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Memorandum

To: Area Manager, Albuquerque Area Office, Bureau of Reclamation, Albuquerque, New Mexico

From: Field Supervisor, U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, Albuquerque, New Mexico

Subject: U.S. Fish and Wildlife Service's Biological Opinion on the Effects of the San Acacia Diversion Dam (SADD) Field Exploration Project

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) on the effects of the action described in the 2008 Biological Assessment (BA) for the San Acacia Diversion Dam Field Exploration Project in Socorro County, New Mexico. This BO concerns the effects of the action on the endangered Rio Grande silvery minnow, *Hybognathus amarus*, (silvery minnow) and its designated critical habitat. The project site is located on the downstream side of the San Acacia Diversion Dam. Request for initiation of 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 received on November 14, 2008.

This BO is based on information submitted in the BA dated November 2008; conversations and communications between the Bureau of Reclamation (BOR) 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).

The current 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.

Consultation History
The Service conducted a site visit of the project location on October 7, 2008, and received a final BA on November 14, 2008. On November 20, 2008, the Service and BOR met to discuss the proposed action. This BO is tiered off the 2003 Biological and Conference Opinions on the Effects of the Bureau's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande (2003 BO; see U.S. Fish and Wildlife Service 2003a).

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

Background
The proposed project is located at the San Acacia Diversion Dam (SADD), in Socorro County, New Mexico, near approximate river mile 116.2. The 2003 BO's Reasonable and Prudent Alternative requires completion of fish passage at the SADD to allow upstream movement of silvery minnows (see page 96 of U.S. Fish and Wildlife Service 2003a). Prior to and separate from any future structures that may be built at the SADD, the BOR proposes to determine geological conditions in the area by conducting subsurface exploration (i.e., core drilling) and associated construction for temporary access of equipment to the drilling site.

A description of the proposed action, as addressed in this biological opinion, is provided below. The BOR proposes to conduct the core drilling and associated construction activities between mid-January and the beginning of March 2009.

Proposed Action
The BOR proposes to conduct core drilling on the downstream side of the SADD along the eastern bank of the Rio Grande, using drilling equipment that would be placed within an area up to 55 feet by 14 feet and weigh up to 60,000 pounds. SADD gates would be closed and river flows directed away from the drilling site during core drilling. Five holes would be drilled as follows, all in the dry: one within the river channel, one on the downstream concrete apron, and three holes along the left river bank. If unusual foundation conditions are encountered, the location of proposed holes may be shifted or additional holes may be added within the boundary identified in the November 2008 BA. Minimal amounts of groundwater at the drilling site or river water may be used as drilling fluid, without any additives. Any pumping of water would occur through a protective intake screen (≤ ¼-inch). Drilling fluids that may resurface would be treated to remove sediment and reused. Core drilling would be conducted using Standard Penetration Testing and is expected to take up to 20 work days to complete, with drilling conducted over eight days in a row and four days off in between drilling phases. Drill holes will be approximately 70 feet deep, and will collapse when drill equipment is extracted; therefore, no backfilling is expected. If backfilling becomes necessary, natural material will be pushed into the top of each hole.

Access to the core drilling site is planned by constructing a temporary access ramp from the west bank, a road across the riprap apron adjacent to the downstream concrete apron of the SADD, and then an additional ramp to the east river bank. Construction of the temporary ramps and road will occur in the dry to the extent possible. While building the ramps and access road, SADD gates will be closed in the construction area and opened at the opposite end of the dam to direct water away from the work area and allow the area to drain prior to construction. Because work will be conducted when river flows are relatively low, no significant leakage of water is expected underneath the gates during the proposed action.

The temporary access ramps will be built using an excavator to remove materials and stockpile earth behind the ramp location. A small amount of vegetation will be removed (< 0.25 acres) to build both ramps, which will be constructed in the dry and have side slopes ranging from 1:1 to 2:1 (H:V). Both ramps will have a drivable surface of 10 to 14 feet in width, and a fill depth ranging from two to seven feet. For the west ramp, six corrugated metal pipe (CMP) culverts 60 inches in diameter and 40 feet in length would be installed to allow flows to pass under the ramp without damaging the road surface. The ramp will extend an estimated 200 linear feet and require ±600 yd^3 of waste rock. The east ramp would be constructed by cutting the river embankment and placing fill materials into the dry river channel and across the riprap apron. No installation of culverts would occur for the east ramp, which will be used as a base for the drill rig. The ramp will extend 150 linear feet and require ±300 yd^3 of waste rock.

