.	Highest (Completed)	BC	2000	2003	This determination was made through a risk assessment and consensus of biologists. Davis (2003) identified Channel Catfish and Common Carp as the most problematic species.
Task 4.1.1.2 Design and implement a pilot program to evaluate nonnative fish control strategies and gears.	Highest (Completed)	FWS	2000	2003	The Nonnative Fish Monitoring And Control Plan (Davis 2003) served as a pilot program and identified removal reaches and evaluated sampling gears and strategies.
Task 4.1.1.3 Develop a long-term nonnative fish control strategy and specific objectives for nonnative fish control...	Highest (Completed)	FWS	2009	2010	A nonnative fish control strategy will be developed and implemented for the San Juan River. This strategy will identify removal tactics, gear types, personnel, and costs necessary to meet removal criteria established in Task 5.1.1.2.
Action 4.1.4 Obtain reliable population estimates of CPM and RBS.					

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Task 4.1.4.1 Implement pilot project to develop mark-recapture population estimates to supplement catch rate estimators for reliable and precise population estimates to help determine if downlist and delist criteria of recovery goals are being achieved	2009	2013	BC	Ongoing	In 2009 and 2010, population estimates for CPM (age 2+) and RBS (if they had been in the river for one over-winter period) were calculated using data collected during nonnative fish removal efforts from Shiprock, NM to Clay Hills, UT. Specific mark/recapture trips were not completed; however, estimates were generated using data collected via standard nonnative fish removal methodologies. To develop point estimates, data were used from a variety of sampling trips that were conducted within one month of each other. Estimates were not generated in 2011 but will be generated using data collected during 2012.
Action 3.1.2 Establish and evaluate strategies for handling removed nonnative fish in collaboration with state and tribal agencies.					
Task 3.1.2.1 Evaluate and revise, as necessary, translocation strategy for Channel Catfish removed from the San Juan River.		FWS	FWS		Channel Catfish are no longer translocated, in part, due to several reasons including: (1) cost/benefit of translocation in relation to unpredictability of catch among trips; (2) fish health concerns, specifically the accumulation of mercury in older Channel Catfish; and (3) fish importation concerns between the States of Utah and New Mexico. Channel Catfish have not been translocated since 2006 and, at this point, there are no plans to reinstate this activity. Will not be pursued until the health concerns can be addressed.
Task 3.1.2.2 Implement standardized fish health analysis for translocated Channel Catfish to avoid transfer of harmful pathogens.		FWS	FWS		Standardized fish health testing should be implemented if the translocation of Channel Catfish is reinstated.
Task 3.1.2.3 Develop, evaluate, and implement standard procedures for disposal of fish that cannot be translocated.		FWS	FWS		Standard procedures have not been developed, to date. Current disposal is to bury, when feasible, all nonnative fishes removed from the San Juan River.

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Goal 5.3— Integrate And Synthesize Monitoring Data And Information To Evaluate Fish Community And Ecosystem Responses To Recovery Actions.					
Action 5.3.1 Develop fish community and ecosystem response strategies					
Task 5.3.1.2 Develop an ecosystem model specific to the San Juan River and present it for approval by the BC.	Medium (Completed)	BC, FWS	2000	2005	Completed in 2000-2005. The Program may choose to further develop an ecosystem model specific to the San Juan River to assist in evaluating possible responses by fish species to management actions.
Task 5.3.1.3 Hold workshop on ecosystem model specific to the San Juan River to evaluate model and determine future direction of this effort	Medium (Completed)	FWS, BC	2007	2007	Workshop held in 2007.
Goal 7.1—Facilitate Program Planning and Management.					
Action 7.1.1 Develop and coordinate a Program plan.					
Task 7.1.1.1 Develop and implement a LRP as a framework for ongoing and future Program activities.	Highest (Completed)	PO	1995	1995	A LRP was developed in 1995 (Program 1995).