United States Department of the Interior

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Cons. # 22420-2010-F-0077

Lt. Colonel Jason Williams
(Attn: Julie A. Hall) Environmental Resources
U.S. Army Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, New Mexico 87109-3435

Dear Lt. Colonel Williams:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) on the effects of the action described in the 2010 Biological Assessment (BA) for the Middle Rio Grande Bosque Restoration Project, Bernalillo and Sandoval Counties, New Mexico. This BO analyzes the effects of the action on the endangered Rio Grande silvery minnow, *Hybognathus amarus*, (silvery minnow) and on the endangered southwestern willow flycatcher, *Empidonax traillii extimus*, (flycatcher). The restoration project will be located in the bosque of the Rio Grande within Sandoval and Bernalillo Counties. Request for formal consultation, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), was originally received on April 8, 2010 and was amended and resubmitted on November 23, 2010.

This BO is based on information submitted in the April 2010 BA and the November 2010 amended BA; conversations and communications between the U.S. Army Corps of Engineers (Corps) and the Service; and other sources of information available to the Service. A complete administrative record of this consultation is on file at the Service's New Mexico Ecological Services Field Office (NMESFO).

This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. USDI Fish and Wildlife Service (CIV No. 03-35279) to complete the following analysis with respect to critical habitat. This consultation analyzes the effects of the action and its relationship to the function and conservation role of silvery minnow critical habitat to determine whether the current proposal destroys or adversely modifies critical habitat.

Southwestern Willow Flycatcher
The Corps has determined the proposed project "may affect, but is not likely to adversely affect," the flycatcher. We concur with this determination for the reasons described below.

Restoration treatments proposed may provide long term benefits to the species. As a result of implementing the proposed action, approximately 663 acres of bosque vegetation will be treated, retreated as necessary and revegetated. Approximately 65 acres of willow swales will be created and are anticipated to develop into suitable flycatcher habitat. In addition, approximately 38 acres of wetlands will be restored and some aspects may have potential to support flycatchers.

The flycatcher is a migrant through this portion of the Rio Grande and may be present from April through August. Suitable nesting habitat does not currently exist within the project area. The nearest nesting occurs approximately 1.3 miles downstream of the nearest proposed habitat restoration site. Migrating flycatchers could still be disturbed by construction activities and the clearing of woody vegetation in the action area; however, these activities will not occur during the timeframe when flycatchers could be present. No work will be conducted between April 15 and August 15 of each year. Thus, direct effects to flycatchers will be avoided.

Since implementation of the proposed action spans over multiple years during the non-breeding season, the Corps will continue to conduct flycatcher surveys. If breeding flycatchers are detected, the Corps will reinitiate consultation with the Service. Any detected territories will immediately be protected by a no-work buffer zone of 1/4 mile radius.

Although one of the long-term goals of the proposed action includes creating, restoring, and enhancing riparian habitat which would potentially benefit the flycatcher, short-term indirect effects on flycatchers are possible from the removal of any vegetation that currently represents suitable migratory-stopover habitat. Vegetation disturbance is expected to be temporary, becoming re-established after implementation of the proposed action. Vegetation will be monitored as it re-establishes in the restoration treatment areas. Water features to be constructed are expected to provide benefits to flycatchers in the long term. Creation of willow swales will over time result in willow stands of the preferred density and stature for the flycatcher. Wetland restoration, bank terracing, and creation of ephemeral and backwater channels are all expected to have the potential to result in dense native vegetation as edge habitat is established or because of lowering ground levels closer to groundwater. Restoration proposed in the San Antonio Oxbow would also improve potential habitat where migrants have been detected for the past three years. Specifically, in this area, about 1 acre of stopover habitat would be removed in order to create connections with the river in the form of backwater habitat. Nearby there is sufficient stopover habitat such that we expect any effects on migrating flycatchers to be insignificant.

Habitat may be removed for access and staging. Many of the proposed restoration sites can be access by existing levees and have existing staging areas within or near the site (i.e.: previously cleared or burned bosque areas). These areas can be utilized for daily movement of equipment while overnight staging and fueling would occur nearby along the lower levee or existing parking areas. A temporary access road off of the levee/paved trail will be constructed to access proposed construction areas where one does not exist. These temporary access roads will be removed and reseeded once construction is complete or left in place if so desired by City of Albuquerque Open Space Division (OSD). Any additional disturbance caused by equipment accessing the site will be reseeded with native vegetation and mulched once complete. Access to all work areas will occur along the levee, and staging will occur in adjacent open areas made available by the sponsor, the Middle Rio Grande Conservancy District (MRGCD).

Firebreaks associated with implementation of the Exotic Species/Fuel Load Reduction and Riparian Gallery Forest Mosaic Restoration component have the potential to affect flycatcher. No new firebreaks would be created near any potential flycatcher habitat. Also no areas will remain cleared. Where an area is already open due to new or previous fuel reduction (or a fire), the area may be reseeded with native grass seed and small shrubs to keep it more open as a fire break. Fire breaks would be maintained mainly where they already exist.

In addition, conservation measures will be implemented to minimize potential effects on vegetation in the action area. These include avoiding dense willow-dominated riparian vegetation in all project areas other than the San Antonio Oxbow, using all efforts to minimize damage to native vegetation and wetlands, using existing roads and cleared staging areas, and operating equipment in the most open area available to minimize damage to vegetation. Willow removal in the San Antonio Oxbow site is required to introduce more water into the site via backwaters resulting in long term habitat improvements and benefits to flycatchers. Stopover habitat for flycatchers is available in nearby areas. Therefore, indirect effects on flycatchers from removing vegetation are considered insignificant because vegetation in the action area does not currently support flycatcher territories, is not considered suitable breeding habitat for the flycatcher, stopover habitat for migrating flycatchers is available nearby to the San Antonio Oxbow, and disturbance to vegetation will be temporary with beneficial effects anticipated in the long-term.

Recreation features will include pedestrian bridges across ephemeral high flow channels where needed in order to maintain trail connections, enhancement of existing trails around bridges (providing access to all users by converting to crusher fine for a certain extent), addition of benches and interpretive kiosks at main public access points (again near bridges/parking lots), and improvement of canoe/boat access at locations where this activity currently takes place. The features are expected to improve safety for hikers and boaters and concentrate public use into locations already being used. The trail and boat access improvements will lessen the likelihood of the public creating new informal trails and lessen the likelihood of using existing informal trails and river access routes.

Given the conservation measures in place during the proposed restoration project including that construction will not occur during the flycatcher migratory season, anticipated effects to the flycatcher from the proposed action are insignificant and discountable. There is no designated critical habitat for the flycatcher within the action area. The remainder of this biological opinion will deal with the effects of implementation of the proposed action on the silvery minnow.

Consultation History

The Service received a BA on April 8, 2010 in which no adverse effects were anticipated to either silvery minnow or the flycatcher. The Service met with the Corps on November 4, 2010 to discuss the project. The Corps updated its BA and submitted an amended BA on November 23, 2010 and requesting incidental take for potentially adverse effects during construction of the proposed project. The Service requested additional information and clarification on the proposed action and effects analysis and received that information on January 31, 2011 and February 24, 2011. On February 26, 2011, the Service provided a draft BO to the Corps for review and met with the Corps on March 25, 2011. Additional information was received from the Corps on March 30 and April 4, 2011. On April 5, 2011, the Service provided a final draft BO to the Corps for review and also to the Pueblo of Sandia for review pursuant to our obligation in Secretarial Order 3206 (U.S. Department of the Interior 1997). Comments on the final draft were received from the Corps on April 11, 2011 and from the Pueblo of Sandia on April 14, 2011.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

Overview

Goals of the Corps of Engineers Middle Rio Grande Bosque Restoration Project (project) are as follow:

- Improve habitat quality and increase the amount of native bosque communities.
- Reestablish fluvial processes in the bosque to a more natural condition.
- Restore hydraulic processes between the bosque and the river to a more natural condition.
- Reduce the risk of catastrophic fires in the bosque.
- Protect, extend and enhance areas of potential habitat for listed species within the bosque.
- Provide educational or interpretive features.
- Integrate recreational features that are compatible with ecosystem integrity.

The project will apply several habitat restoration techniques in 5 different reaches spanning approximately 26 miles along the Rio Grande in Bernalillo and Sandoval Counties, New Mexico. The project will restore approximately 916 acres of the bosque through (1) improving hydrologic function by constructing high-flow channels, willow swales, and wetlands, and (2) restoring native vegetation and habitat by removing jetty jacks, thinning exotic species, and re-vegetation with native species. Improvements of existing facilities for educational, interpretative and low-impact recreational uses will also be constructed. Project construction will be phased over 3-5 years and is proposed to begin in September 2011 and continue through April 2016. The proposed activities will not be conducted between April 15 and August 15, annually.

The MRGCD is the non-Federal sponsor for this project. MRGCD and OSD co-manage the bosque within the project area. Both are critical partners in the development and implementation of this project. The team responsible for the planning process (the Project Development Team) included representatives of the MRGCD, OSD and New Mexico State Parks in addition to the Corps and their consultants. Early in the process, an interagency Ecosystem Assessment Team

(E-Team) was convened. Representatives from the Corps' Albuquerque District, the Service, Reclamation, New Mexico Interstate Stream Commission (ISC), New Mexico Department of Game and Fish (NMDGF), New Mexico State Forestry Division (NMSFD), Natural Heritage New Mexico (NHNM), USFS Rocky Mountain Research Station (RMRS), MRGCD, OSD, University of New Mexico (UNM), Corrales Bosque Preserve, Village of Corrales and Parametrix consultants actively participated in the assessment process.

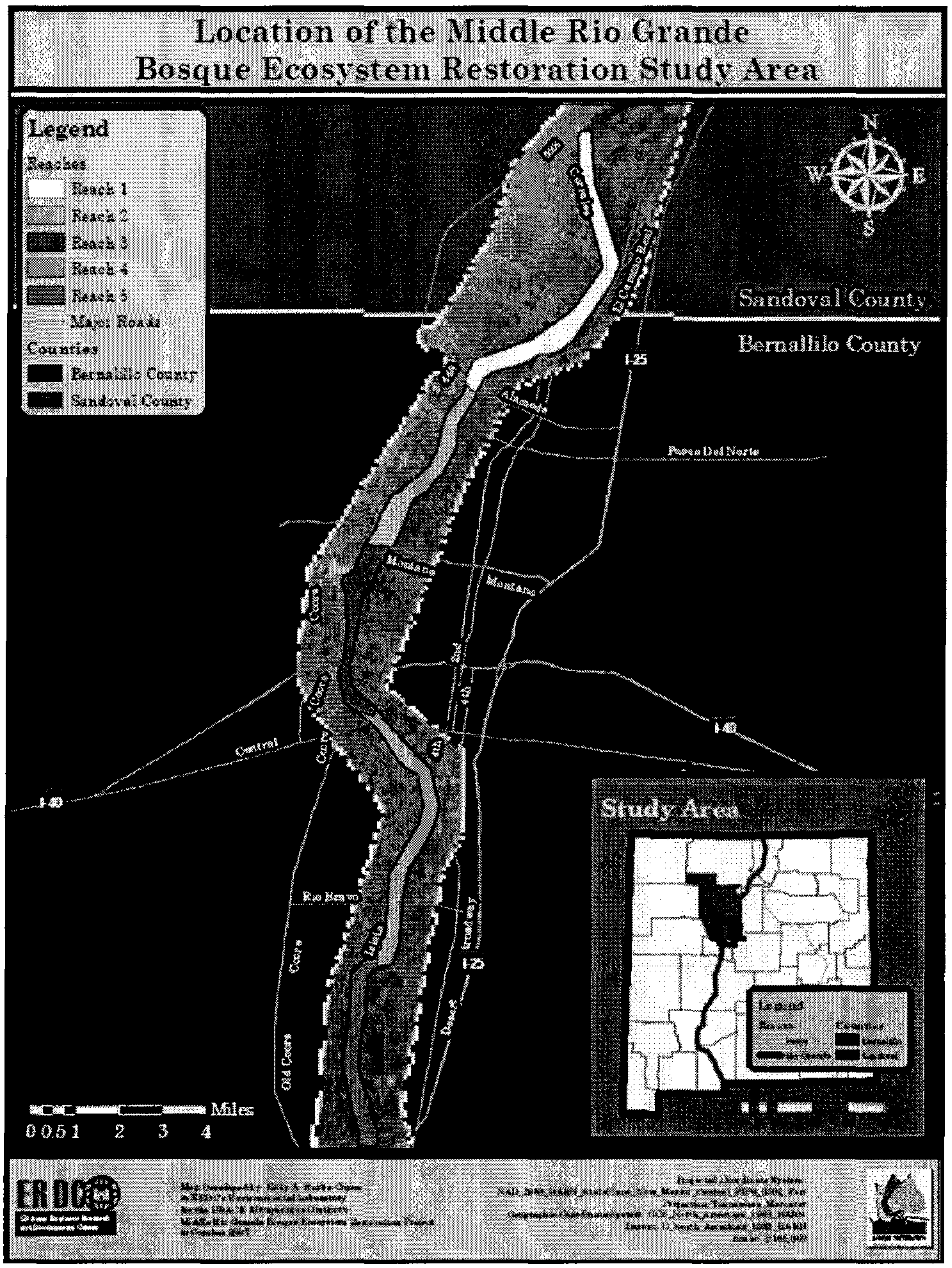

Figure 1. General project location map (from Corps November 2010 Biological Assessment)

Project Location
The proposed action will occur in the Angostura reach of the Rio Grande between the levees and the main river channel extending from north of Corrales in Sandoval County (River Mile 198.4) downstream to the northern boundary of the Pueblo of Isleta in Bernalillo County (River Mile 172) (Figure 1). The Corps has divided the proposed action area into five reaches, defined as follows:

Reach 1	North end of Corrales south to Alameda Blvd. – includes lands of Village of Corrales, Pueblo of Sandia, and Rio Grande Valley State Park (Co managed and/or owned by MRGCD, USBR and City of Albuquerque Open Space Division)	River miles ~ 198.4-192.2 (~ 6 miles in length)
Reach 2	Alameda south to Montano	River miles ~ 192.2 - 188 (~ 4 miles in length)
Reach 3	Montano south to Central	River miles ~ 188 - 183.5 (~4.5 miles in length)
Reach 4	Central south to South Diversion Channel	River miles ~ 183.5 - 177 (~6.5 miles in length)
Reach 5	South Diversion Channel south to Pueblo of Isleta boundary;	River miles ~177 - 172 (~ 5 miles in length)

The Proposed Action Area also includes the bosque within Albuquerque, which was designated as the *Rio Grande Valley State Park* through the Park Act of 1983. This area is cooperatively managed by the OSD and MRGCD. The Proposed Action Area also includes lands of the Village of Corrales, which is designated as the *Corrales Bosque Preserve* and is cooperatively managed by the Village of Corrales and the Corrales Bosque Commission through an agreement with the MRGCD. Pueblo of Sandia lands are also located within the Proposed Action Area and are managed by the Pueblo. The Pueblo of Sandia is the proponent for the two proposed project sites located within Pueblo boundaries.

Proposed Restoration Treatments
Specific restoration treatments at 18 different project sites will be implemented during the proposed action. They are designed to create aquatic habitat and to improve riparian habitat in and along approximately 26 miles of the Rio Grande. Approximately 663 acres of bosque is planned be treated, retreated and re-vegetated. Construction of the restoration treatments is expected to occur between August 15 and April 15 over a period of 3 to 5 years. Pre-construction baseline monitoring has been and will continue to be conducted. Treatments will be

monitored during construction and afterward for a period of no less than 5 years. Treatments will be evaluated to allow for adaptive management to improve the effectiveness of treatments constructed in later phases. Treatments that will be used during implementation of the proposed action include jetty jack removal, non-native plant removal, revegetation, wetland restoration, bank terracing, ephemeral high flow channels with associated backwaters and bank scallops as possible, and willow swales. Overall, plans for water features call for approximately 70 acres of bank terraces, 70 acres of high flow channels with backwaters and a 10 acres bank-line scallop, 55 acres of willow swales, and restoration of approximately 38 acres of wetlands. In addition, approximately 800 jetty jacks will be removed. In many cases, the removal of jacks allows for subsequent vegetation management and removal along a bank-line may provide for subsequent bank terracing. Construction and clearing of vegetation will not occur between April 15 and August 15.