To build the temporary access road across the downstream side of the SADD, a portion of the riprap apron will be repaired and upgraded to allow the necessary heavy equipment to drive across and access the east side of the river where core drilling will occur. As the roadway is constructed, existing materials on the riprap apron will be adjusted or relocated, and waste rock will be added to fill in holes and voids. The final, drivable surface will have a width of 10 to 14 feet and a fill depth of two to three feet. An estimated ±600 yd^3 of waste rock will be required to construct the roadway, which will take five to ten working days.

Prior to installing the access ramps and temporary access road across the riprap apron, an estimated 700 linear feet of turbidity curtain or an inflatable bladder dam will be installed to exclude silvery minnows from the construction and access areas. The curtain or bladder dam will be installed by hand using T-posts or other metal posts, with the bottom secured to the river bed. If a bladder dam is used, it will be installed and inflated with river water to create a barrier to a height of four feet above the river bed. River water would be pumped in using a protected inlet with a ¼-inch or smaller mesh to prevent intake of any small fish. Installation of the curtain or bladder dam during ramp construction is expected to occur in the dry, and will protect against any influx of river water into the project area that could expose silvery minnows to the construction. Culverts will be placed into the river bed below the western ramp to allow river flows to continue after the ramp is completed, with outfall downstream from the curtain or bladder dam barrier. For the access road across the SADD, installation of the curtain or bladder dam will occur in the river, in up to two intervals (each reaching across approximately half of the dam with the endpoint connected to the concrete cap of the downstream sheetpiles). BOR will coordinate with the Service to ensure that prior to construction activities, any remaining pools of water between the turbidity curtain or bladder dam and the SADD will be seined or electro-fished by the Service to remove silvery minnows.

Two staging areas will be used during the proposed action - one site located north of the SADD between the railroad tracks and the Low Flow Conveyance Channel (LFCC), and the second site located adjacent to the core drilling site downstream of the SADD. In addition, staging of materials for turbidity curtain or bladder dam installation would occur on the concrete apron or temporary road, with materials hand-carried for installation at the base of the riprap apron.

During construction of the temporary access ramps and road, any woody debris that must be removed from the site will be placed in the river channel directly below the riprap apron and behind the turbidity curtain or inflatable bladder dam. The equipment used to move the woody debris will stay on the established access road and ramps. In addition, dust abatement would be conducted during the proposed activities. Water would be used from the Socorro Main Channel, Low Flow Conveyance Channel (LFCC), or the Drain Unit 7 Extension; or alternatively from municipalities if these three sources are not available. No water will be obtained from the river for dust suppression.

After core drilling is completed, the eastern ramp will be left in place. The western ramp, culverts, and turbidity curtain or bladder dam will be removed using the same measures employed during their construction to protect silvery minnows. Equipment will be stored at the SADD or at the Socorro Field Division's wareyard in Socorro or at the San Marcial Yard. Waste rock used to build the west ramp will be removed and used to reshape the river embankment, with any excess waste rock materials stockpiled. It is estimated that removal of the turbidity curtain or bladder dam and the west ramp and culverts will take three to five days. At the completion of core drilling, the access road across the SADD may be removed following the same measures used during its construction, or it may be left in place. If left in place, this road would be expected to partially erode when exposed to river flows, with materials (i.e., rock) filling in the adjacent riprap apron (H. Garcia, BOR, *pers. comm.* 2008).

Conservation Measures
In addition to the use of the turbidity curtain or bladder dam, BOR will implement the following conservation measures during the proposed activities to help minimize or avoid adverse effects of the project work (November 2008 BA; H. Garcia, BOR, *pers. comm.* 2008):

Construction BMPs. BOR will utilize construction best management practices (BMPs) during the proposed activities, for example cleaning all equipment before entering the channel. Specifically, the following BMPs will be implemented: (1) drill rigs will be cleaned to assure no contamination of soil or waterways, (2) all equipment will be checked for leaks to assure no oil or hydraulic fluids will be released, (3) operators will have spill protection kits onboard and will be trained in use of the kits, (4) all equipment using or containing fuel will be stored above the high water mark, (5) the drill rig will be on a pad during operation, as well as when above the high water mark for storage, (6) the fuel loader will cross using the access road to fuel the drill rig, and will return to the levee system for storage, (7) spill barriers will be in place during fueling and while equipment is in use, (8) if an abnormal event occurs during drilling, drilling will stop to assess and minimize the risk of spills, and (9) clean soil and materials will be used for construction of ramps and road.

Dust Abatement. If water is needed for dust abatement during the proposed activities, water will be obtained from the Socorro Main Channel, LFCC, Drain Unit 7 Extension, or from municipalities. Water will not be obtained from the river.

Table 1. Wetted disturbance area during the proposed action

Activity	Maximum Disturbance Area (ft^2)	Maximum # of Days	Disturbance Area (wetted acres)
Installation of 150' turbidity curtain or inflatable bladder dam	2,250	3	0.15
Removal of 150' turbidity curtain or deflation of bladder dam	2,250	1	0.05
Installation of 550' turbidity curtain or bladder dam and seining and/or electro-fishing	7,700	5	0.9
Area between concrete apron and turbidity curtain or bladder dam that may require seining and/or electro-fishing	66,000	n/a	1.5
Re-installation of 150' turbidity curtain or inflatable bladder dam	2,250	3	0.15
Removal of 550' turbidity curtain or bladder dam	7,700	3	0.54
Removal of 150' turbidity curtain or bladder dam	2,250	1	0.05
		TOTAL	**3.34 acres**

Areas of Disturbance
The proposed action is anticipated to disturb a dry area of 5,600 ft^2 and 2,100 ft^2 for construction of the western and eastern ramps, respectively. In addition, selective removal of vegetation for ramp construction is expected on <0.25 acres. Wetted disturbance areas are detailed in Table 1 (previous page), from the November 2008 BA. It is anticipated that the area will be dry for the installation and removal of the 150' turbidity curtain or bladder dam (associated with access ramps); however, the disturbance acreage is included below in the event river flows extend into this area at the time of construction.

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 would be conducted on the downstream side of the San Acacia Diversion Dam, on both banks of the Rio Grande, and across the width of the river. For this consultation, the action area is defined as the entire width of the 100-year floodplain of the Rio Grande from the San Acacia Diversion Dam to the downstream boundary of the anticipated disturbance zone.

II. STATUS OF THE SPECIES

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

Legal Status

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 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 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. 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 Pueblo lands of Santo Domingo, Santa Ana, Sandia, and Isleta within this area are 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 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 dissolved oxygen, 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 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). It is unknown if individual silvery minnow spawn more than once a year or if some spawn earlier and some later in the year.

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 reduced the species' effective population size (N_e) to critically low levels (Alò and Turner 2005, Osborne et al. 2005). Adults, eggs and larvae are also 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 1999).

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 mi 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 1.5 to 1.6 in by late autumn (U.S. Fish and Wildlife Service 1999). 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 25 months, but very few survive more than 13 months (U.S. Fish and Wildlife Service 1999). Captive fish have lived up to four years (C. Altenbach, City of Albuquerque, *pers. comm.* 2003).

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).

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 1999). The majority of spawning silvery minnows are one year in age, with two year old fish comprise less than 10 percent of the spawning population. High silvery minnow mortality occurs during or subsequent to spawning, consequently very few adults are found in late summer. By December, the majority (greater than 98 percent) of individuals are YOY (i.e., Age 0). This population ratio does not change appreciably between

January and June, as Age 1 fish usually constitute over 95 percent of the population just prior to spawning.

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).