Table 1 provides a summary of the types of restoration treatments, the area of each treatment to be constructed at the 18 different sites, and the estimated area of disturbance of wetted habitat during construction. Information in Table 1 is based on the November 2010 BA and subsequent information exchange and correspondence from the Corps.

Specific recreational features will be implemented during the proposed action. They are designed to enhance the recreation system within the action area. Recreational features that will be used include benches, picnic tables, kiosks, parking improvements, trail improvements, canoe launch improvements, a bridge, and signage. Two small canoe ramps are proposed (one at the northwest corner of Alameda and the river, and one at the northeast corner of Central and the river). Each area will disturb approximately 20 feet wide by 150 feet long of vegetation/bank edge of the river. These features conform to and build upon Open Space Division plans for the Rio Grande Valley State Park.

Table 1. MRG Bosque Restoration Proposed Restoration Treatments, Restored Area and Wetted Area Affected by Construction

Reach	Project	Treatment	Restored Area (Acres)	Construction Disturbance in Wetted Areas (Acres)[1]
1	1A	Treat-Retreat-Revegetation	34.9	-
		Bank terracing	16.35	4.51
		High flow channel	26.38	0.08
	1B	Treat-Retreat-Revegetation	82.74	-
		Bank scallop	9.46	2.64
	1C	Treat-Retreat-Revegetation	37.78	-
		Bank terracing	23.19	6.38
		High flow channel	8.36	0.08
		Willow swales	9.75	-
	1D	Treat-Retreat-Revegetation	18.74	-

		Willow swales	2.44	-
	1E	Treat-Retreat-Revegetation	66.36	-
		Bank terracing	10.38	2.86
		High flow channel	5.85	0.08
		Marsh Wetland	13.48	0
		Willow swales	11.71	-
		Jetty jack removal (30 units)		
	1F	Treat-Retreat-Revegetation	9.57	-
		Bank terracing	8.25	2.2
		High flow channel	3.6	0.08
		Jetty jack removal (100 units)		
	1G	Treat-Retreat-Revegetation	30	-
		Willow swales	3.48	-
		Canoe ramp	2.8	0.08
	1H	Treat-Retreat-Revegetation	12.21	-
		Willow swales	1.18	-
		Jetty jack removal (10 units)		
2	**2A**	Treat-Retreat-Revegetation	19.05	-
		High flow channel /Backwater	3.5	0.08
		Jetty jack removal (100 units)		
3	**3A**	Treat-Retreat-Revegetation	48.52	-
		Bank terracing	5.15	1.43
		Open Water	17.16	0
		Marsh Wetland	1.99	0
		Jetty jack removal (150 units)		
4	**4A**	Treat-Retreat-Revegetation	62.64	-
		Wet Meadow Wetland	5.16	-
		Canoe ramp	2.8	0.08
	4B	Treat-Retreat-Revegetation	23.86	-
		Willow swales	5.38	0.55
	4C	Treat-Retreat-Revegetation	33.45	-
		Bank terracing	7.58	2.09
		High flow channel	15.31	0.08
		Jetty jack removal (170 units)		
5	**5A**	Treat-Retreat-Revegetation	35.34	-
		Willow swales	4.35	-
		High flow channel/Backwater	1.0	0.08
		Jetty jack removal (100 units)		
	5B	Treat-Retreat-Revegetation	61.1	-
		Willow swales	7.29	-
		Jetty jack removal (100 units)		
	5C	Treat-Retreat-Revegetation	33.89	-

	Willow swales	4.68	-
	High flow channel	6.5	0.08
	Jetty jack removal (30 units)		
5D	Treat-Retreat-Revegetation	40.42	-
	Willow swales	6.9	-
5E	Treat-Retreat-Revegetation	12.15	-
	Willow swales	1.89	-

[1]Includes wetted area that is anticipated to be disturbed during construction and a 10% buffer zone to encompass construction disturbance zone in wetted areas.

Jetty Jack Removal

The jetty jacks within the project area are either owned or are, otherwise, under the authority of the Corps, the Reclamation or the MRGCD. Approximately 800 jetty jacks are currently proposed for removal. In a cooperative effort, the three agencies have reviewed the Albuquerque Reach to evaluate whether jetty jack removal would conflict with flood control and erosion management. Jetty jack removals have been approved in most locations, with only a few exceptions. Exceptions are typically in areas where the active river channel has migrated to an alignment very close to the levee, such that only a very narrow overbank buffer remain between the active river flow and the levee toe. Such bank line jetty jacks that are to be removed will be mitigated with some form of bio-stabilization method, such as willow swales, to prevent excessive migration of the river channel toward the levee. Typically, however, these bank line jetty jacks must remain fully intact. Any broken cable or snapped/cut wires resulting from this work or the recent activity of others will be repaired. Additionally, where tieback lines are removed, new anchors will be installed as needed to insure that the remaining lines of jetty jacks cannot migrate from their current position. If only one or two jetty jacks within a continuous line are removed, the remaining jacks will be reconnected with a buried steel cable. Tieback lines (roughly perpendicular to the river) will not be removed without also placing a buried anchor (known as a "deadman") to replace the tieback line.

The Corps Hydrology and Hydraulics Section has determined that the jetty jacks identified for removal in the proposed action can be removed with a low hydraulic risk based on implementation of the proposed restoration methods and techniques for this project.

All jetty jack materials will be safely disposed of after they are removed from the work site. Ongoing inspections as well as a final inspection will be conducted to insure that the proposed action is implemented as described above.

Vegetation Management

Restoration is basically comprised of non-native plant removal and re-vegetation. The purpose of non-native plant removal is to 1) facilitate restoration efforts by eliminating the chief competition to native trees, shrubs, forbs and grasses, 2) reduce the fire hazard, and 3) enhance aesthetic and recreational aspects of the bosque. The purpose of re-vegetation is to re-create the lost native understory in the bosque forest woodland areas and the lost native shrub thickets in open areas.

In many areas, continued maintenance and repeated treatment of invasive species for stump sprouting, and removal of juvenile volunteer non-natives, will be necessary. Both the removal of jetty jacks, where needed, and the thinning of non-native vegetation would need to occur prior to implementing the remaining activities/features described below.

Specific non-native plant treatment methods are as follows:
A number of protocols for reducing fuel loads and treating non-native vegetation have been, and are being, utilized in the MRG and throughout the Southwest. These methods include both manual and mechanical treatment methods, which are described below. Follow-up treatment with herbicides, or root ripping (raking approximately 6-12 inches into the ground in order to remove roots), are also options. Removal of non-native vegetative species, would take place between September and April 15 of each year.

1. Manual treatment - Using this method, dead material will be piled up and/or processed by cutting into small pieces using a chain saw. Large material will be hauled off, with some resources for use as fire wood. Smaller material will be chipped, using a chipper, on site. Chips would either be tilled into the ground prior to revegetation or hauled off, depending on their density. No more than 2 inches of chipped material would be left on site. The stump of any live non-native trees that is cut will be treated immediately with herbicide (see Chemical treatment below), if not entirely removed. This method will be used in areas where the bosque is not very wide and equipment will not fit, or areas where there are a large number of native trees and shrubs to protect.

2. Mechanical treatment - Mechanical control entails the removal of aerial portions of the tree (trunk and stems) by large machinery such as a tree shear or large mulching equipment. Both dead material and live non-native trees will be treated mechanically. Where possible, trees will be removed with the root-ball intact. Otherwise, the stump will be treated immediately with herbicide (see Chemical treatment below). Material will be processed as stated above: large material will be hauled off and smaller material will be chipped.

3. Combination treatment - The most efficient approach for treatment of dead material and non-native vegetation (and the most frequently used in the MRG where a fair amount of native species are mixed in with non-native) is a combination of manual treatment, mechanical treatment and use of herbicide (see Chemical treatment below). Some areas may be very dense, and the use of manual methods allows them to be opened up for machinery access. Mechanical equipment can then take over while hand crews move ahead of machinery to keep areas open enough to work in without damaging native vegetation to remain. The procedure to be implemented at each location will be evaluated on a site-by-site basis.

4. Chemical treatment - Once initial removal of non-native species has occurred, or in areas where OSD crews have already removed standing non-native vegetation as part of their routine operations and maintenance, resprouting of non-native vegetation will occur. These resprouts will be treated with either herbicide or by root-ripping prior to revegetating the area with native species. Thinning and removal of non-native vegetation under this proposed action will include herbicide treatment in many locations. Herbicide application will be used where root ripping is not an option. Herbicide will be immediately applied to the plant using a backpack sprayer, hand application with a brush, or other equipment that allows direct application.

Herbicide application would be used after manual and/or mechanical treatment of non-native vegetation. The preferred herbicides to use are Garlon®4 (for treatment of resprouts) and Garlon® 3A (for initial treatment). These are both selective herbicides which means that they can kill certain groups of plants and have little or no effect on other plants. These herbicides should not be used near surface water or saturated soils. In or adjacent to wetted areas and in areas where water would enter at some point in time after construction, only aquatic approved herbicide would be used (Renovate 3® (triclopyr) is the preferred herbicide). Renovate 3® is the only formulation of triclopyr registered by the EPA as an aquatic herbicide. Herbicides would only be used between October and April in order to protect amphibian species from potential exposure and to allow work to take place outside of the avian migratory nesting season.

Garlon® is the commercial version of triclopyr and generally contains one or more inert ingredients. The contents of two triclopyr formulations are: Garlon® 3A: triclopyr (44.4%), and inert ingredients (55.6%) including water, emulsifiers, surfactants, and ethanol (1%); and Garlon ®4: triclopyr (61.6%), and inert ingredients (38.4%) including kerosene. Triclopyr acts by disturbing plant growth. It is absorbed by green bark, leaves and roots and moves throughout the plant. Triclopyr accumulates in the meristem (growth region) of the plant. Surfactants used would include non-ionic surfactants that have been approved for use in aquatic habitats (such as Induce).

Basal bark and cut surface treatments will only be applied during the work window, from August 15 – April 15. Triclopyr should be applied only when there is little or no hazard of spray drift. It should be applied immediately to the stump of the cut tree (within two hours). Triclopyr is active in the soil, and is absorbed by plant roots. Microorganisms degrade triclopyr rapidly; the average half-life in soil is 46 days. Triclopyr degrades more rapidly under warm, moist conditions. The potential for leaching depends on the soil type, acidity and rainfall conditions. This herbicide is selective to woody plants and has little to no effect on grasses (Parker et al., 2005). It has been certified and labeled to be used near water by the Environmental Protection Agency (EPA, 1998). After use, the public must remain away from the area for 48 hours. Signage would be placed at areas after they have been treated.

Triclopyr is slightly toxic to practically non-toxic to soil microorganisms. Practically nontoxic is defined as a probable lethal oral dose for humans at less than 15 g/kg (Klaassen et al., 1986). Triclopyr is toxic to many plants if applied directly. Even very small amounts of spray may injure some plants. That is why it is to be applied directly to the stump of the tree being treated. The ester form of triclopyr, found in Garlon® 4, is more toxic, but under normal conditions, it rapidly breaks down in water to a less toxic form. Triclopyr is slightly toxic to practically non-toxic to invertebrates. Slightly toxic is defined as a probable lethal oral dose for humans at 5-15 g/kg (Klaassen et al., 1986). Triclopyr and its formulations have not been tested for chronic effects in aquatic animals. Triclopyr is slightly toxic to mammals. In mammals, most triclopyr is excreted, unchanged, in the urine. Triclopyr and its formulations have very low toxicity to birds. Triclopyr is non-toxic to bees. Triclopyr and its formulations have not been tested for chronic effects in terrestrial animals. The exposure levels a person could receive from these sources, as a result of routine operations, are below levels shown to cause harmful effects in laboratory studies. Inert ingredients found in triclopyr products may include water, petroleum solvents, kerosene, surfactants, emulsifiers, and methanol. Methanol, kerosene and petroleum solvents may be a toxic hazard if the pesticide is swallowed. Non-ionic surfactants and emulsifiers are generally low in toxicity. The formulated products are generally less toxic than triclopyr. Garlon® 3A is a skin irritant and a severe eye irritant.

It has been found by other agencies in the area currently using these herbicides (MRGCD, OSD and the Bosque del Apache National Wildlife Refuge) that both Garlon® 4 (mixed 25-75% with vegetable oil) or Garlon® 3A (mixed 50-50% with water) have been successful.

Garlon® 4 would be used for initial treatment and has been shown to be more successful in cut-stump treatments (U.S. Army Corps of Engineers 2004). Garlon® 3A would be used for treatment of resprouts once they have grown at least 3 feet in height. Garlon® 3A has been shown to be more effective on smaller stems and resprouts (U.S. Army Corps of Engineers).

Revegetation

The overall restoration strategy for the Riparian Gallery Forest Mosaic Restoration measures is to revegetate all areas within the proposed action areas utilizing native shrub and juvenile tree species. The purpose of this strategy is to re-create the lost native understory in the bosque forest woodland areas and the lost native shrub thickets in open areas. At the same time, gaps will be left in between the revegetated areas to create edge habitat, the richest type of habitat, and to create firebreaks to limit the potential for catastrophic fire.

Maintenance and adaptive management will be important to the long-term success of the revegetated areas. Ongoing removal of non-native stump sprouts and volunteers will be necessary in all planted areas. In firebreak areas, the vegetation will have to be mowed or "brush-hogged" (another mowing method that removes standing vegetation) periodically, in order to maintain the function as a firebreak and to keep out woody plants. The different planting strategies will be combined in order to create the target mosaic mixture of different ecosystem types (bosque forest, grass meadow, wet features).

Planting strategies to target a riparian gallery forest mosaic will include the following revegetation techniques:

1. Seeding with native grasses and forbs, such as Indian rice grass (*Oryzopsis hymenoides*), galleta grass (*Hilaria jamesii*), side oats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), sand dropseed (*Sporobolus cryptandrus*), and sunflower (*Helianthus annuus*) and in wetter areas, yerba mansa (*Anemopsis californicus*), emory sedge (*Carex emoryi*), and salt grass (*Distichlis stricta*). Seeding involves sowing seed via methods such as broadcasting, crimp and drill or hydro-mulching. Other than the gel in the hydro mulch, no irrigation would be applied. Timing of seeding will be critical to the establishment of the vegetative cover, and is planned for late summer (after August 15). Wood debris, such as large logs that remain after thinning, will be placed strategically to provide additional habitat once seeding is completed. Seeding will be applied wherever restoration occurs. In firebreak areas, seeding is the only revegetation strategy proposed.

2. Bare root or container planting with native shrubs, such as New Mexico olive (*Forestiera neomexicana*), four wing saltbush (*Atriplex canescens*), chamisa (*Chrysothamnus nauseosus*), false indigo (*Amorpha fruticosa*), golden currant (*Ribes aureum*), three leaf sumac (*Rhus trilobata*), wolfberry (*Lycium pallidum*), and in wetter areas, coyote willow (*Salix exigua*), black willow (*Salix nigra* var. *gooddingii*), and seep willow (*Baccharis salicifolia*) is an important strategy for establishing woody plants. Bare root planting refers to planting a plant directly in the ground without a rootball. Most of the native shrubs listed above are grown in tall pots, which provide a longer and more established root system, and have been found to support excellent seedling survival (U.S. Department of Agriculture, 2001). Container planting refers to planting small plants in small containers. A watering tube will be placed alongside the shrub plant material and will be watered through the first summer. Water is usually obtained from the riverside drain in coordination with the project sponsor, MRGCD. Coyote willows can be planted directly in wet areas as live sticks. Shrubs will be planted at various densities depending on what is currently at the location. If no native understory vegetation exists at a location, then shrub planting density will be higher (500 stems per acre or more). If there is existing native vegetation, then a lower density of native shrubs will be installed (100-500 stems per acre as needed). Shrubs will be planted in the fall and trees will be planted in the winter.

3. Plug planting will be used to plant wetland and other moist soil plants within created water features. Species that could be provided as plugs include yerba mansa (*Anemopsis californicus*), native sedge (*Carex spp.*), native rush (*Scirpus spp.*), and saltgrass (*Distichlis stricta*). Plug planting refers to insertion of small seedlings with the soil or growth medium attached. Plugs are planted directly into moist soils on the edge of water features (wetlands, high-flow channels, etc.).