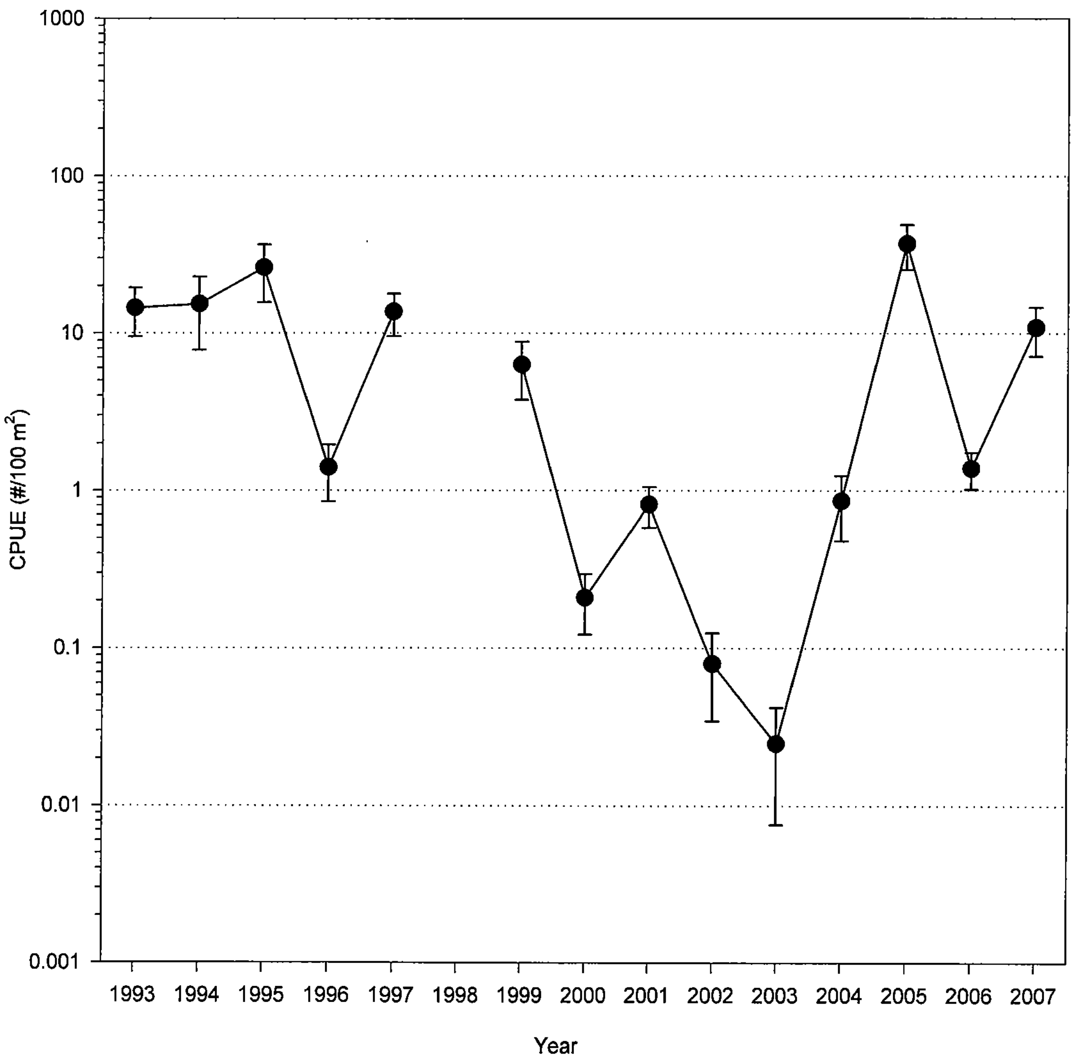
Distribution and Abundance

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 five percent of its historic range.

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 1999). 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 this area (U.S. Fish and Wildlife Service 1999; Torres *et al.* 2008).

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. This includes monitoring at river mile 116.2 within the action area, where the most recent data (October 2008) indicate a density of 29.66 silvery minnows per 100 square meters at this location (Dudley and Platania 2008a). The long-term monitoring of silvery minnows has recorded substantial (order of magnitude increases and decreases) fluctuations in the population. Rio Grande silvery minnow catch rates declined two to three orders of magnitude between 1993 and 2004, but then increased three to four orders of magnitude in 2005 (Figure 1). Population size is highly correlated with hydrologic conditions, particularly the magnitude and duration of the spring runoff (Dudley and Platania 2007). The capacity of the species to respond to good hydrologic years (e.g. 2005) is dependent on a variety of factors including the previous year's survivorship and number of adults available to reproduce.

Figure 1. Rio Grande Silvery Minnow Population Trends 1993-2007 based on October CPUE data.



Augmentation, throughout this period, likely sustained the silvery minnow population throughout its range. Over 1,126,000 silvery minnows have been released (primarily in the Angostura Reach) since 2000 (see *Environmental Baseline*). Captively propagated and released fish supplemented the native adult population and most likely prevented extinction during the extremely low water years of 2002 and 2003.

Middle Rio Grande Distribution

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 and the inability of adults to repopulate upstream reaches because of diversion dams.

This pattern has changed in recent years. In 2004, 2005, and 2007, 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 (nearly 1,000,000 since 2000) and the transplanting of silvery minnows rescued from drying reaches (approximately 770,000 since 2003) may partially explain this pattern. 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, leads 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, the largest numbers of silvery minnows were again highest downstream of San Acacia. Spring runoff volumes were exceedingly low in 2006. Flows at the Albuquerque gage never exceeded 3,000 cfs in 2006 (Porter, pers com.) and likely very little nursery habitat was inundated during critical recruitment times.

Based on available reports for 2008, silvery minnows occurred at all 20 sampling sites along the Middle Rio Grande in August, with flow conditions leading to elevated numbers of this species. The highest densities were noted in the San Acacia Reach, and the lack of extensive river drying this year was likely an important factor in this distribution shift compared to 2007 (i.e., from Angostura to San Acacia Reaches). With continuation of favorable flow conditions, silvery minnow recruitment in 2008 is expected to be high (Dudley and Platania 2008b).

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 1993, 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 has been 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). The draft revised Recovery Plan describes recovery goals for the Rio Grande silvery minnow and actions to complete these (U.S. Fish and Wildlife Service 2007). 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) for the Rio Grande silvery minnow may be considered when three populations (including at least two that are self-sustaining) of the species have been established within the historic range of the species and have been maintained for at least five years.

Delisting (Goal 3) of the species may be considered when three self-sustaining populations have been established within the historic range of the species and they have been maintained for at least ten years (U.S. Fish and Wildlife Service 2007).

Conservation efforts targeting the Rio Grande silvery minnow are also summarized in the draft 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 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. Each of these topics is discussed below.

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 and (2) changes to the magnitude and duration of peak flows.

Loss of Water

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 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; MRGCD, *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 Middle Rio Grande Conservation District (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 (MRGESCP 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's 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 has 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 has been 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 this year, which is the first time there has been no river drying since at least 1996.

Changes to Magnitude and Duration of Peak Flows

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 and 2008 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, prolonging summer base flows, 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.

<u>Changes in Channel and Floodplain Morphology</u>

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).

Several Federal projects alter and maintain these changes in channel and floodplain morphology. For example, BOR has, on a recurring basis, cut a pilot channel in the Rio Grande upstream of the bridge at San Marcial. The purpose of the Tiffany Plug Removal Project is to protect the levee from failure by directing water and sediment through the main channel rather than allow it to overbank into the adjacent floodplain. This reduces the amount of overbank flooded habitat for the silvery minnow, due to a straighter, narrower, and deeper channel. In 2005, the Service consulted with BOR on the removal of sediment plugs through 2015. In the biological opinion issued on this action, the Service anticipated as many as 50 silvery minnows could be taken during each instance of sediment removal, resulting from harassment, harm, or mortality.

In 1997, the Temporary Channel to Elephant Butte began and involved the construction of a temporary channel through the delta area of Elephant Butte Reservoir to increase the efficiency of sediment and water conveyance. An additional project goal was to initiate some degradation of the river bed through the San Marcial Reach to increase overall channel capacity and potentially allow for higher peak releases from Cochiti dam during subsequent spring runoff periods. At the time the channel was constructed, the area was effectively an extension of the reservoir and did not provide suitable habitat for silvery minnow. Surveys conducted prior to the first phase of temporary channel construction did not detect silvery minnow in the headwaters of Elephant Butte (U.S. Bureau of Reclamation 1996). The temporary channel appears to have created a riverine environment that supports silvery minnows, as indicated by surveys in 2005 that detected silvery minnows throughout the temporary channel (Remshardt, Service, *pers. comm.* 2008). At the same time, however, the headcut and streambed degradation associated with the temporary channel has increased channel incision and prevented the formation of backwaters and slackwaters.

And recently in 2008, the Service issued a biological opinion on the Drain Unit 7 River Maintenance Project on the upstream side of the SADD to maintain and protect existing levee, road, and drain structures. The Services estimated the project would cause the harassment of up to 107 silvery minnows (U.S. Fish and Wildlife Service 2008).

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 increases 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 YOY.

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, which 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).

Large precipitation events wash sediment and pollutants into the river from surrounding lands through storm drains and intermittent tributaries. Contaminants of concern to the silvery minnow that are frequently found in storm water include the metals aluminum, cadmium, lead, mercury, and zinc; organics such as oils, the industrial solvents trichloroethene and tetracholoroethene (TCE); and the gasoline additive methyl tert-butyl ether (U.S. Geologic Survey 2001).

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. He 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).

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 four facilities in New Mexico including the Dexter Fish Hatchery, New Mexico State University Coop Unit (Las Cruces), the Service's New Mexico Fishery Resources Office (NMFRO), and the City of Albuquerque's propagation facilities. These facilities are actively propagating and rearing silvery minnow. Silvery minnows are also held in South Dakota at the U.S. Geological Survey, Biological Resources Division Lab, but there is no active spawning program at this facility.