4. Pole planting of native trees, such as the Rio Grande cottonwood (*Populus fremontii var. wislizenii*), black willow (*Salix nigra var. gooddingii*) and peach leaf willow (*Salix amygdaloides*). Pole planting is the technique most frequently used for restoration of riparian areas. Many of the pilot projects in the bosque have utilized pole planting, and according to OSD, they have a 90 percent success rate (U.S. Army Corps of Engineers 2004). Branches

of cottonwoods and willows, 10 feet to 15 feet in length, are slipped into holes that have been augered through the soil to the water table. Little maintenance is required beyond taking precautions to protect the young trees from beavers. Trees will be planted at a fairly low density since cottonwoods exist throughout the action area. They will be supplemented in some areas as needed but at a very low density (10-50 stem per acre). Willow trees are lacking in some areas of the action area and will be planted at a higher density in those areas (25-75 stems per acre). Planting strategies will not include planting larger plants, such as balled and burlapped or container trees, because they would not be successful in the without significant irrigation.

Water Features: bankline terracing, ephemeral high flow and backwater channels, scallops, willow swales and wetland restoration

The purpose of the water-related features is to attempt to mimic natural periods of inundation in specific areas under certain conditions. This would create a hospitable environment for propagation of native vegetation and produce wetted areas that would increase the diversity of habitat types. The proposed action includes implementation of the following water features:

BanklineTerracing
The proposed action includes a total of approximately 70 acres of bank terracing. Bank terracing or bank lowering involves the removal of vegetation and excavation of soils adjacent to the main channel to enhance the potential for overbank flooding. This technique has been utilized in various locations of the MRG, mostly for creation of potential habitat for the silvery minnow by the Middle Rio Grande Endangered Species Collaborative Program. Bank terracing provides opportunities for increasing connectivity with the river during spring runoff and monsoons. As the banks are destabilized, it creates a greater connection with the river. As the river moves through these areas, it both scours and creates moist soil for vegetation. In many cases, coyote willow will fill in these areas creating riparian shrub habitat that provides habitat for birds, small mammals and herpetofauna. Bank terracing has the potential to restore this habitat, facilitate overbank flows and provide sediment for the natural geomorphic system.

Ephemeral High Flow Channels and Backwaters
Approximately 70 acres of high flow channels and backwater channels will be constructed with implementation of the proposed action. Under historic flood flow regimes, high-flow channels were once an integral part of the river form and function. Evidence of former (or abandoned) channels is present in many locations within the action area. The objective of this feature is to re-establish the connections between the river and the bosque by creating a situation in which side channels would become inundated and flowing at flows between 2,500 – 3,500 cfs. Water at lower flows (500 – 2,000 cfs) will begin to inundate the features. Actions necessary for this feature typically include dredging the sediment out of the upstream and downstream portions of the remnant high-flow channels in order to re-establish the bosque-river connection, clearing out debris and non-native plants and revegetating with native plants to increase the habitat quality within the bosque. High-flow channels will deliver much-needed water to bosque vegetation and

increase potential water-based habitats for animals. Scallops and backwater channels will be constructed as part of or within the high-flow channels when possible.

For the construction of bankline terracing, high flow channels and/or backwaters, an earthen dam (the last 1-3 feet of the bank) are left in place during construction. No material extends into the river. This last piece of bank is removed last in order to limit inputs of sediment as well as other potential impacts to silvery minnow. The area of disturbance in wetted habitat that may be occupied by silvery minnow is limited to the inlet and outlet of each high flow channel. Each of those areas is approximately 10 by 150 ft in dimension; thus, construction disturbance associated with each high flow channel is approximately 3,000 ft^2 or (0.07 acre). This is further described below under Project Implementation.

Willow Swales

Approximately 55 acres of willow swales will be created with implementation of the proposed action. The willow swale feature entails optimizing the depressions created by removal of non-native vegetation, dumped debris and jetty jacks to provide microenvironments in which native plants can thrive due to the decreased distance to the water table and moist soils. A series of depressions, approximately a half acre in size, will be created within a 5 to 10 acre area. The number of depressions within each swale would be determined by site-specific conditions. In certain areas of the bosque, the depth-to-water table is minimal and even slight excavations expose water. Willow swales also help create vegetative habitat where establishment of native plants or seed would be challenging due to soil type or depth to groundwater. Depending upon the location, there could be a series of willow swales that become progressively drier with increasing distance from the river or water table. Once established, native plants would thrive in these depressions. About 1/2 of the acreage of swales to be constructed has the potential to inundate with water from the main channel. The willow swale feature will create both wet meadow and shrub habitat.

Wetland Restoration

Wetland restoration will be implemented in various forms of habitat totaling approximately 38 acres of total wetlands. Wetland restoration will focus on development of open water wetlands, wetlands utilizing storm drain outfall areas, marsh wetlands, or wet meadows. An open water wetland planned for the San Antonio Oxbow site would be similar to that constructed at the Albuquerque Biological Park Wetland. Such wetlands provide open water habitat for migrating and local waterfowl and aquatic habitat for numerous species.

Wetland habitat utilizing and restructuring drainage outfalls will be constructed/enhanced in areas where storm water outfalls exist but currently do not create or utilize the potential to create habitat. Some simple modifications to existing outfalls will provide several benefits. The design will focus on connecting the outfall through the bosque to the river, providing wetland and/or moist soil habitat along the way. Each area will be designed differently depending on the outfall size. This will create linear wetland habitat with vegetation along the sides that could create additional habitat for various songbirds, small mammals, amphibians, reptiles, and fish species.

A marsh wetland will have fluctuating water levels (usually 1-5 feet) and various vegetative species. These areas can be created by lowering the ground level and/or creating a connection with surface water flows.

Wet meadow habitat is similar to a marsh wetland, but has much shallower standing water, and is created by allowing flow from a deeper wetland area (such as an open water wetland) flow out into an existing dry area or by lowering an area to the shallow groundwater table. This creates marshy or moist soil habitat, usually only about 6 inches deep with water.

Only the wet meadow feature will potentially have a direct connection to occupied habitat of the silvery minnow.

Proposed Recreational Features

Recreational features included in the proposed action would result in a considerable enhancement of the recreation system in the action area. Recreational features that will be used include benches, picnic tables, kiosks, parking improvements, trail improvements, canoe launch improvements, a bridge, and signage. The current trail network is poorly configured; duplicate trail segments run throughout the project area. The use of informal trails in some places has caused deterioration of vegetation and disrupted wildlife habitat. Material to be used for trail improvements is stabilized crusher fine. Additional improvements such as benches, signs and wildlife observation blinds will greatly enhance this resource. Construction activities would temporarily impede recreational activities in the Proposed Action Area. All work zones would be designated and signed with cautionary information. The paved trail would be kept clean for use by park visitors as much as possible and all machinery and vehicles would yield to park users. The only recreational features that would involve disturbance in wetted areas are the two canoe ramps. Two small canoe ramps are proposed (one at the northwest corner of Alameda and the river, and one at the northeast corner of Central and the river). Each area will disturb approximately 20 feet wide by 150 feet long (0.07 acre) of vegetation/bank edge of the river.

Access and Staging

All sites are located between the levee and the active river channel. Access from the levee through the riparian forest to the river edge is available. A temporary access road off of the levee/paved trail will be constructed to access proposed construction areas where one does not exist. These temporary access roads would be removed and reseeded once construction is complete or left in place if so desired by OSD. Any additional disturbance caused by equipment accessing the site will be reseeded with native vegetation and mulched once complete. Access to all work areas will occur along the levee, and staging would occur in adjacent open areas made available by the sponsor, MRGCD. Equipment will access proposed construction areas from the nearest river crossing. Staging will also take place within the bosque if other areas are not available. Additional access and subsidiary staging areas required to facilitate construction activities will be coordinated with local land managers.

Excess soil generated by the construction of these features will be made available to local management agencies (MRGCD, Reclamation and OSD) for their use. Material would be hauled to local areas for use, or stockpiled at their facilities for future use.

Monitoring, Adaptive Management and Maintenance

Due to the relatively recent emergence of restoration science and inherent uncertainty in some aspects of ecosystem restoration theory, planning and methods, success can vary based on a variety of technical and site-specific factors. Recognizing this uncertainty, it is prudent to allow for contingencies to address potential problems in meeting restoration goals that may arise during or after project implementation. Recent Corps' guidance (U.S. Army Corps of Engineers, 2009b) requires that a plan be developed for monitoring the success of the ecosystem restoration. This monitoring plan shall include "1) a description of the monitoring activities to be carried out, the criteria for ecosystem restoration, and the estimated costs and duration of the monitoring; and 2) specify that the monitoring shall continue until such time as the Secretary determines that the criteria for ecosystem restoration success will be met." The Corps has developed a Monitoring and Adaptive Management Plan for the proposed action (Corps of Engineers, 2011) which includes details on what parameters will be measured, sampling design, performance standards, adaptive management expectations, and estimated costs.

Post-project monitoring is a crucial requisite of the adaptive management process, as performance feedback may generate new insights on ecosystem response and provides a basis for determining the necessity or feasibility of subsequent design or operational modifications. Success should be measured by comparing post-project conditions to the restoration project purpose and needs and to pre-project conditions. Monitoring also provides the feedback needed to establish protocols and make adjustments where and when necessary to achieve the desired results. Monitoring of the Corps' Bosque Wildfire and Albuquerque Biological Park Wetlands projects has provided information that has been useful in developing goals and alternatives for this project. Monitoring from those projects will also aid in design. Monitoring of this project will be essential to the success of not only the MRG Bosque Restoration Project, but other Corps' studies as well.

Monitoring of project performance and success will be conducted for at least five consecutive years following construction. Wetland and bosque monitoring would include vegetation mortality, wildlife and vegetation species, groundwater and other environmental indicators. Monitoring of the project would include ongoing monitoring through the continuing Bosque Environmental Project Monitoring Program (BEMP) which has a number of existing sites within the project area. The BEMP program provides monthly monitoring of ground water as well as quarterly monitoring of arthropods. Avian monitoring is currently being conducted by Hawks Aloft providing input on use by raptors as well as songbirds. Comparison of use by wildlife before, during and after project implementation utilizing 'indicator species' has also occurred within the project area (Daniel B. Stephens & Associates, 2008). These monitoring activities have been conducted under the Bosque Wildfire Project, and have provided input toward planning the proposed action. These efforts will continue post-construction to show project benefits and changes in use before and after construction. Feature specific studies such as wildlife use by water features and other project features, will also be conducted.

Part of this monitoring may provide information on design that may require changes. Depending on how the project features function (i.e.: high flows move through the channel and potential for maintenance items such as scouring and/or build up of sediment could occur), adaptive management would be enlisted to make changes in the field if it is determined to be needed once the proposed action features are in use.

In addition, the Corps will conduct monitoring for potential entrapment post-construction at the high flow channels and backwaters created and any other restored features that may form isolated pools as flows recede. After two years, it may be determined in coordination with the Service that further monitoring is unnecessary. A thorough visual examination for the sites will be conducted to look for the presence of silvery minnows. This includes isolated pools of any depth where potential entrapment may have occurred. The following protocol will be used:

1. Monitoring for silvery minnow entrapment in restored features will occur following peak/secondary runoff, and after large rainfall/monsoons and any other high flow events that could introduce water into an area and then result in isolated pool(s) as water recedes.

2. Monitoring at restored features will start when discharge on the descending limb of the hydrograph approaches 0-500 cfs, or 10% of a site-specific target inundation.

3. When monitoring is started once flows are receding, monitoring at restored features will be done a minimum of twice weekly. Best judgment will be used to determine the appropriate frequency above this minimum, as well as the appropriate time of day to conduct monitoring based on conditions at the restored feature.

4. Monitoring will be conducted until such time as (a) the site is dry, (b) all silvery minnows are removed from the isolated pool, or (c) flows increase such that the isolated pool becomes reconnected to the main channel.

5. If isolated pools occur at restored features that may contain silvery minnows, a permitted fisheries biologist will lead the effort to seine (or if seining is not feasible, then other net gear may be substituted) these pools and determine (a) the presence or absence of silvery minnows, and (b) the potential number present. Fish monitoring will only be conducted in these isolated pools, and not in areas that have the potential to become isolated but are not yet disconnected from the river. Silvery minnows collected from isolated pools will then be released nearby into continuous parts of the river.

6. Species identification, standard length, reproductive condition, and health condition of fish; and pool depth, dimensions and water quality information will be recorded to the extent possible. Health information includes whether fish exhibit signs of compromised health due to disease (e.g., fungus, *Lernia*, hemorrhagic lesions), anemia (i.e., emaciation), or physical deformity. Species counts will be maintained for all collections

separately for each pool. A handheld global positioning system (GPS) unit with sub-meter accuracy will be used to record pool locations. Any dead silvery minnows will be preserved and transferred to the Museum of Southwestern Biology.

7. The findings of this monitoring program for the Corps MRG Bosque Restoration project will be reported to the Service once per year in December, including all accounts of silvery minnows found in isolated pools (whether dead or alive) and their condition.
8. If silvery minnow take is met or exceeded (based on Corps MRG Bosque Restoration Project Incidental Take Statement) in these isolated pools at the restored features, the Service will be contacted before continuing with further silvery minnow monitoring activities.

Maintenance work may be needed for ephemeral high flow channels or backwaters and would be conducted during the work window between August 15 and April 15. Any maintenance work required would be conducted in the dry when the channels are not connected to the main channel. Maintenance of vegetation treatments is anticipated to meet project objectives, monitoring and adaptive management goals.

Project Implementation Timing and Sequencing

Due to the scope of the project and anticipated availability of funding, it is estimated that implementation of the proposed action would take place over a period of three to five years. The first phase is scheduled to begin September 2011. The proposed action would be phased to make the most efficient use of available funds, and to phase tasks that require sequential implementation. Whereas bank terracing and high-flow channel building at any one site can be accomplished in a relatively short time (a few months), for example, this activity would only take place at one or two areas at a time to minimize impacts to water quality. Removal of non-native species and revegetation with natives is, generally, a multiple year effort. Once initial removal takes place, follow-up treatment is required 6 months to a year later to eliminate trees that resprout from roots or stumps. Planting of native species is not prudent until such follow-up treatments have been performed. In some areas, removal of non-native species, or jetty jacks, would also be required to allow access to construct other features.

All work will be scheduled during the typical low flow seasons on the MRG and would avoid the period between April 15 and August 15. Non-native plant removal would take place first, followed by construction of water features. Recreation features would come last. Water features would be constructed within the bosque, and only later connected to the river to reduce sediment inputs into the river and potential disturbance of silvery minnow. Water features are connected to the river during the lowest flow possible.

Sequencing the construction of high flow channels and/or bank terracing) is proposed to reduce the amount of potential sediment moving into the river and reduce impacts at the river bank edge. The high flow channels will be constructed so that the opening at the downstream end would be excavated first and the opening at the upstream end would be excavated last (similar to the Rio Grande Nature Center and Route 66 projects – U.S. Army Corps of Engineers 2006, 2008). The area of disturbance to wetted habitat is limited to approximately 1,500 ft^2 at each end of a constructed channel. Flows in the river during construction of these high flow channels are anticipated to be about 300-400 cfs. If flows are low enough, the contractor will leave the edge of the berm (the bank of the river) for each end of the ephemeral channel in place during construction until opening the channel at the very end. The berm serves as a 'dam' to avoid impacts to the river and/or silvery minnow. Therefore, a coffer dam or silt curtain is not usually needed. If one is needed, the silt curtain or coffer dam would be placed along the bank line and then pushed out into the channel to expand the bankline approximately 20 feet under the supervision of Corps' biologists, in order to minimize disturbance to the flows. The placement of cofferdams or silt fences will exclude silvery minnow, and repeated disturbance of silvery minnow at a construction site is not anticipated. If silt fences are deployed, a downstream opening will be allowed for silvery minnow escapement as sediment placement begins in the upstream portion. In all cases to date, leaving the bank edge in place for the construction of high flow channels has worked and no silt fencing or cofferdams were required.

For construction of bankline terracing, the bank edge would be removed one shelf at a time with equipment placed further back on the bank edge (ie: the fork from a track excavator would reach over and pull sediment from the bank edge). This would be done by pulling the dirt back in to the bosque in order to avoid dumping sediment into the river. The terracing would be done during very low flows in order to have limited impact to the river. Construction is expected to disturb some wetted habitat - approximately ¼ of the total treatment area.

Conservation Measures
Measures will be implemented during the proposed action to help minimize or avoid adverse effects of the restoration projects and to successfully and safely implement all habitat restoration activities. These include the following:

Construction Timing and Sequencing

- Proposed activities will not take place during April 15 – August 15 of each year.
- Sequencing the construction of high flow channels and/or bank terracing) is proposed to reduce the amount of potential sediment moving into the river and reduce impacts to the river bank edge. The high flow channels will be constructed so that the opening at the downstream end would be excavated first and the opening at the upstream end would be excavated last. The bankline terracing will be constructed by removing the bank edge one shelf at a time by pulling the material back, away from the water interface.