Since 2000, over 1,126,000 silvery minnows have been propagated and then released into the wild (J. Remshardt, Service, *pers. comm.* 2008). Wild gravid adults 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 by the NMFRO since 2002 under a formal augmentation effort funded by the Middle Rio Grande ESA Collaborative Program (Collaborative Program). Silvery minnows are released into the Angostura Reach of the river near Alameda Bridge to ensure downstream repopulation. 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 are collected to ensure genetic diversity within the remaining population.

Silvery Minnow Salvage and Relocation

During river drying, the Service's silvery minnow salvage crew captures and relocates silvery minnow. Since 1996, approximately 770,000 silvery minnows have been rescued and relocated to wet reaches, the majority of which were released in the Angostura Reach. Studies are being conducted to determine survival rates for salvaged fish.

Ongoing Research

There is ongoing research by the NMFRO 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).

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. This 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). 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). No significant genetic differences have been found in populations isolated in the different reaches of the Rio Grande (D. Alo UNM, *pers. comm.* 2002). 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. 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). Silvery minnow propagation efforts should be sufficient to maintain 100,000 to 1,000,000 fish in the wild (T. Turner, UNM, *pers. comm.* 2003). For instance if it were determined that 50,000 silvery minnows were in the wild, a minimum of 50,000 adult fish should be in propagation facilities. We do not know how many fish are in the wild, making it difficult at this time to determine the exact number needed in propagation facilities. However, to insure against a catastrophic event where most wild fish are lost, it is suggested that 100,000 to 1,000,000 silvery minnows should be kept in propagation facilities to maintain sufficient genetic variability for propagation efforts (T. Turner, UNM, *pers. comm.* 2003). Approximately 150,000 silvery minnows are currently being maintained in captivity (M. Ulibarri, Service, *pers. comm.* 2007).

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(18)). 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 from 2002-2004, 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 December 1994, BOR submitted a biological assessment addressing the diversion of water from the Rio Grande into the Low Flow Conveyance Channel (LFCC) to study the effects of channel gradient and sedimentation on water delivery. The Federal action evaluated the alternative of installing a temporary outfall to the river and diverting water during spring runoff for three consecutive years. Experimental diversions into the LFCC began in May 1997 and continued through June 1997, resuming again in early March 1998 through the end of spring runoff. This resulted in the entrainment of silvery minnow eggs and subsequent recruitment of silvery minnow adults into the LFCC. Experimental operations began again in May 2001. In March, 2002, the Service consulted again with BOR on additional LFCC experimental operations.

In 2001 and 2003, the Service issued jeopardy biological opinions resulting from programmatic section 7 consultation with Reclamation and the Corps, which addressed water operations and management on the Middle Rio Grande and the effects on the silvery minnow and the southwestern willow flycatcher. 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. For example, the Los Lunas Habitat Restoration Project tiered off the 2001 biological opinion, and was intended to partially fulfill RPA requirements associated with the 2001 BO to benefit the silvery minnow and southwestern willow flycatcher. Approximately 37 acres of native riparian and 40 acres of aquatic habitat have been created by this project. This project included side-channels with increased inundation frequency to cause the inundation of the area at flows greater than or equal to 2,500 cfs. A variety of substrate elevations were intended to allow inundation of some areas during flows less than 2,500 cfs.

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 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 in the San Acacia Reach and near the proposed action area, such as the Drain Unit 7 Extension River Maintenance Project, the Bosque de Apache Sediment Plug Removal Project, and the Tiffany Plug Removal Project.

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 the current year (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 releases from dams 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. Silvery minnow abundance has increased compared to 2002–2003 levels. However, 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 silvery minnows in other parts of their 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.

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 from the San Acacia Diversion Dam to the downstream boundary of the anticipated disturbance zone as described in the November 2008 BA. Silvery minnows are present in the San Acacia Reach, delineated as Rio Grande waters from the San Acacia Diversion Dam downstream to the Elephant Butte Reservoir (see Dudley and Platania 2008a). Monitoring data are available from river mile 116.2, located near the action area, and indicate that silvery minnows are likely to occur during the field exploration activities and may be affected by the proposed action. The most recent monitoring data from this site (October 2008) indicate a density of 29.66 silvery minnows per 100 m^2 in the action area (Dudley and Platania 2008a). Given an estimated monthly survival rate of 70 percent, the catch rate of silvery minnows in the action area adjusted for a project start date in January would be 10.17 minnows per 100 m^2 (J. Remshardt, Service, *pers. comm.* 2008).