Equipment and Operations

- Wherever possible, equipment will operate on the riverbanks or otherwise in the dry to avoid contact with silvery minnow habitat.
- All equipment will be steam-cleaned before arriving and departing the job site.
- To avoid any potential impacts to listed species or their habitat, all fuels, hydraulic fluids, and other hazardous materials will be stored outside the normal floodplain and refueling will

take place on dry ground with a spill kit ready. Extra precautions will be taken when refueling because of the environmentally sensitive location.

- A spill kit will be maintained on every rig in the river, with spill pans, containment diapers, oil booms, absorbent pads, oil mats, plastic bags, gloves, and goggles.
- An environmental specialist trained in spill prevention and spill cleanup will be on site during all construction activities.
- Steel-mesh guards will cover all external hydraulic lines
- Silt fencing will be installed adjacent to the riverbank to prevent erosion to the river.
- Equipment operation will minimize sediment displacement by river flow.
- Prior to leaving contractor facilities, all equipment will be thoroughly inspected, and any leaky or damaged hydraulic hoses will be replaced.
- Maintenance of high flow channels or backwaters will be conducted in the dry.
- The "berm" (existing river bank), or, if necessary, cofferdams and/or silt curtains or other suitable erosion control measures will be used during construction of bank line features (high flow channel inlets and outlets, bank terracing).
- Storage and dispensing fuels, lubricants, hydraulic fluids, and other petrochemicals outside the 100-year floodplain. Inspect construction equipment daily for petrochemical leaks. Contain and remove any petrochemical spills and dispose of these materials at an approved upland site. Park construction equipment outside the 100-year floodplain during periods of inactivity.
- Ensure equipment operators carry an oil spill kit or spill blanket at all times and are knowledgeable in the use of spill containment equipment. Develop a spill contingency plan prior to initiation of construction. Immediately notify the proper Federal and state authorities in the event of a spill.
- Mature cottonwood trees will be protected from damage during clearing of non-native species or other construction activities using fencing, or other appropriate materials.
- Local genetic stock will be used wherever possible in the native plant species establishment throughout the riparian area.
- A Corps' biologist will monitor the project during construction at the bank of the river in order to detect any potential silvery minnow in the area. Findings of injured or dead silvery minnows will immediately be reported to the Service.
- All features regardless of location will be sloped toward the main river channel to minimize the potential for entrapment of silvery minnows as flows recede.
- High flow channels, backwater channels, willow swales, scallops and any other restoration features that have the potential to strand silvery minnow as flows recede will be monitored following established protocol.
- Surveys will be conducted for the presence/absence of Flycatchers during their breeding season throughout the project area immediately prior to construction. If such surveys indicate breeding season occupation, then ESA Section 7 consultation would be reinitiated and a no work buffer zone of ¼ mile would immediately be established.

Staging and Access

- All work and staging areas should be limited to the minimum amount of area required.

Existing roads and right-of-ways and staging areas should be used to the greatest extent practicable to transport equipment and construction materials to the project site, and described in the USACE's project description. Provide designated areas for vehicle turn around and maneuvering to protect riparian areas from unnecessary damage.

Permitting

- Clean Water Act (CWA) 404 and 401 permitting processes will be completed prior to commencement of the proposed action.
- Stormwater Pollution Prevention Plan (SWPPP) for construction sites will be adhered to.

Herbicide Treatments

- Herbicides will not be applied when winds exceed 15 miles per hour or when rain is forecasted for the local area within 48 hours of application. Herbicides will be applied no later than two months before the normal spring runoff and high water tables, or by March 15th. Garlon-4 will be used, but not within a 20-ft buffer zone from areas where standing or flowing water is present; Renovate 3® (triclopyr) will be applied as needed within the 20-ft buffer zone.
- All required permitting and licensure would be obtained by the contractor. Prior to application, all chemicals would be specifically approved per manufacturer's instructions.
- Herbicide label requirements will be followed. Mixing and application of these herbicides would be done so in accordance with all manufacturer instructions and proper personal protective equipment would be worn. Storage and mixing would also be performed following manufacturer's instructions. Storage would not be allowed on site within the bosque.
- Follow-up inspections and monitoring post-herbicide application would be performed at all locations. All excess herbicide would be disposed of off-site.

Water Quality Monitoring

- During in-river work, water-quality testing will be conducted prior to entering the water and periodically during the operating day to ensure that standards are being maintained. Water quality measurements will be taken before, during and after construction activity. Water-quality parameters to be tested include pH, temperature, DO, and turbidity, both upstream and downstream of the work area.

Action Area

The action area includes all areas to be affected directly or indirectly by the proposed action (see 50 CFR §402.02). The proposed action will occur in the Angostura reach of the Rio Grande between the levees extending approximately 26.4 miles from the north side of the Village of Corrales in Sandoval County downstream to the northern boundary of the Pueblo of Isleta in Bernalillo County. For this consultation, the action area is defined as the entire width of the 100-year floodplain of the Rio Grande from RM 198.4 to RM 172.

II. STATUS OF THE SPECIES

The proposed action considered in this biological opinion may affect the Rio Grande silvery minnow (*Hybognathus amarus*) which is provided protection as an endangered species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*; ESA). A description of this species, its status, and its habitat is provided below and informs the effects analysis for this biological opinion.

RIO GRANDE SILVERY MINNOW

Description

The silvery minnow currently occupies a 170-mile (275-kilometer) reach of the Middle Rio Grande, New Mexico, from Cochiti Dam in Sandoval County, to the headwaters of Elephant Butte Reservoir in Socorro County (U.S. Fish and Wildlife Service 1994). The silvery minnow was also introduced into the Rio Grande near Big Bend, Texas, in December 2008 as an experimental, non-essential population under section 10(j) of the ESA. The silvery minnow is a stout minnow, with moderately small eyes, a small, sub-terminal mouth, and a pointed snout that projects beyond the upper lip (Sublette *et al.* 1990). The back and upper sides of the silvery minnow are silvery to olive, the broad mid-dorsal stripe is greenish, and the lower sides and abdomen are silver. Maximum length attained is about 3.5 inches (90 millimeters). The only readily apparent sexual dimorphism is the expanded body cavity of ripe females during spawning (Bestgen and Propst 1994).

In the past, the silvery minnow was included with other species in the genus *Hybognathus* due to morphological similarities. Phenetic and phylogenetic analyses corroborate the hypothesis that it is a valid taxon, distinct from other species of *Hybognathus* (Cook *et al.* 1992, Bestgen and Propst 1994). It is now recognized as one of seven species in the genus *Hybognathus* in the United States and was formerly one of the most widespread and abundant minnow species in the Rio Grande basin of New Mexico, Texas, and Mexico (Pflieger 1980, Bestgen and Platania 1991). Currently, *Hybognathus amarus* is the only remaining endemic pelagic spawning minnow in the Middle Rio Grande. The speckled chub (*Extrarius aestivalus*), Rio Grande shiner (*Notropis jemezanus*), phantom shiner (*Notropis orca*), and bluntnose shiner (*Notropis simus simus*) are either extinct or have been extirpated from the Middle Rio Grande (Bestgen and Platania 1991).

<u>Legal Status</u>

The silvery minnow was federally listed as endangered under the ESA on July 20, 1994 (58 FR 36988; see U.S. Fish and Wildlife Service 1994). The species is also listed as an endangered species by the State of New Mexico. Primary reasons for listing the silvery minnow are described below in the *Reasons for Listing/Threats to Survival* section. The Service designated critical habitat for the silvery minnow on February 19, 2003 (68 FR 8088). See description of designated critical habitat below.

Habitat

The silvery minnow travels in schools and tolerates a wide range of habitats (Sublette *et al.* 1990), yet generally prefers low velocity (< 0.33 $ft{\cdot}s^{-1}$ or 10 $cm{\cdot}s^{-1}$) areas over silt or sand substrate that are associated with shallow (< 15.8 in, 40 cm) braided runs, backwaters, or pools (Dudley and Platania 1997). Habitat for the silvery minnow includes stream margins, side channels, and off-channel pools where water velocities are low or reduced from main-channel velocities. Stream reaches dominated by straight, narrow, incised channels with rapid flows are not typically occupied by the silvery minnow (Sublette *et al.* 1990, Bestgen and Platania 1991).

Adult silvery minnows are most commonly found in backwaters, pools, and habitats associated with debris piles; whereas, young of year (YOY) fish occupy shallow, low velocity backwaters with silt substrates (Dudley and Platania 1997). A study conducted between 1994 and 1996 characterized habitat availability and use at two sites in the Middle Rio Grande – one at Rio Rancho and the other at Socorro. From this study, Dudley and Platania (1997) reported that the silvery minnow was most commonly found in habitats with depths less than 19.7 in (50 cm). Over 85 percent were collected from low-velocity habitats (<0.33 $ft{\cdot}s^{-1}$ or 10 $cm{\cdot}s^{-1}$) (Dudley and Platania 1997, Watts *et al.* 2002).

Designated Critical Habitat

The action area for this consultation occurs primarily on land designated as critical habitat for silvery minnow (16 of the 18 proposed restoration sites); however, two of the proposed restoration sites (1B and 1D) do not occur within designated critical habitat because they are located on Pueblo of Sandia lands. The Service designated critical habitat for the silvery minnow on February 19, 2003 (68 FR 8088; see U.S. Fish and Wildlife Service 2003b). The critical habitat designation extends approximately 157 mi (252 km) from Cochiti Dam in Sandoval County, New Mexico, downstream to the utility line crossing the Rio Grande, which is a permanent identified landmark in Socorro County, New Mexico. In addition to the Pueblo of Sandia, the Pueblo lands of Santo Domingo, Santa Ana, and Isleta within this area are also not included in the critical habitat designation. Except for these Pueblo lands, the remaining portion of the silvery minnow's occupied range in the Middle Rio Grande in New Mexico is designated as critical habitat.

The critical habitat designation defines the lateral extent (width) as those areas bounded by existing levees or, in areas without levees, 300 ft (91.4 m) of riparian zone adjacent to each side of the bankfull stage of the Middle Rio Grande. Some developed lands within the 300-ft lateral extent are not considered critical habitat because they do not contain the primary constituent elements of critical habitat and are not essential to the conservation of the silvery minnow. Lands located within the lateral boundaries of the critical habitat designation, but not considered critical habitat include: developed flood control facilities, existing paved roads, bridges, parking lots, dikes, levees, diversion structures, railroad tracks, railroad trestles, water diversion and irrigation canals outside of natural stream channels, the Low Flow Conveyance Channel, active gravel pits, cultivated agricultural land, and residential, commercial, and industrial developments.

The Service determined the primary constituent elements (PCEs) of silvery minnow critical habitat based on studies on silvery minnow habitat and population biology. These PCEs include:

1. A hydrologic regime that provides sufficient flowing water with low to moderate currents capable of forming and maintaining a diversity of aquatic habitats, such as, but not limited to the following: backwaters (a body of water connected to the main channel, but with no appreciable flow), shallow side channels, pools (that portion of the river that is deep with relatively little velocity compared to the rest of the channel), and runs (flowing water in the river channel without obstructions) of varying depth and velocity – all of which are necessary for each of the particular silvery minnow life history stages in appropriate seasons (e.g., the silvery minnow requires habitat with sufficient flows from early spring (March) to early summer (June) to trigger spawning, flows in the summer (June) and fall (October) that do not increase prolonged periods of low- or no flow, and relatively constant winter flow (November through February);

2. The presence of eddies created by debris piles, pools, or backwaters, or other refuge habitat within unimpounded stretches of flowing water of sufficient length (i.e., river miles) that provide a variation of habitats with a wide range of depth and velocities;

3. Substrates of predominantly sand or silt; and

4. Water of sufficient quality to maintain natural, daily, and seasonally variable water temperatures in the approximate range of greater than 1°C (35°F) and less than 30°C (85°F) and reduce degraded conditions (e.g., decreased DO, increased pH).

These PCEs provide for the physiological, behavioral, and ecological requirements essential to the conservation of the silvery minnow.

Life History

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event (Platania 1995, Platania and Altenbach 1998). The majority of adults in the wild spawn in about a one-month period in late spring to early summer (May to June) in association with spring runoff. Platania and Dudley (2000, 2001) found that the highest collections of silvery minnow eggs occurred in mid- to late May. In 1997, Smith (1999) collected the highest number of eggs in mid-May, with lower frequency of eggs being collected in late May and June. These data suggest multiple silvery minnow spawning events during the spring and summer, perhaps concurrent with flow spikes. Artificial spikes have apparently induced silvery minnows to spawn (Platania and Hoagstrom 1996). In captivity, silvery minnow have been induced to spawn as many as four times in a year (C. Altenbach, City of Albuquerque, *pers. comm.* 2000); however, it is unknown if individual silvery minnow spawn more than once per year in the wild or if multiple spawning events suggested during spring and summer represent the same or different individuals.

The spawning strategy of releasing semi-buoyant eggs can result in the downstream displacement of eggs, especially in years or locations where overbank opportunities are limited. The presence of diversion dams (Angostura, Isleta, and San Acacia Diversion Dams) prevents the recolonization of upstream habitats (Platania 1995) and has affected the species' effective population size (N_e) which is at critically low levels (Alò and Turner 2005, Osborne *et al.* 2005). Adults, eggs and larvae may also be transported downstream to Elephant Butte Reservoir. It is believed that none of these fish survive because of poor habitat and predation from reservoir fishes (U.S. Fish and Wildlife Service 2010).

Platania (2000) found that development and hatching of eggs are correlated with water temperature. Eggs of the silvery minnow raised in 30°C water hatched in approximately 24 hours while eggs reared in 20-24°C water hatched within 50 hours. Eggs were 0.06 inches in size upon fertilization, but quickly swelled to 0.12 in. Recently hatched larval fish are about 0.15 inches in standard length and grow about 0.005 inches per day during the larval stages. Eggs and larvae have been estimated to remain in the drift for three to five days, and could be transported from 134 to 223 miles downstream depending on river flows and availability of nursery habitat (Platania 2000). Approximately three days after hatching the larvae move to low velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce. YOY attain lengths of 39-41 mm (1.53-1.61 in) by late autumn (U.S. Fish and Wildlife Service 2010). Age-1 fish are 1.8 to 1.9 in by the start of the spawning season. Most growth occurs between June (post spawning) and October, but there is some growth in the winter months. In the wild, maximum longevity is about 30 months for wild fish inferred from length-frequency, but up to 36 months for hatchery-released fish (U.S. Fish and Wildlife Service 2010). Based on estimated length groups for assigning an age class, it is possible that some individuals in the wild survive to be Age-3 fish; however >95% of the population in any given year is estimated to comprise Age-0 and Age-1 fish (U.S. Fish and Wildlife Service 2010). In comparison to longevity in the wild, it is not uncommon for captive silvery minnows to live beyond two years, especially at lower water temperatures. The U.S. Geological Survey's (USGS) Columbia Environmental Research Center in Yankton, South Dakota, has several silvery minnows in captivity with a maximum age of 11 that range in size from 46 to 73 (± 8.1) mm SL (Buhl, pers. comm. *as cited in* U.S. Fish and Wildlife Service 2010).

The silvery minnow is herbivorous (feeding primarily on algae); this is indicated indirectly by the elongated and coiled gastrointestinal tract (Sublette *et al.* 1990). Additionally, detritus, including sand and silt, is filtered from the bottom (Sublette *et al.* 1990, U.S. Fish and Wildlife Service 1999). The presence of this sand and silt in the gut of wild-captured specimens suggests that epipsammic algae (algae growing on the surface of sand) is an important food (U.S. Fish and Wildlife Service 2010). Laboratory-reared Rio Grande silvery minnow have been directly observed grazing on algae in aquaria (Platania 1995 and Magana 2007 both *as cited in* U.S. Fish and Wildlife Service 2010).

Population Dynamics

Generally, a population of silvery minnows consists of only two age classes: YOY and Age 1 fish (U.S. Fish and Wildlife Service 2010). The majority of spawning silvery minnows are one year in age, with two year-old fish and older estimated to comprise less than five percent of the spawning population (U. S. Fish and Wildlife Service 2010). High silvery minnow mortality occurs during or subsequent to spawning, consequently very few adults are found in late summer. By December, in general the majority of surviving Rio Grande silvery minnow represents Age-0 fish – those that hatched the previous spring (Dudley and Platania 2007; Remshardt 2007, 2008 – all *as cited in* U.S. Fish and Wildlife Service 2010).

Platania (1995) found that a single female in captivity could broadcast 3,000 eggs in eight hours. Females produce 3 to 18 clutches of eggs in a 12-hour period. The mean number of eggs in a clutch is approximately 270 (Platania and Altenbach 1998). In captivity, silvery minnows have been induced to spawn as many as four times in a year (C. Altenbach, City of Albuquerque, *pers. comm.* 2000). It is not known if they spawn multiple times in the wild. The high reproductive potential of this fish appears to be one of the primary reasons that it has not been extirpated from the Middle Rio Grande. However, the short life span of the silvery minnow increases the population instability. When two below-average flow years occur consecutively, a short-lived species such as the silvery minnow can be impacted, if not completely eliminated from dry reaches of the river (U.S. Fish and Wildlife Service 1999, 2010).

Distribution and Abundance

Historically, the silvery minnow occurred in 2,465 mi (3,967 km) of rivers in New Mexico and Texas. The species was known to have occurred upstream to Española, New Mexico (upstream from Cochiti Lake); in the downstream portions of the Chama and Jemez Rivers; throughout the Middle and Lower Rio Grande to the Gulf of Mexico; and in the Pecos River from Sumner Reservoir downstream to the confluence with the Rio Grande (Sublette *et al.* 1990, Bestgen and Platania 1991). The current distribution of the silvery minnow is limited to the Rio Grande between Cochiti Dam and Elephant Butte Reservoir, which amounts to approximately seven percent of its historic range. In December 2008, silvery minnows were introduced into the Rio Grande near Big Bend, Texas as a nonessential, experimental population under section 10(j) of the ESA (73 FR 74357). Additional silvery minnows were stocked in this reached in 2009 and 2010. Monitoring is being conducted to determine the success of the reintroduction.

The construction of mainstem dams, such as Cochiti Dam and irrigation diversion dams have contributed to the decline of the silvery minnow. The construction of Cochiti Dam in particular affected the silvery minnow by reducing the magnitude and frequency of flooding events that help to create and maintain habitat for the species. In addition, the construction of Cochiti Dam has resulted in degradation of silvery minnow habitat within the Cochiti Reach. River outflow from Cochiti Dam is now generally clear, cool, and free of sediment. There is relatively little channel braiding, and areas with reduced velocity and sand or silt substrates are uncommon. Substrate immediately downstream of the dam is often armored cobble (rounded rock fragments generally 8 to 30 cm (3 to 12 in) in diameter). Further downstream the riverbed is gravel with some sand material. Ephemeral tributaries including Galisteo Creek and Tonque Arroyo introduce sediment to the lower sections of this reach, and some of this is transported downstream with higher flows (U.S. Fish and Wildlife Service 2001, 1999). The Rio Grande below Angostura Dam becomes a predominately sand bed river with low, sandy banks in the downstream portion of the reach. The construction of Cochiti Dam also created a barrier between silvery minnow populations (U.S. Fish and Wildlife Service 2010). As recently as 1978, the silvery minnow was collected upstream of Cochiti Lake; however surveys since 1983 suggest that the fish is now extirpated from that area (U.S. Fish and Wildlife Service 1999; Torres *et al.* 2008). Similarly, the another mainstem dam, Elephant Butte Dam, created a barrier between silvery minnow populations at a time when silvery minnow still occupied the Rio Grande to the Gulf of Mexico and contributed to its listing as endangered (U.S. Fish and Wildlife Service 1994). The last known collection of silvery minnow in the reach between Elephant Butte Dam and Presidio occurred in 1944.

Long-term monitoring for the Rio Grande silvery minnow and fish communities in the Middle Rio Grande began in 1993 and has continued annually, with the exception of 1998 and the majority of 2009. This includes monitoring at three sites, at River Mile 200 just upstream of the action area and within the action area at River Miles 183.4 and 178.3. The most recent data from these three sites indicate a density of 0.18 silvery minnows per 100 square meters within the action area in December of 2010 (Dudley and Platania 2011a). The long-term monitoring of silvery minnows has recorded substantial fluctuations (order of magnitude increases and decreases) in the population. Rio Grande silvery minnow catch rates declined two to three orders of magnitude between 1993 and 2003, but then increased three to four orders of magnitude by 2005 and continue to fluctuate (see Figure 2). Having declined again in 2010, silvery minnow catch rates are again lower than at the time of its listing as an endangered species in 1994. Population size is highly correlated with hydrologic conditions, particularly the magnitude and duration of the spring runoff (Dudley and Platania 2008b) and length of river channel that becomes intermittent (Dudley *et al*, 2009).

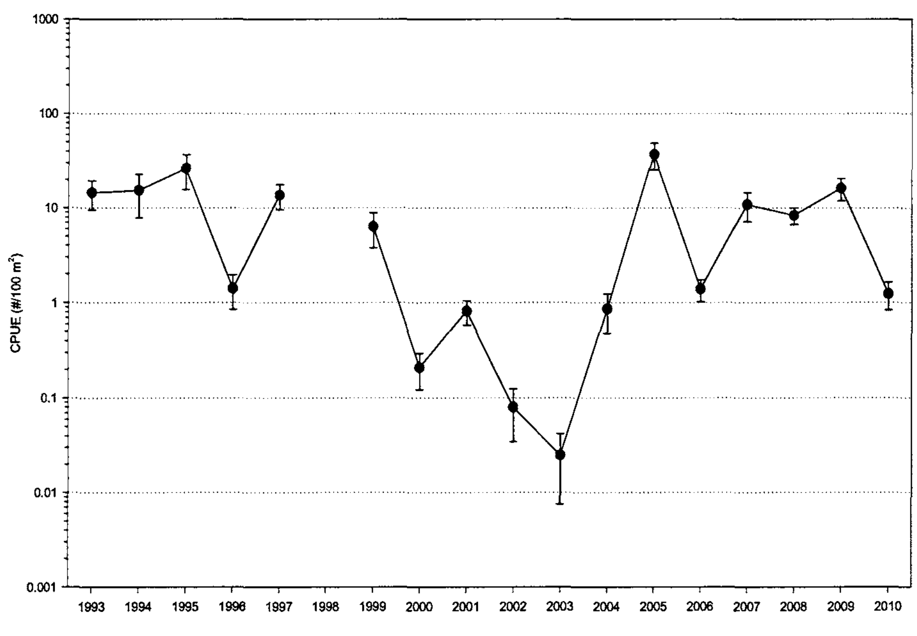

Figure 2. Rio Grande Silvery Minnow Population Trends 1993-2010 based on October CPUE data (American Southwest Ichthyological Researchers, LLC)

Augmentation has likely sustained the silvery minnow population throughout its range. Over 1.25 million silvery minnows have been released since 2002. Captively propagated and released fish supplement the native adult population, most likely prevented extinction during the extremely low water years of 2002 and 2003. Since 2001, the Angostura Reach has been the focus of augmentation efforts; however, beginning in 2008, augmentation shifted focus to the Isleta and San Acacia Reaches only (J. Remshardt, Service, *pers. comm.* 2010). To accurately determine the success of these efforts and the continued effects of these releases, a period of five years (2008-2012) without intensive stocking is being evaluated. If the overall catch rate for Angostura Reach drops to below 0.1 silvery minnows per 100 m^2 during October, then augmentation will be re-initiated for this reach the following year (Remshardt 2008).

In November 2010, the Isleta and San Acacia reaches, but not the Angostura reach, were augmented with silvery minnow. Silvery minnow surveys in December 2010 and February 2011 revealed the effect that augmentation has on maintaining the species. While catch rates in the Angostura reach declined compared to the October survey, catch rates in the Isleta and San Acacia reaches increased and many silvery minnow captured in the Isleta and San Acacia reaches were fish that had been hatchery raised and stocked – presence of the VIE tag (Dudley and Platania 2011a, 2011b).

<u>Middle Rio Grande Distribution Patterns</u>

During the early 1990s, the density of silvery minnows generally increased from upstream (Angostura Reach) to downstream (San Acacia Reach). During surveys in 1999, over 98 percent of the silvery minnow captured were downstream of San Acacia Diversion Dam (Dudley and Platania 2002). This distributional pattern can be attributed to downstream drift of eggs and larvae, limited availability of habitats to retain the early life stages, and the inability of adults to repopulate upstream reaches because of diversion dams.

For several years (2004, 2005, and 2007), this pattern changed. Catch rates were highest in the Angostura Reach and lower the Isleta and San Acacia Reaches. Routine augmentation of silvery minnows in the Angostura Reach (the focus of augmentation efforts starting in 2001) may partially explain this pattern. Transplanting of silvery minnows rescued from drying reaches (approximately 802,700 through 2009) has also occurred since 2003; however, it is not possible to quantify the effects of those efforts on silvery minnow distribution patterns (J. Remshardt, Service, *pers. comm.* 2010). Good recruitment conditions (i.e., high and sustained spring runoff) throughout the Middle Rio Grande during April and May followed by wide-scale drying in the Isleta and San Acacia reaches from June-September in these years, may also explain the shift. High spring runoff (>3,000 cfs for 7-10 days) and perennial flow lead to increased availability of nursery habitat and increased survivorship in the Angostura Reach. In contrast, south of Isleta and San Acacia Diversion Dams, large stretches of river (30+ miles) have been routinely dewatered and young silvery minnows in these areas were either subjected to poor recruitment conditions (i.e., lack of nursery habitats during low-flows) or were trapped in drying pools where they perished. In 2006, 2008, 2009 and 2010, densities of silvery minnows were again highest downstream of San Acacia. The Angostura reach has not been augmented with silvery minnow since 2007.

Distribution and Abundance in the Action Area

Long term monitoring for silvery minnows has been carried out at 5 sites within the Angostura reach which includes 3 sites that are within or near the action area. Until the Angostura reach was augmented with silvery minnow, the reach supported lower densities of silvery minnow than the lower reaches. After augmentation of the Angostura reach ceased in 2008, silvery minnow catch rates again declined to levels less than the catch rates in the Isleta and San Acacia reaches. In 2010, catch rates declined markedly between July and October and continued to decline in the Angostura reach. The action area extends from approximately River Mile 198.4 downstream to approx. River Mile 172. Fish monitoring occurs at sampling sites at River Miles 200, 183.4, and 178.3. The most recent CPUE data collected in December 2010 and February 2011 (Dudley and Platania 2011a, 2011b) from these three sampling locations averages 0.18 silvery minnow/100 m^2 and 0.13 silvery minnow/100 m^2, respectively. In October 2010, at the same sampling locations, the density of silvery minnow was 0.29 per 100 m^2 (Dudley and Platania 2010). Over the last 5 years (2006-2010), October catch rate data at the 3 sampling locations averaged 7.36 silvery minnows/100 m^2 (Dudley and Platania 2006, 2007, 2008a, 2009, 2010).

Reasons for Listing/Threats to Survival

The silvery minnow was federally listed as endangered for the following reasons:

1. Regulation of stream waters, which has led to severe flow reductions, often to the point of dewatering extended lengths of stream channel;

2. Alteration of the natural hydrograph, which impacts the species by disrupting the environmental cues the fish receives for a variety of life functions, including spawning;

3. Both the stream flow reductions and other alterations of the natural hydrograph throughout the year can severely impact habitat availability and quality, including the temporal availability of habitats;

4. Actions such as channelization, bank stabilization, levee construction, and dredging result in both direct and indirect impacts to the silvery minnow and its habitat by severely disrupting natural fluvial processes throughout the floodplain;

5. Construction of diversion dams fragment the habitat and prevent upstream migration;

6. Introduction of nonnative fishes that directly compete with, and can totally replace the silvery minnow, as was the case in the Pecos River, where the species was totally replaced in a time frame of 10 years by its congener the plains minnow (*Hybognathus placitus*); and

7. Discharge of contaminants into the stream system from industrial, municipal, and agricultural sources also impact the species (U.S. Fish and Wildlife Service 1993b, 1994).

These reasons for listing continue to threaten the species throughout its currently occupied range in the Middle Rio Grande.

Recovery Efforts

The final Recovery Plan for the silvery minnow was released in July 1999 (U.S. Fish and Wildlife Service 1999). The Recovery Plan was updated and revised, and a draft revised Recovery Plan (U.S. Fish and Wildlife Service 2007) was released for public comment on January 18, 2007 (72 FR 2301). Based on public comment and peer review comments on the 2007 draft Recovery Plan, the recovery criteria were revised and released for an additional period of public comment on April 9, 2009 (74 FR 16232). Incorporating public comments and peer review comments the Service received on the draft revision, the First Revision of the Rio Grande Silvery Minnow Recovery Plan was finalized and issued on February 22, 2010 (75 FR 7625). The revised Recovery Plan describes recovery goals for the Rio Grande silvery minnow and actions to complete these (U.S. Fish and Wildlife Service 2010). The three goals identified for the recovery and delisting of the Rio Grande silvery minnow are:

1. Prevent the extinction of the Rio Grande silvery minnow in the middle Rio Grande of New Mexico.

2. Recover the Rio Grande silvery minnow to an extent sufficient to change its status on the List of Endangered and Threatened Wildlife from endangered to threatened (downlisting).

3. Recover the Rio Grande silvery minnow to an extent sufficient to remove it from the List of Endangered and Threatened Wildlife (delisting).

Downlisting (Goal 2) of the Rio Grande silvery minnow may be considered when the criteria have been met resulting in three populations (including at least two that are self-sustaining) that have been established within the historical range of the species and have been maintained for at least five years.

Delisting (Goal 3) of the species may be considered when the criteria have been met resulting in three self-sustaining populations have been established within the historical range of the species and have been maintained for at least ten years (U.S. Fish and Wildlife Service 2010).

Conservation efforts targeting the Rio Grande silvery minnow are also summarized in the revised Recovery Plan. These efforts include habitat restoration activities; research and monitoring of the status of the silvery minnow, its habitat, and the associated fish community in the Middle Rio Grande; and programs to stabilize and enhance the species, such as tagging fish and egg monitoring studies, salvage operations, captive propagation, and augmentation efforts. In addition, specific water management actions in the Middle Rio Grande valley over the past several years have been used to meet river flow targets and March 2003 BO (U.S. Fish and Wildlife Service 2003a) requirements for silvery minnows.

III. ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the ESA, when considering the effects of the action on federally listed species, we are required to take into consideration the environmental baseline. Regulations implementing the ESA (50 FR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area; the anticipated impacts of all proposed Federal actions in the action area that have already undergone formal or early section 7 consultation; and the impact of State and private actions that are contemporaneous with the consultation in process. The environmental baseline defines the effects of these activities in the action area on the current status of the species and its habitat to provide a platform to assess the effects of the action now under consultation.
Several activities have contributed to the current status of the silvery minnow and its habitat in the action area, and are believed to potentially affect the survival and recovery of silvery minnows in the wild. These include the current weather patterns, changes to the natural hydrology of the Rio Grande, changes to the morphology of the channel and floodplain, water quality, storage of water and release of spike flows, captive propagation and augmentation, silvery minnow salvage and relocation, ongoing research, and past projects in the Middle Rio Grande.

Changes in Hydrology

There have been two primary changes in hydrology as a result of the construction of dams on the Rio Chama and Rio Grande that affect the silvery minnow: (1) loss of water in minnow habitat and (2) changes to the magnitude and duration of peak flows.

Loss of Water in Minnow Habitat

Prior to measurable human influence on the system, up to the fourteenth century, the Rio Grande was a perennially flowing, aggrading river with a shifting sand substrate (Biella and Chapman 1977). There is now strong evidence that the Middle Rio Grande first began drying up periodically after the development of Colorado's San Luis Valley in the mid to late 1800s (Scurlock 1998). After humans began exerting greater influence on the river, there are two documented occasions when the river became intermittent during prolonged, severe droughts in 1752 and 1861 (Scurlock 1998). The silvery minnow historically survived low-flow periods because such events were infrequent and of lesser magnitude than they are today. There were also no diversion dams to block repopulation of upstream areas, the fish had a much broader geographical distribution, and there were oxbow lakes, cienegas, and sloughs associated with the Rio Grande that supported fish until the river became connected again.