After a review of the proposed action, we determined several activities would have no effect or only insignificant effects on the silvery minnow. The proposed action is expected to disturb a dry area of 0.18 acres, and result in the removal of <0.25 acres of vegetation. We do not expect this to have any adverse effects on silvery minnows. Dust abatement will use water from nearby channels, drains, or from municipalities and not directly from the river; thus, we do not expect this activity would cause any adverse effects for silvery minnows. Core drilling will be conducted in the dry and is not expected to have any effects on aquatic habitat, including any effects due to physical disturbance of the substrate or noise generated by drilling. As a result, we do not expect any effects on silvery minnows. Similarly, removal of the western access ramp and culverts will be conducted in the dry and will not affect silvery minnows. Construction BMPs implemented during the proposed action – including operation of equipment, re-fueling, and spill prevention measures – are expected to minimize the risk of any spills that might affect silvery minnows. Movement of river flows through different gates of the SADD and through the CMP culverts is not expected to affect silvery minnows. In addition, the temporary access road across the SADD may be left in place at the completion of the proposed action. Erosion of temporary road materials will result in waste rock displacement into the riprap apron immediately adjacent to the access road. This is not expected to have any significant effect on river flows, water quality, or on silvery minnows. And lastly, LWD removed at the project site will be placed on the downstream side of the turbidity curtain or bladder dam barrier and therefore may affect silvery minnows. However, given the short duration of any exposure to this activity, and the low magnitude of any disturbance that would result, we do not expect any responses by silvery minnows to this activity would be significant or rise to the level of harassment.

The primary adverse effects of the proposed action on the silvery minnow may occur during several different activities: (1) the installation and removal of the 150-ft and 550-ft turbidity curtain or inflatable bladder dam, (2) seining and/or electro-fishing of silvery minnows from behind the curtain or bladder dam, and (3) construction of two access ramps and a temporary access road across the SADD.

Harassment of silvery minnows is expected to occur as a result of the proposed activities. 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). The activities above are expected to result in harassment of silvery minnows. Construction of access ramps may occur in the dry, but if aquatic habitat is present then we expect silvery minnows would be affected during the installation and removal of turbidity curtains or bladder dams. Minnows are expected to exhibit an avoidance response to many of these 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. Given the mobility of silvery minnows, and the small area affected over a limited duration, we do not expect the avoidance response, itself, would lead to any long-term significant effects on silvery minnow behaviors such as breeding, feeding, or sheltering.

The installation of a barrier (i.e., turbidity curtain or bladder dam) and removal of fish from the construction zone by seining and/or electro-fishing will reduce the potential exposure of silvery minnows to construction activities and minimize the risk of any repeated harassment. Thus, the potential number of individuals affected within the immediate vicinity of the equipment during construction is expected to be minimal, because we expect an initial flight response at the onset of barrier installation, removal of any remaining minnows by seining and/or electro-fishing, and a sustained avoidance of the area due to the presence of the barrier during in-water construction work.

In addition to the harassment described above, we also expect limited mortality of silvery minnows resulting from the proposed seining and electro-fishing activities. A stress response is likely in some individuals due to handling; however, this should be minimal if done correctly (J. Remshardt, Service, *pers. comm.* 2008). Experiments in the field compared to laboratory control groups indicate an increase in mortality due to handling wild fish in the field (J. Remshardt, Service, *pers. comm.* 2008). Given the status of the species, location, and timing of the proposed seining and electro-fishing, we provisionally assume that the mortality due to handling during the proposed action would range from 10 to 15 percent (J. Remshardt, Service, *pers. comm.* 2008).

Given our assessment of anticipated effects on silvery minnows, and the available information on disturbance zones for each activity above, we expect silvery minnows would be affected by installation and removal of the turbidity curtain or bladder dam over a total area of 1.84 acres. We also expect seining and electro-fishing to occur within an area of 66,000 square feet (or 1.5 acres) from the turbidity curtain or bladder dam and the SADD concrete apron. However, only an estimated 50 percent of this area will be in water; thus, the area affected by these activities is estimated at 33,000 square feet or 0.78 acres. Given a density of 10.17 silvery minnows per $100m^2$ in the action area, these disturbance areas translate into the harassment of 1,069 silvery minnows (757 during curtain or bladder dam activities and 312 during seining/electro-fishing), as well as the subsequent mortality of 31 to 47 of those fish due to handling (based on the 10 to 15 percent mortality rate described above).

Effects on Critical Habitat

As mentioned above, many of the proposed activities will be conducted in the dry or outside of designated silvery minnow critical habitat and are not expected to result in any effects that extend into critical habitat. However, some of the proposed activities may adversely affect designated silvery minnow critical habitat by reducing the amount of river channel available to minnows. The installation of turbidity curtains or bladder dams will temporarily reduce habitat available to silvery minnows. In addition, the eastern access ramp will remain in place after the proposed action and may slightly reduce the amount of river channel available for minnows. In addition, the proposed action may temporarily affect water quality within the anticipated disturbance zone. Turbidity curtains and bladder dams will minimize any effects to water quality during construction of access routes; however, the erosion of the temporary access road across the SADD after the completion of the proposed action will result in waste rock and sediment displacement into the riprap apron immediately adjacent to the access road. This may temporarily affect water quality in critical habitat, but these effects are not expected to be significant.

Although the proposed action may adversely affect critical habitat, we find that the effects 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 and occur over a very small area relative to the overall critical habitat designation. 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 and research to benefit silvery minnows, 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. Development also reduces overbank flooding favorable for the silvery minnow.

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

- Contamination of the 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. Silvery minnow larvae require shallow, low velocity habitats for development. Therefore, encroachment of non-native species will result in a reduction of habitat available for the silvery minnow.

- 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 non-point sources; habitat disturbance from recreational use, suburban development, and removal of large woody debris.

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.

V. 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 SADD Field Exploration Project, as proposed in the November 2008 BA, 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 San Acacia Reach, or the species as a whole. We expect harassment of minnows may occur, but the duration and intensity of this effect would be short-term, with no long-term significant effects on silvery minnow behaviors such as breeding, feeding, or sheltering. Any risk of repeated harassment is minimized due to measures employed during the proposed action. Limited mortalities are expected to occur due to handling stress after minnows are removed from the disturbance zone; however, we do not expect this to result in any significant long-term effects on the population in the San Acacia Reach or for the species as a whole.

We found that the proposed action has the potential to cause adverse effects to designated critical habitat. However, we anticipate that these effects on critical habitat will be short-term and will not affect the conservation role of critical habitat for silvery minnows relative to the overall designation. The conservation measures included in the BA and provided by BOR during the November 20, 2008, meeting with the Service (e.g., construction BMPs) are expected to help minimize adverse effects to the silvery minnow and its designated critical habitat. We also do not expect the effects of the proposed action to appreciably alter the function and intended conservation role of silvery minnow critical habitat.

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 BOR so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. BOR has a continuing duty to regulate the activity covered by this incidental take statement. If BOR (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, BOR 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 San Acacia Diversion Dam Field Exploration Project will be implemented as proposed. Take of silvery minnows is expected in the form of harassment and limited mortality and is restricted to the action as proposed. If actual incidental take meets or exceeds the predicted level, BOR must reinitiate consultation.

The Service anticipates that take in the form of harassment may affect up to 1,069 silvery minnows during the proposed field exploration activities. We base these figures on the best available information on minnow density in the area disturbed by the proposed activities, adjusted for survivorship until the project start date (10.17 silvery minnows per 100 m^2), as well as the estimated area where harassment would occur (total of 10,512 m^2 in water). The Service also anticipates that of those 1,069 fish, lethal take of up to 47 silvery minnows may occur due to handling stress in the field.

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 field exploration 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 in the San Acacia Reach or the species as a whole.

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 the proposed field exploration activities.

2. Continue to 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.

To implement RPM 1, BOR shall:

1. Ensure that all proposed work is conducted within the timeframes described in this biological opinion (i.e., mid-January to early March 2009).
2. Ensure that all conservation measures described in this biological opinion are implemented, including construction BMPs.

3. Coordinate with the Service to ensure that applicable pools of water are seined or electro-fished by the Service prior to construction activities, as described in this biological opinion.
4. Coordinate with the Service for all seining and electro-fishing conducted during the proposed action to ensure take is adequately recorded and reported.
5. Monitor the implementation of RPM1 and associated Terms and Conditions

To Implement RPM 2, BOR shall:

1. 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. Encourage adaptive management of flows and conservation of water to benefit listed species.

RE-INITIATION NOTICE

This concludes formal consultation on the actions described in the November 2008 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 22420-2009-F-0013. If you have any questions or would like to discuss any part of this biological opinion, please contact Jen Bachus of my staff at (505) 761-4714.

Wally Murphy

cc:
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