Water management and use has resulted in a large reduction of suitable habitat for the silvery minnow. Agriculture accounts for 90 percent of surface water consumption in the Middle Rio Grande (Bullard and Wells 1992). The average annual diversion of water in the Middle Rio Grande by the Middle Rio Grande Conservation District (MRGCD) was 535,280 af (65,839 hectare-meters) for the period from 1975 to 1989 (U.S. Bureau of Reclamation 1993). In 1990, total water withdrawal (groundwater and surface water) from the Rio Grande Basin in New Mexico was 1,830,628 af, significantly exceeding a sustainable rate (Schmandt 1993). Water withdrawals have not only reduced overall flow quantities, but also caused the river to become locally intermittent or dry for extended reaches. Irrigation diversions and drains significantly reduce water volumes in the river. However, the total water use (surface and groundwater) in the Middle Rio Grande by the MRGCD may range from 28 – 37 percent (S.S. Papadopulos & Associates, Inc. 2000; U.S. Geologic Survey 2002). A portion of the water diverted by the MRGCD returns to the river and may be re-diverted, sometimes more than once (Bullard and Wells 1992; Middle Rio Grande Conservancy District, *in litt.* 2003). Although the river below Isleta Diversion Dam may be drier than in the past, small inflows may contribute to maintaining flows. Since 2001, improvements to physical and operational components of the irrigation system have contributed to a reduction in the total diversion of water from the Middle Rio Grande by the MRGCD. Prior to 2001, average diversions were 630,000 afy and now average 370,000 afy. The change was possible because of the considerable efforts of MRGCD to install new gages, automated gates at diversions, and the scheduling and rotation of diversions among water users. The new operations reduce the amount of water diverted; however, this also reduces return flows that previously supported flow in the river. In February 2007, the City of Albuquerque and Albuquerque Bernalillo County Water Utility Authority with six conservation groups established a fund that will provide the opportunity to lease water from Rio Grande farmers and have that water remain in the river channel to support the silvery minnow. The Pilot Water Leasing Project supports the need for reliable sources of water to support conservation programs as identified by the Middle Rio Grande Endangered Species Collaborative Program (Middle Rio Grande Endangered Species Collaborative Program 2004).

River reaches particularly susceptible to drying occur immediately downstream of the Isleta Diversion Dam (river mile 169), a 5-mile (8-km) reach near Tome (river miles 150-155), a 5-mile (8-km) reach near the U.S. Highway 60 Bridge (river miles 127-132), and an extended 36-mile (58-km) reach from near Brown Arroyo (downstream of Socorro) to Elephant Butte Reservoir. Extensive fish kills, including tens of thousands of silvery minnows, have occurred in these lower reaches when the river has dried. It is assumed that mortalities during river intermittence are likely greater than documented levels, for example due to predation by birds in isolated pools (J. Smith, NMESFO, *pers. comm.* 2003). From 1996 to 2007, an average of 32 miles of the Rio Grande dried each year, mostly in the San Acacia Reach. The most extensive drying occurred in 2003 and 2004 when 60 and 68.7 miles, respectively, were dewatered. Most documented drying events lasted an average of two weeks before flows returned. In contrast, 2008 was considered a wet year, with above average runoff and at least an average monsoon season. As a result, there was no river intermittency and no minnow salvage that year, which is the first time there has been no river drying since at least 1996. In 2010, 28.2 miles of the river in the Isleta and San Acacia reaches experienced intermittency.

Changes to Magnitude and Duration of Peak Flow

Water management has also resulted in a loss of peak flows that historically triggered the initiation of silvery minnow spawning. The reproductive cycle of the silvery minnow is tied to the natural river hydrograph. A reduction in peak flows or altered timing of flows may inhibit reproduction. Since completion of Elephant Butte Dam in 1916, four additional dams have been constructed on the Middle Rio Grande, and two have been constructed on one of its major tributaries, the Rio Chama (Scurlock 1998). Construction and operation of these dams, which are either irrigation diversion dams (Angostura, Isleta, San Acacia) or flood control and water storage dams (Elephant Butte, Cochiti, Abiquiu, El Vado), have modified the natural flow of the river. Mainstem dams store spring runoff and summer inflow, which would normally cause flooding, and release this water back into the river channel over a prolonged period of time. These releases are often made during the winter months, when low-flows would normally occur. For example, release of carryover storage from Abiquiu Reservoir to Elephant Butte Reservoir during the winter of 1995-96 represented a substantial change in the flow regime. The Army Corps of Engineers (Corps) consulted with the Service on the release of water from November 1, 1995 to March 31, 1996, during which time 98,000 af (12,054 hectare-meters) of water was released at a rate of 325 cfs (9.8 cm). Such releases depart significantly from natural, historic winter flow rates, and can substantially alter the habitat for silvery minnows. In spring and summer, artificially low flows may limit the amount of habitat available to the species and may also limit dispersal of the species (U.S. Fish and Wildlife Service 1999).

In the spring of 2002 and 2003, an extended drought raised concerns that silvery minnows would not spawn because of a lack of spring runoff. River discharge was artificially elevated through short duration reservoir releases during May to induce silvery minnow spawning. In response to the releases, significant silvery minnow spawning occurred and was documented in all reaches except the Cochiti Reach (S. Gottlieb, UNM, *in litt.* 2002; Dudley *et al.* 2005). Fall populations in 2003 and 2004 continued to decrease despite large spawning events, indicating a lack of recruitment.

By contrast, spring runoff in 2005 was above average, leading to a peak of over 6,000 cfs at Albuquerque and sustained high flows (> 3,000 cfs) for more than two months. These flows improved conditions for both spawning and recruitment. October 2005 monitoring indicated a significant increase in silvery minnows in the Middle Rio Grande compared to 2003 and 2004. In 2006, however, October numbers declined again after an extremely low runoff period and channel drying in June and July (Dudley *et al.* 2006). October samples that year yielded no small silvery minnows, indicating poor recruitment in the spring. Runoff conditions in 2007, 2008, and 2009 were average or above average.

Mainstem dams and the altered flows they create can affect habitat by preventing overbank flooding, trapping nutrients, altering sediment transport regimes, reducing and dewatering main channel habitat, modifying or eliminating native riparian vegetation, and creating reservoirs that favor non-native fish species. These changes may affect the silvery minnow by reducing its food supply, altering its preferred habitat, preventing dispersal, and providing a continual supply of non-native fish that may compete with or prey upon silvery minnows. Altered flow regimes may also result in improved conditions for other native fish species that occupy the same habitat, causing those populations to expand at the expense of the silvery minnow (U.S. Fish and Wildlife Service 1999).

In addition to providing a cue for spawning, flood flows also maintain a channel morphology to which the silvery minnow is adapted. The changes in channel morphology that have occurred from the loss of flood flows are discussed below.

Changes in Channel and Floodplain Morphology

Historically, the Rio Grande was sinuous, braided, and freely migrated across the floodplain. Changes in natural flow regimes, narrowing and deepening of the channel, and restraints to channel migration (i.e., jetty jacks) adversely affected the silvery minnow. These effects result directly from constraints placed on channel capacity by structures built in the floodplain. These anthropogenic changes have and continue to degrade and eliminate spawning, nursery, feeding, resting, and refugia areas required for species' survival and recovery (U.S. Fish and Wildlife Service 1993).

The active river channel within occupied habitat is also being narrowed by the encroachment of vegetation, resulting from continued low flows and the lack of overbank flooding. The lack of flood flows has allowed non-native riparian vegetation such as salt cedar and Russian olive to encroach on the river channel (U.S. Bureau of Reclamation 2001). These non-native plants are very resistant to erosion, resulting in channel narrowing and a subsequent increase in water velocity. Higher velocities result in fine sediment such as silt and sand being carried away, leaving coarser bed materials such as gravel and cobble. Habitat studies during the winter of 1995 and 1996 (Dudley and Platania 1996), demonstrated that a wide, braided river channel with low velocities resulted in higher catch rates of silvery minnows, and narrower channels resulted in fewer fish captured. The availability of wide, shallow habitats that are important to the silvery minnow is decreasing. Narrow channels have few backwater habitats with low velocities that are important for silvery minnow fry and young-of-year.

Within the current range of the silvery minnow, human development and use of the floodplain have greatly restricted the width available to the active river channel. A comparison of river area between 1935 and 1989 shows a 52 percent reduction, from 26,598 acres (10,764 ha) to 13,901 acres (5,626 ha) (Crawford *et al.* 1993). These data refer to the Rio Grande from Cochiti Dam downstream to the "Narrows" in Elephant Butte Reservoir. Within the same stretch, 234.6 mi (378 km) of levees occur, including levees on both sides of the river. Analysis of aerial photography taken by Reclamation in February 1992, for the same river reach, shows that of the 180 mi (290 km) of river, only 1 mi (1.6 km), or 0.6 percent of the floodplain has remained undeveloped. Development in the floodplain, makes it difficult, if not impossible, to send large quantities of water downstream that would create low velocity side channels that the silvery minnow prefers. As a result, reduced releases have decreased available habitat for the silvery minnow and allowed encroachment of non-native species into the floodplain.

Water Quality

Many natural and anthropogenic factors affect water quality in the Middle Rio Grande, including the action area. Water quality in the Middle Rio Grande varies spatially and temporally throughout its course primarily due to inflows of groundwater, as well as surface water discharges and tributary delivery to the river. Factors that are known to cause poor fish habitat include temperature changes, sedimentation, runoff, erosion, organic loading, reduced oxygen content, pesticides, and an array of other toxic and hazardous substances. Both point source pollution (e.g., pollution discharges from a pipe) and non-point source pollution (i.e., diffuse sources) affect the Middle Rio Grande. Major point sources include waste water treatment plants (WWTPs) and feedlots. Major non-point sources include agricultural activities (e.g., fertilizer and pesticide application, livestock grazing), urban storm water run-off, and mining activities (Ellis *et al.* 1993).

Effluents from WWTPs contain contaminants that may affect the water quality of the river. It is anticipated that WWTP effluent may be the primary source of perennial flow during extended periods of intermittency in the lower portion of the Angostura Reach. For that reason, the water quality of the effluent is extremely important. Within or near the action area, the largest WWTP discharges are from Albuquerque, followed by two WWTPs in Rio Rancho, and Bernalillo (mean annual discharge flows are 80.4, 2.5, 0.9, and 0.7 cfs, respectively) (Bartolino and Cole 2002). Since 1998, total residual chlorine (chlorine) and ammonia, as nitrogen (ammonia), have been discharged unintentionally at concentrations that exceed protective levels for the silvery minnow. In addition to chlorine and ammonia, WWTP effluents may also include cyanide, chloroform, organophosphate pesticides, semi-volatile compounds, volatile compounds, heavy metals, and pharmaceuticals and their derivatives, which can pose a health risk to silvery minnows when discharged in concentrations that exceed the protective water quality criteria (J. Lusk, Service, *in litt.* 2003). Even if the concentration of a single element or compound is not harmful by itself, chemical mixtures may be more than additive in their toxicity to silvery minnows (Buhl 2002). The long-term effects and overall impacts of chemicals on the silvery minnow are not known.

Large precipitation events wash sediment and pollutants into the river from surrounding lands through storm drains and intermittent tributaries. Constituents of concern that are commonly found in stormwater include petroleum hydrocarbons (from oil spills, parking lot runoff, illicit dumping, roadways); the metals aluminum, cadmium, lead, nickel, copper, chromium, mercury, and zinc; nutrient runoff (phosphates, nitrogen compounds, potassium, trace elements); pesticide runoff (herbicides, insecticides, fungicides, termiticides); solid waste; sedimentation, erosion, and salts (which reduce oxygen content in water and alter habitat); toxics such as PCBs and controlled substances; the industrial solvents trichloroethene and tetracholoroethene (TCE); and the gasoline additive methyl tert-butyl ether (U.S. Geologic Survey 2001; J. Lusk, Service, *pers. comm.* 2010; New Mexico Environment Department 2010). Harwood (1995) studied the North Floodway Channel (Floodway) of Albuquerque, which drains an urban area of about 90 square miles and crosses Pueblo of Sandia lands. The study found that storm water contributions of dissolved lead, zinc, and aluminum were significant and posed a threat to the water quality of the Rio Grande. Because the Floodway crosses lands of the Pueblo of Sandia and enters their portion of the Rio Grande, the Pueblo requested that the Environmental Protection Agency conduct toxicity tests on water in the Rio Grande collected below the Floodway. Aquatic crustaceans exposed to this water were found to have significant reproductive impairment and mortality when compared with controls. Additionally, larval fish also experienced significant mortality and/or narcosis when exposed to water and bed sediment collected from this same area on April 22, 2002 (http://oaspub.epa.gov/enviro/pcs det_report.detail_report?npdesid=NM0022250). This study indicates that storm water runoff can impact the water quality of the Rio Grande and the aquatic organisms that live in the river.

Sediment is the sand, silt, organic matter, and clay portion of the river bed, or the same material suspended in the water column. Ong *et al.* (1991) recorded the concentrations of trace elements and organochlorine pesticides in suspended sediment and bed sediment samples collected from the Middle Rio Grande between 1978 and 1988. These data were compared to numerical sediment quality criteria (Probable Effects Criteria [PEC]) proposed by MacDonald *et al.* (2000). According to MacDonald *et al.* (2000) most of the PEC provide an accurate basis for predicting sediment toxicity to aquatic life and a reliable basis for assessing sediment quality in freshwater ecosystems. Although the PEC were developed to assess bed (bottom) sediments, they also provide some indication of the potential adverse effects to organisms consuming these same sediments when suspended in the water column.

Semi-volatile organic compounds are a large group of environmentally important organic compounds. Three groups of compounds, polycyclic aromatic hydrocarbons (PAHs), phenols, and phthalate esters, were included in the analysis of bed sediment collected by the USGS (Levings *et al.* 1998). These compounds were abundant in the environment, are toxic and often carcinogenic to organisms, and could represent a long-term source of contamination. The analysis of the PAH data by Levings *et al.* (1998) show one or more PAH compounds were detected at 14 sites along the Rio Grande with the highest concentrations found below Albuquerque and Santa Fe. Polycyclic aromatic hydrocarbons and other semi-volatile compounds affect the sediment quality of the Rio Grande and may affect silvery minnow behavior, habitat, feeding, and health.

Pesticide contamination occurs from agricultural activities, as well as from the cumulative impact of residential and commercial landscaping activities. The presence of pesticides in surface water depends on the amount applied, timing, location, and method of application. Water quality standards have not been set for many pesticides, and existing standards do not consider cumulative effects of several pesticides in the water at the same time. Roy *et al.* (1992) reported that DDE, a degradation product of DDT, was detected most frequently in whole body fish collected throughout the Rio Grande. The authors suggested that fish in the lower Rio Grande may be accumulating DDE in concentrations that may be harmful to fish and their predators.

In addition to the compounds discussed above, several other constituents are present and affect the water quality of the Rio Grande. These include nutrients such as nitrates and phosphorus, total dissolved solids (salinity), and radionuclides. Each of these also has the potential to affect the aquatic ecosystem and health of the silvery minnow. As the river dries, pollutants will be concentrated in the isolated pools. Even though these pollutants do not cause the immediate death of silvery minnows, the evidence suggests that the amount and variety of pollutants present in the Rio Grande, could compromise their health and fitness (Rand and Petrocelli 1985).

Pipelines

Based on information reported in the National Response Center (NRC) database (http://www.nrc.uscg.mil), one spill incident involving crude oil has occurred in Sandoval County near the city of Bernalillo, New Mexico just upstream from the action area for this consultation. In April 1999, a 16-inch (41-cm) transmission pipeline fitting was ruptured by a backhoe, releasing crude oil into the water and soil; reports indicate it may have entered the Rio Grande. Accordingly, this spill may have negatively affected silvery minnow in the action area. There is concern about the potential adverse effects of spills from these pipelines. Fuels such as diesel that are carried by pipelines have documented toxicity due to polycyclic aromatic hydrocarbons (PAHs), which are known to persist after spills, pass readily into tissues, are potent carcinogens, and are toxic to fish (Schein et al. 2009; Eisler 1987; and Lee and Grant 1981 *as cited in* Eisler 1987). A break in a pipeline if it were to release fuel into the river has the potential for lethal effects on minnows as well as adverse effects downstream on critical habitat (e.g., water quality; J. Lusk, Service, *pers. comm.* 2010). No available information on the spill indicates the extent of past adverse effects to silvery minnows from this incident.

Silvery Minnow Propagation and Augmentation

In 2000, the Service identified captive propagation as an appropriate strategy to assist in the recovery of the silvery minnow. Captive propagation is conducted in a manner that will, to the maximum extent possible, preserve the genetic and ecological distinctiveness of the silvery minnow and minimize risks to existing wild populations.

Silvery minnows are currently housed at two facilities in New Mexico that conduct captive propagation of the species, including the Dexter Fish Hatchery and Technology Center and the City of Albuquerque's BioPark propagation facilities. These facilities are actively propagating and rearing silvery minnow. In 2010, the Interstate Stream Commission (ISC) Refugium in Los Lunas, New Mexico reared silvery minnow and contributed to November 2010 augmentation. Silvery minnows are also held at the Service's New Mexico Fish and Wildlife Conservation Office (FWCO)[1] and at the U.S. Geological Survey Biological Resources Division Lab in Yankton, South Dakota; however, there are no active spawning programs at these facilities.

Since 2002, over 1.25 million silvery minnows have been propagated and then released into the wild (J. Remshardt, Service, *pers. comm.* 2011). Wild-caught silvery minnows are successfully spawned in captivity at the City of Albuquerque's propagation facilities. Eggs are raised and released as larval fish. Marked fish have been released into the Middle Rio Grande by the FWCO since 2002 under a formal augmentation effort funded by the Collaborative Program. Eggs left in the wild have a very low survivorship and this ensures that an adequate number of spawning adults are present to repopulate the river each year. While hatcheries continue to successfully spawn silvery minnow, wild eggs and larvae are collected to maximize genetic diversity within the remaining population (Turner and Osborne 2004).

Silvery Minnow Salvage and Relocation

[1] Formerly the New Mexico Fishery Resources Office (NMFRO)

During river intermittency, the Service's silvery minnow salvage crew captures and relocates silvery minnow. Through 2009, approximately 802,700 silvery minnows have been rescued and relocated to wet reaches. Studies are being conducted to determine survival rates for salvaged fish. Caldwell et al. (2009) reported on studies that assessed the physiological responses of wild silvery minnows subjected to collection and transport associated with salvage. The authors examined primary (plasma cortisol), secondary (plasma glucose and osmolality), and tertiary indices (parasite and incidence of disease) and concluded that the effects of stressors associated with river intermittency and salvage resulted in a cumulative stress response in wild silvery minnows. Caldwell et al. also concluded that fish in isolated pools experienced a greater risk of exposure and vulnerability to pathogens (parasites and bacteria), and that the stress response and subsequent disease effects were reduced through a modified salvage protocol that applied specific criteria to determine which wild fish are to be rescued from pools during river intermittency (Caldwell et al. 2009).

Ongoing Research

There is ongoing research by the New Mexico FWCO and University of New Mexico (UNM) to examine the movement of silvery minnows. Augmented fish are marked with a visible fluorescent elastomer tag and released in large numbers in a few locations. Crews sample upstream and downstream from the release site in an attempt to capture the marked fish. Preliminary results indicate that the majority of silvery minnows disperse a few miles downstream. One individual was captured 15.7 mi (25.3 km) upstream from its release site (Platania *et al.* 2003). Monitoring within 48 hours after the release of the 41,500 silvery minnows resulted in the capture of 937 fish. Of these, 928 were marked and 927 were collected downstream of the release point. The farthest downstream point of recapture was 9.4 mi (15.1 km). Studies are also currently underway by New Mexico FWCO using Passive Integrated Transponder (PIT) tags to examine silvery minnow movement and use of the fishway at the Albuquerque Bernalillo County Water Utility Authority's drinking water diversion site near the Alameda Bridge in Albuquerque. Preliminary results indicate use of the fishway and both upstream and downstream movement of minnows in that location.

In 2002, a hybridization study involving the plains minnow and silvery minnow was conducted to determine the genetic viability of hybrids. Plains minnow are found in the Pecos River where reintroduction of the silvery minnow is being considered. The results are preliminary because the number of trials was low and because there is some question about the fitness of the females used in the experiments. The plains minnow and silvery minnow did spawn with each other and the hybrid eggs hatched. However, none of the larvae lived longer than 96 hours. The control larvae (non-hybrids) for both the plains minnow and silvery minnow lived until the end of the study (24 days) (Caldwell 2002).

Due to the increased efforts in captive propagation, recent studies by UNM have focused on the genetic composition of the silvery minnow. Several studies since 2003 have documented a significant decline in overall mitochondrial (mt)DNA and gene diversity in the silvery minnow (e.g., Osborne *et al.* 2005; Turner *et al.* 2006), which may correspond to an increased extinction risk. Research indicates that the net effective population size (N_e) (the number of individuals that contribute to maintaining the genetic variation of a population) of the silvery minnow in the wild is a fraction of the census size (Alò & Turner 2002, *cited in* U.S. Fish and Wildlife Service 2007; Turner *et al.* 2005). In addition, estimates of the current genetic effective size for silvery minnow have consistently fallen well below the values recommended to maintain the adaptive potential of the species. For example, Alò and Turner (2005) found that genetic data from 1999 to 2001 indicated the current effective population size of the largest extant population of silvery minnows is 78. Other estimates have ranged as low as 50 (for 2004 and 2005; *cited in* U.S. Fish and Wildlife Service 2007). It has been suggested that a N_e of 500 fish is needed to retain the long-term adaptive potential of a population (Franklin 1980). Because the number of wild fish in the river appears to be low, the addition of thousands of silvery minnows raised in captivity could impact the genetic structure of the population. For example, estimates of the effective population size for stocks that were reared from wild-caught eggs were consistently lower than for wild counterparts; in addition, stocks produced by captive spawning consistently show lower levels of allelic diversity than those reared from wild-caught eggs (Osborne *et al.* 2006). This indicates that samples collected and reared in captivity do not accurately reflect the allelic frequencies or diversity seen in the wild population (U.S. Fish and Wildlife Service 2007). Results indicate that while captive propagation can be important for reducing the loss of some genetic markers (including microsatellite allelic diversity and heterozygosity) as seen in recent years, it cannot be relied upon to fully address declines in genetic diversity in the silvery minnow population.

10(j) Experimental Population

In December 2008, silvery minnows were introduced into the Rio Grande near Big Bend, Texas as a nonessential, experimental population under section 10(j) of the ESA (73 FR 74357). The Service released approximately 445,000 silvery minnows in 2008, approximately 509,000 in 2009, and approximately 488,000 in 2010. The four release sites are distributed across Federal, state, and private lands: one in Big Bend Ranch State Park; two within Big Bend National Park; and one on the Adams Ranch del Carmen, a privately-owned and managed conservation area. The silvery minnows came from the Service's Dexter National Fish Hatchery and Technology Center and the City of Albuquerque's Rio Grande Silvery Minnow Rearing and Breeding Facility.

Preliminary monitoring is currently being conducted to determine the success of the Big Bend reintroduction effort. It is expected to take years of monitoring to fully evaluate if the species is established and will remain viable in this river reach. Monitoring is expected to continue on a quarterly basis to document the success of the stocking program. Post-release monitoring of silvery minnows in proximity to the four release sites began in May 2009. Seven adult silvery minnows were found during monitoring in May, indicating at least some and likely many of the fish released in December 2008 survived over the winter. No silvery minnows were found during monitoring efforts conducted in August or October 2009. In February 2010, 84 silvery minnows were found during monitoring efforts, which includes detection at three of the four monitoring locations. During spring 2010 monitoring, the Service documented the presence of Rio Grande silvery minnow eggs at two of the monitoring sites, indicating spawning activity within the 10(j) population. February 2011 monitoring captured silvery minnow at 3 of the 6 sites. Future monitoring efforts will be expanded to document dispersal and density.

Past Projects in the Middle Rio Grande

"Take" of ESA-listed species is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (see ESA section 3(19)). Take of silvery minnows has been permitted or authorized during prior projects conducted in the Middle Rio Grande. The Service has issued permits authorizing take for scientific research and enhancement purposes under ESA section 10(a)(1)(A), and incidental take under section 7 for actions authorized, funded, or carried out by Federal agencies. Applicants for ESA section 10(a)(1)(A) permits must also acquire a permit from the State of New Mexico to "take" or collect silvery minnows. Many of the section 10 permits issued by the Service allow take for the purpose of collection and salvage of silvery minnows and eggs for captive propagation. Eggs, larvae, and adults are also collected for scientific studies to further our knowledge about the species and how best to conserve the silvery minnow. Because of the population decline in the early 2000's, the Service has reduced the amount of take permitted for voucher specimens in the wild.

The Service has conducted numerous section 7 consultations on past projects in the Middle Rio Grande. In 2001 and 2003, the Service issued jeopardy biological opinions resulting from programmatic section 7 consultation with Reclamation and the U.S. Army Corps of Engineers (Corps), which addressed water operations and management on the Middle Rio Grande and the effects on the silvery minnow and the southwestern willow flycatcher (U.S. Fish and Wildlife Service 2001, 2003a). Incidental take of listed species was authorized associated with the 2001 programmatic biological opinion (2001 BO), as well as consultations that tiered off that opinion.

The 2003 jeopardy biological opinion (2003 BO) was issued on March 17, 2003, is the current programmatic biological opinion on Middle Rio Grande water operations, and contains one RPA with multiple elements. These elements set forth a flow regime in the Middle Rio Grande and describe habitat improvements necessary to alleviate jeopardy to both the silvery minnow and southwestern willow flycatcher. In 2005, the Service revised the Incidental Take Statement (ITS) for the 2003 BO using a formula that incorporates October monitoring data, habitat conditions during the spawn (spring runoff), and augmentation. Incidental take of silvery minnows is authorized with the 2003 BO (with 2005 revised ITS), and now fluctuates on an annual basis relative to the total number of silvery minnows found in October across the 20 population monitoring locations. Incidental take is authorized through consultations tiered off this programmatic BO and on projects throughout the Middle Rio Grande.

Within the Angostura Reach of the Middle Rio Grande, the Service has conducted numerous section 7 consultations on past projects, including the following:

- In 1999, the Service consulted with Reclamation on a restoration project on the Santa Ana Pueblo in an area where the river channel was incising and eroding into the levee system. The second phase of this Rio Grande Restoration Project at Santa Ana Pueblo underwent consultation in 2008, and the Service anticipated that up to 36,688 silvery minnow would be harassed by construction, fill placement in the river, and movement of equipment; no mortality was expected.

- In 2003, the Service completed consultation with the City of Albuquerque on its Drinking Water Project, which involved the construction and operation of a new surface diversion north of the Paseo del Norte bridge, conveyance of raw water to a new treatment plant, transmission of treated water to customers throughout the Albuquerque metropolitan area, and aquifer storage and recovery. The Service anticipated that up to 20 silvery minnows would be killed or harmed during construction, up to 25,000 eggs would be entrained each year at the diversion, and up to 7,000 larval fish would be harmed, wounded, or killed during operational activities.
- The Service consulted on habitat restoration projects on the Rio Grande near Albuquerque, including the 2005 Phase I, the 2007 Phase II, and the 2009 Phase IIa projects. Biological opinions addressing this prior habitat restoration work reviewed the effects on silvery minnows. Incidental take authorized included 190 silvery minnows in 2005 due to harm or harassment, in 2007 the harassment of up to 3,365 minnows and mortality of up to 341 minnows, and in 2009 the harassment of up to 4,094 minnows and mortality of up to 187 silvery minnows.
- In 2006 and 2007, the Service consulted with Reclamation on the Bernalillo Priority Site Project and the Sandia Priority Site Project for river maintenance activities. The Bernalillo project was anticipated to kill no more than 42 silvery minnows due to channel modification, berm removal, dewatering, and sediment deposition in the river. The most recent consultation on the Sandia Priority Site River Maintenance project concluded that direct take of up to 539 silvery minnows, and harassment of 53,853 silvery minnows would occur due to construction activities.
- In 2007, the Service determined through consultation with the Corps on the Rio Grande Nature Center Habitat Restoration Project, that up to 10 silvery minnows would be harassed during construction and that up to 154 silvery minnows would be killed due to entrapment in constructed channels.
- In 2007, consultation on the Corrales Siphon River Maintenance Project concluded that the harassment of up to 244 silvery minnows would occur during construction, fill placement in the river, and movement of equipment.
- In 2008, the Service concluded an intra-Service consultation on the Pueblo of Sandia Management of Exotics for the Recovery of Endangered Species (MERES) Habitat Restoration Project. The Service anticipated that up to 2,449 silvery minnows would be harassed due to construction, and up to 770 killed due to potential entrapment in channels.
- In 2009, the Service concluded a consultation with the Bureau of Reclamation on the Pueblo of Sandia Bosque Rehabilitation Project, which concluded that up to 85 silvery minnows would be harassed during the proposed restoration activities, and up to 269 would be killed due to potential entrapment in a restored channel.
- In 2010, the Service consulted with Reclamation for a habitat restoration project located on the Pueblo of Sandia. The Service anticipated that take in the form of harassment may affect up to 36,318 silvery minnow due to proposed construction and river crossings, as

well as the harassment and mortality of up to 6 silvery minnows due to potential stranding in restored features after peak flows recede.

Summary of the Environmental Baseline
The remaining population of the silvery minnow is restricted to approximately seven percent of its historic range. With the exception of 2008, every year since 1996 has exhibited at least one drying event in the river that has negatively affected the silvery minnow population. The species is unable to expand its distribution because poor habitat quality and Cochiti Dam prevent upstream movement and Elephant Butte Reservoir blocks downstream movement (U.S. Fish and Wildlife Service 1999). Augmentation of silvery minnows with captive-reared fish has been ongoing, and monitoring and evaluation of these fish provide information regarding the survival and movement of individuals.

Water withdrawals from the river and water regulation severely limit the survival of silvery minnows. The consumption of shallow groundwater and surface water for municipal, industrial, and irrigation uses continues to reduce the amount of flow in the Rio Grande and eliminate habitat for the silvery minnow (U.S. Bureau of Reclamation 2003). However, under New Mexico State law, the municipal and industrial users are required to offset the effects of groundwater pumping on the surface water system. The City of Albuquerque for example, has been offsetting its surface water depletions with 60,000 afy returning to the river from the WWTP (U.S. Bureau of Reclamation 2003). The effect of water withdrawals means that discharges from WWTPs and irrigation return flows will have greater importance to the silvery minnow and a greater impact on water quality. Lethal levels of chlorine and ammonia have been released from the WWTPs in the last several years. In addition, a variety of organic chemicals, heavy metals, nutrients, and pesticides have been documented in storm water channels feeding into the river and contribute to the overall degradation of water quality.

Various conservation efforts have been undertaken in the past and others are currently being carried out in the Middle Rio Grande for the benefit of the silvery minnow. Population monitoring indicates that densities of this species have recently decreased to a level lower than that observed in 2006 but not as low as the extremely low levels seen in 2002–2003. However, current data show catch rates are currently lower than at the time of its listing as an endangered species in 1994. The threat of extinction for the silvery minnow continues because of increased reliance on captive propagation, the fragmented and isolated nature of currently occupied habitat, and the absence of the silvery minnow throughout most of its historic range.

IV. EFFECTS OF THE ACTION

Regulations implementing the ESA (50 FR 402.02) define the *effects of the action* as the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, which will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification; interdependent actions are those that have no independent utility apart from the action under consideration. The following section describes the anticipated effects on silvery minnow resulting from the proposed action. Designated critical habitat for the silvery minnow occurs throughout most of the action area.

Effects on Silvery Minnow

As described earlier, the action area for this consultation is defined as the entire width of the 100-year floodplain of the Rio Grande encompassing the disturbance zone boundaries from RM 198.4 to RM 172 which is located in the Angostura reach from just north of the Village of Corrales downstream to the northern boundary of the Pueblo of Isleta. Monitoring data are available for two sampling locations within the action area and one location just north (River Miles 200, 183.4 and 178.3), and indicate that minnows are likely to occur during habitat restoration activities and may be affected by the proposed action. Densities of silvery minnows in and near the action area in October 2010, December 2010, and February 2011, were 0.29, 0.18, and 0.13 silvery minnows/100 m^2, respectively. However, the proposed action is expected to be implemented over a period of 3-5 years beginning in Fall 2011, and silvery minnow densities are expected to vary over that period of time. Therefore, to calculate an estimated density of silvery minnow juveniles and adults during implementation of the proposed action, we averaged October catch rate data from the last 5 years available at 3 sampling locations (two within the action area and one just upstream). During the proposed action, we are estimating that silvery minnow may be present at a density of 7.36 silvery minnows/100 m^2.

The Service reviewed the proposed action, including measures implemented to reduce risk to listed species. The proposed action is expected to have beneficial effects on silvery minnows in the long-term by establishing diverse mesohabitats that support the species. Such habitat is expected to benefit silvery minnows through improved egg and larval retention, increased recruitment rates, and increased survival of both YOY and adult silvery minnows. In the long-term, the project is anticipated to contribute to improving the status of this species into the future through improved habitat availability and function.

However, we also expect the proposed action may generate adverse effects on silvery minnows as a result of two different activities: (1) construction of the proposed restoration treatments in wetted areas; and (2) indirect effects beyond the construction period due to potential stranding of silvery minnows in constructed ephemeral high flow and backwater channels and willow swales and in restored bankline features.

Short-term adverse effects on silvery minnows are expected due to in-water disturbance during construction of the high flow channels and backwaters, bank terracing, willow swales, bank scallop and canoe ramps. We expect silvery minnows will be present during these activities and will be harassed as a direct effect of the proposed action. The Service has defined take by harassment as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (see 50 CFR 17.3).

Minnows are expected to exhibit an avoidance response to construction activities. Avoidance behavior, or fleeing from the disturbance, represents a disruption in normal behaviors and an expenditure of energy that an individual silvery minnow would not have experienced in the absence of the proposed action. However, this form of harassment is expected to be short in duration, with pre-exposure behaviors to resume after fleeing the disturbance. The potential number of silvery minnows affected within the immediate vicinity of the equipment is minimized, as we expect an initial flight response at the onset of activities. In the event that cofferdams or silt fences are required, their placement will exclude silvery minnow, and repeated disturbance of silvery minnow at a construction site is not anticipated. Conservation measures used during the proposed action will help to minimize disturbance, for example by operating equipment on riverbanks whenever possible to avoid contact with silvery minnow habitats; and by using silt fencing and allowing a downstream opening for silvery minnow escapement as sediment placement begins in the upstream portion. The construction technique of using the existing bank to serve as a barrier during excavation of terraces and high flow channels avoids most disruption of silvery minnow habitat. In addition, the applicable work window (i.e., not during April 15 to August 15) will avoid adverse effects on pre-spawn and spawning adult silvery minnows, as well as YOY during early growth (i.e., until large enough for sufficient mobility and resilience). Conservation measures and best practices in place for operation of equipment also minimize risk of adverse effects due to accidental introduction of hydrocarbon contaminants such that we expect it to be discountable. As a result, given the mobility of silvery minnows, the limited area and duration where effects are expected, and the proposed work window, we do not expect the anticipated avoidance response to construction – or the timing of that response relative to the species' life history – will lead to any long-term significant effects on silvery minnow behaviors such as breeding, feeding, or sheltering.

Adverse effects on silvery minnows may also occur due to sediment disturbance by equipment and placement of materials in the channel. These activities may affect water quality, causing localized increases in turbidity and suspended sediments. Direct effects from excess suspended sediments on a variety of fish species have included alarm reactions, abandonment of cover, avoidance responses, reduction in feeding rates, increased respiration, physiological stress, poor condition, reduced growth, delayed hatching, and mortality (Newcombe and Jensen 1996). In addition, indirect effects from sediment mobilization in the channel are possible, including the potential smothering and mortality of algae and aquatic invertebrates, depressed rates of growth, reproduction, and recruitment or reduced physiological function of invertebrates. Decreases in primary production are also associated with increased sedimentation and turbidity and can produce negative cascading effects through depleted food availability for zooplankton, insects, mollusks, and fish. We expect silvery minnows will exhibit an avoidance response to construction activities as described earlier. Water quality monitoring previously conducted by the Corps before, during and after construction of similar habitat restoration features did not produce any results exceeding the range of values normal for the Rio Grande. Conservation measures will help minimize the risk due to dispersal of suspended sediments (e.g., construction technique, silt fences or cofferdams as needed; water quality monitoring) and restrict the effects of suspended sediments to within the action area. Therefore, beyond the initial avoidance response to activities, we do not expect suspended sediments will result in significant direct effects on silvery minnows. Those same conservation measures are also expected to reduce the risk of indirect effects on silvery minnows from these activities.

Indirect effects on silvery minnows may also result from the proposed restoration treatments. Beyond the construction period, harassment and mortality of silvery minnows may occur due to potential stranding of fish in restored features. For example, high flows may deposit sediment in or near restored features resulting in isolated pools containing silvery minnows, particularly in ephemeral channels. Also, some of the willow swales proposed for construction will have the potential to become inundated and strand silvery minnow in isolated pools. We expect silvery minnows may become stranded in these isolated pools and die. Entrapment has also been noted to occur in other types of restored features on an infrequent basis (e.g., bankline scallop features similar to the proposed bankline terracing). Therefore, we cannot discount the probability that some entrapment mortality may occur as an indirect effect of the proposed action. The Corps designs these features such that they drain back into the river as flow recedes during the descending limb of the spring hydrograph. Monitoring of similar features at other habitat restoration sites during normal river recession has shown little to no entrapment of silvery minnow (New Mexico Interstate Stream Commission 2010; U.S. Army Corps of Engineers 2009a).

Given our assessment of anticipated effects on silvery minnows, and the available information on disturbance zones for each activity (see Table 1), we expect silvery minnows will be harassed by construction activities related to habitat restoration treatments in wetted areas over a total area of 23.46 acres (94,939 m^2). The best available information on silvery minnow density in the action area for 5 past October surveys was used to estimate silvery minnow density at the time of construction between Fall 2011 and 2016 – a density of 7.36 silvery minnows per 100 m^2. Therefore, we expect that 6,988 silvery minnows (juveniles and adults) would be harassed during construction. Given the timeframe for construction, we do not expect any eggs or larval silvery minnows will be harassed or otherwise taken during construction. Potential entrapment and stranding of silvery minnows in restored features is expected to result in take of this species due to harassment and mortality. Although entrapment has been noted to occur in other features on an infrequent basis (e.g., bankline scallops), we expect the majority of risk for entrapment of silvery minnows as flows recede will occur in ephemeral channels and willow swales. Thus, we assume the calculation of incidental take for entrapment in ephemeral channels and willow swales (the swales with a connection to the river) will encompass all entrapment-related take in both ephemeral channels and other features during the proposed action. Of the total post-construction area of these features, we expect a smaller portion (1/3) of the area has the potential to become disconnected when flows recede and result in entrapment of silvery minnow in isolated pools. In addition to the potential entrapment of juveniles and adults, during and immediately following the silvery minnow spawning period, there is potential for silvery minnow eggs and larvae to be entrained and stranded. Given a total impact area for ephemeral channels of 70.5 acres (285,303 m^2) and 24.3 acres (98,339 m^2) for willow swales connected to the river, and an adjustment to one-third of the total impact area, we expect take of 8,471 silvery minnows (juveniles and adults) in the form of harassment and mortality due to indirect effects from stranding. In addition, we expect an unquantifiable amount of silvery minnow eggs and larvae will be taken in the form of harassment and mortality due to indirect effects from stranding.

The Service notes that this represents a best estimate of the amount and extent of take that is likely during the proposed action. Thus, estimated incidental take may be modified from the above should research or early life stage monitoring indicated substantial deviations from the estimated extent of incidental take, or if it allows for a calculation of the amount of take of young life stages. In this case further consultation may be necessary.

Effects on Silvery Minnow Critical Habitat
The action area occurs within designated silvery minnow critical habitat. Direct and indirect effects of the proposed action are likely to result in a beneficial impact on several primary constituent elements (PCEs) of silvery minnow critical habitat. PCEs for critical habitat include backwaters, shallow side channels, pools, and runs of varying depth and velocity; substrates of predominantly sand or silt; and the presence of eddies created by debris piles, pools, or backwaters, or other refuge habitat within unimpounded stretches of flowing water of sufficient length that provide a variation of habitats with a wide range of depth and velocities. The proposed action is expected to contribute to these PCEs, which provide for the physiological, behavioral, and ecological requirements essential to the conservation of the silvery minnow.

However, construction activities during the proposed action may have short-term adverse effects on PCEs of silvery minnow critical habitat. Specifically, there is risk of adverse effects on water quality due to equipment fueling and leakage or accidental spills. We expect the conservation measures and best management practices (e.g., cleaning of equipment, inspection, storage and refueling requirements, spill kit readiness, and guards on external hydraulic lines) will reduce this risk such that it is extremely unlikely to occur and is therefore discountable. The proposed action will also disturb sediment due to equipment operation and placement of materials in the channel, which is expected to adversely affect water quality in designated critical habitat within the applicable disturbance zone. However, conservation measures in place during the proposed action are expected to restrict this disturbance and minimize the risk to the water quality PCE of critical habitat. These include the use of silt fences during placement and/or disturbance of sediments; water quality monitoring to ensure standards are maintained during the proposed action; and compliance with the SWPPP. In addition, the temporary disturbance to critical habitat would result in adverse effects to water quality over a very small area relative to the overall critical habitat designation, which extends approximately 157 miles (252 km) from Cochiti Dam in Sandoval County, New Mexico, downstream to the utility line crossing the Rio Grande in Socorro County, New Mexico.

In summary, we find that the effects of the proposed action on the function and conservation role of silvery minnow critical habitat relative to the entire designation are not significant because the effects will be temporary, are minimized by conservation measures employed during the proposed action, and will occur over a very small area relative to the overall critical habitat designation. In addition, the proposed action is intended to have beneficial effects over the long-term and contribute to the PCEs that form critical habitat. Therefore, we conclude that the primary constituent elements of silvery minnow critical habitat will continue to serve the intended conservation role for silvery minnows with implementation of the proposed action.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur within the action area considered in this biological opinion (50 FR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.
The Service expects the natural phenomena in the action area will continue to influence silvery minnows as described in the *Environmental Baseline*. The Service also expects the continuation of habitat restoration projects in the Middle Rio Grande and research that will benefit silvery minnows in the action area, for example projects funded and carried out by the State of New Mexico, City of Albuquerque, the Pueblos, and other groups. In addition, we expect cumulative effects to include the following:

- Increases in development and urbanization in the historic floodplain that result in reduced peak flows because of the flooding threat. Development in the floodplain makes it more difficult, if not impossible, to transport large quantities of water that would overbank and create low velocity habitats that silvery minnows prefer.

- Increased urban use of water, including municipal and private uses. Further use of surface water or further groundwater withdrawals that reduce surface water from the Rio Grande will reduce river flow and decrease available habitat for the silvery minnow.

- Contamination of water (i.e., sewage treatment plants; runoff from urban areas, small feed lots, and dairies; and residential, industrial, and commercial development). A decrease in water quality and gradual changes in floodplain vegetation from native riparian species to non-native species (e.g., saltcedar), as well as riparian clearing and chemical use for vegetation control and crops could adversely affect the silvery minnow and its habitat.

- Human activities that may adversely impact the silvery minnow by decreasing the amount and suitability of habitat include dewatering the river for irrigation; increased water pollution from point and non-point sources; habitat disturbance from recreational use, and suburban development.

The Service anticipates the continued and expanded degradation of silvery minnow habitat as a result of these types of activities. Effects from these activities will continue to threaten the survival and recovery of the species by reducing the quality and quantity of minnow habitat.

VI. CONCLUSION

After reviewing the current status of the silvery minnow, the environmental baseline for the action area, the anticipated effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the Corps MRG Bosque Restoration Project, as proposed in the November 2010 amended BA and subsequent correspondence with the Service during this consultation, is not likely to jeopardize the continued existence of the silvery minnow. We expect the level and type of take associated with this project is unlikely to appreciably diminish the population in the Angostura Reach, or the species as a whole. We expect harassment of minnows may occur, but the duration and intensity of this effect will be short-term, with no long-term significant effects on silvery minnow behaviors such as breeding, feeding, or sheltering. Any risk of more serious effects or repeated harassment is minimized due to measures employed during the proposed action. Mortalities may occur due to stranding in restored sites as peak flows recede; however, we anticipate that the increased availability of nursery habitat will improve overall survival of early life stages, and we do not expect these incidental mortalities to result in any significant long-term effects on the population in the Angostura Reach or for the species as a whole.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require adherence to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement (50 CFR §402.14(i)(3)).

Amount or Extent of Take Anticipated

The Service has developed the following incidental take statement based on the premise that the Middle Rio Grande Bosque Restoration Project will be implemented as proposed. Take of silvery minnows is expected in the form of harassment and mortality due to the proposed habitat restoration activities, and is restricted to the action as proposed. If actual incidental take meets or exceeds the predicted level, the Corps must reinitiate consultation.

The Service anticipates that take in the form of harassment may affect up to 6,988 silvery minnows due to proposed construction, as well as the harassment and mortality of up to 8,471 silvery minnows (juveniles and adults) due to potential stranding in restored features after peak flows recede. We base these figures on the best available information on minnow density in the area to be disturbed by the proposed activities during the next 3-5 years of project implementation. We also expect mortality of silvery minnow eggs and larvae that may become stranded in restored features after flows recede; however, it is not possible to estimate the number of eggs and larvae that would be taken. We expect the extent of this take would encompass the project area over the same footprint that applies to stranding of juveniles and adults. We expect any take of eggs and larval silvery minnows would be small in relation to natural mortality of these life stages.

Effect of Take

The Service has determined that this level of anticipated take is not likely to result in jeopardy to the silvery minnow. The restoration project is likely to have adverse effects on individual silvery minnows but those effects are not anticipated to result in any long-term consequences on the population. Incidental take will result from harassment of minnows during construction activities and mortality of any individuals that may become stranded in restoration features (e.g., ephemeral channels/backwaters/willow swales) after peak flows recede.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the silvery minnow resulting from the proposed action:

1. Minimize take of silvery minnows due to habitat restoration activities.

2. Manage for the protection of water quality from activities associated with the restoration project.

3. Work collaboratively with the Service on the Middle Rio Grande Endangered Species Collaborative Program.

Terms and Conditions

Compliance with the following terms and conditions must be achieved in order to be exempt from the prohibitions of section 9 of the ESA. These terms and conditions implement the Reasonable and Prudent Measures described above. These terms and conditions are non-discretionary. The Corps must report to the Service's New Mexico Ecological Services Field Office (NMESFO) on the implementation of these terms and conditions.

To implement RPM 1, the Corps shall:

1. Ensure that all restoration treatment work is conducted during low flow periods, avoiding the silvery minnow spawning period and effects to potentially large numbers of offspring, by working within the timeframes described in this biological opinion (not between April 15 and August 15 of each year).
2. Ensure that conservation measures described in this biological opinion are implemented, including those pertaining to equipment and operations, staging and access, water quality, and others.
3. Ensure that the presence/absence of silvery minnows is visually monitored at construction sites by a permitted biologist, and use adaptive management to modify activities to minimize adverse effects.
4. Implement the project-specific monitoring, including entrapment monitoring, and adaptive management as proposed and report results annually to the Service.
5. As appropriate, report to the Service the results and effectiveness of restoration treatments.
6. Report to the Service findings of injured or dead silvery minnows.
7. Monitor the implementation of RPM 1 and its associated Terms and Conditions.

To implement RPM 2, the Corps shall:

1. Ensure that conservation measures described in this biological opinion are implemented, including those pertaining to construction timing and sequencing, water quality monitoring, equipment and operations, and staging and access.
2. Ensure that all restoration treatment work is conducted during low flow periods, minimizing water quality impacts, by working within the timeframes described in this biological opinion (not between April 15 and August 15 of each year)
3. Report to the Service any significant spills of fuels, hydraulic fluids, and other hazardous materials.
4. Monitor the implementation of RPM 2 and its associated Terms and Conditions.

To implement RPM 3, the Corps shall:

1. Encourage adaptive management of flows and conservation of water to benefit listed species.
2. Utilize existing authorities and discretion to maximize water management benefits to silvery minnow.

3. Work to further conduct habitat/ecosystem restoration projects in the Middle Rio Grande to benefit the silvery minnow.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following conservation activities:

1. Evaluate the effectiveness of habitat restoration techniques implemented in the Middle Rio Grande for ESA-listed species, including an evaluation of site longevity and benefits provided to species.
2. Seek additional authorities and flexibilities in the operation and management of Corps reservoirs/facilities that may benefit southwestern willow flycatcher and silvery minnow.
3. Implement recovery actions identified in the southwestern willow flycatcher and silvery minnow recovery plans.

RE-INITIATION NOTICE

This concludes formal consultation on the action described in the November 2010 amended Biological Assessment. As provided in 50 CFR § 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this BO; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this BO; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

In future correspondence on this project, please refer to consultation number 22420-2010-F-0077. If you have any questions or would like to discuss any part of this biological opinion, please contact Lori Robertson of my staff at (505) 761-4710.

for Wally Murphy

cc:
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