United States Department of the Interior

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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 Pueblo of Sandia Riverine Habitat Restoration 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 2010 Biological Assessment (BA) for the Pueblo of Sandia Riverine Habitat Restoration Project in the Middle Rio Grande, which will be funded by the Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) through the Bureau of Reclamation (Reclamation). This BO analyzes the effects of the action on the endangered Rio Grande silvery minnow, *Hybognathus amarus*, (silvery minnow) and on the endangered southwestern willow flycatcher, *Empidonax traillii extimus*, (flycatcher). The restoration project will be located in Sandoval and Bernalillo Counties, within the Sandia subreach of the Angostura (or Albuquerque) Reach, which extends from the Angostura Diversion Dam south to the Isleta Diversion Dam. Request for formal consultation, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.), was received on May 28, 2010.

This BO is based on information submitted in the May 2010 BA, conversations and communications between the Reclamation 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).

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

The flycatcher is a migrant through this portion of the Rio Grande and may be present from April through August. Suitable nesting habitat does not currently exist within the project area, which occurs at more than ¼-mile from existing flycatcher nest sites. Migrating flycatchers could still be disturbed by construction activities and the clearing of woody vegetation in the action area, however, these activities will not occur during the timeframe when flycatchers could be present (April 15 to August 15). If work is planned within two weeks before April 15 of after August 15, the Pueblo of Sandia will consult with the Service and Reclamation and will conduct additional surveys if warranted to determine the presence of breeding flycatchers in the action area and minimize the risk of exposing the species to proposed activities. Any positive pre-construction survey results or observation of the species will be discussed with the Service to coordinate nesting area avoidance. Thus, we expect direct effects on flycatchers are discountable.

Although long-term goals of the proposed action include restoring native willow-dominated riparian habitat that may benefit the flycatcher, short-term indirect effects on flycatchers are possible from the removal of any vegetation that currently represents suitable migratory-stopover habitat. However, dense willow-dominated vegetation sufficient to support flycatchers will not be disturbed during the proposed action. A vegetation survey of all proposed treatment locations was conducted during November 2009 to characterize vegetation within the project area. Vegetation to be modified during the proposed action will mostly consist of mixed native and exotic riparian species from 5 to 35 feet (1.5–10.6 m) tall, with intermittent native vegetation. Vegetation proposed for disturbance does not constitute suitable habitat for the flycatcher; most of the sites that could have the potential for flycatcher habitat are composed of young vegetation and do not yet have the structure to attract the species. Vegetation disturbance is expected to be temporary, becoming re-established shortly after the proposed action (e.g., within one growing season after disturbance). Vegetation will be monitored as it re-establishes in the restoration treatment areas. The proposed action is intended to bring the island and bar ground levels closer to groundwater, and we expect the potential future development of dense native vegetation may benefit the flycatcher in the future. In addition, conservation measures will be implemented to minimize potential effects on vegetation in the action area. These include avoiding dense willow-dominated riparian vegetation, using all efforts to minimize damage to native vegetation and wetlands, using existing roads and cleared staging areas, and operating equipment in the most open area available to minimize damage to vegetation. Therefore, indirect effects on flycatchers from removing vegetation are considered insignificant because vegetation in the action area does not currently support flycatcher territories, is not considered to be suitable habitat for the flycatcher, and disturbance to vegetation will be temporary with beneficial effects anticipated in the long-term.

Given the conservation measures in place during the proposed restoration project, anticipated effects to the flycatcher from the proposed action are insignificant and discountable. There is no designated critical habitat for the flycatcher within the action area. The remainder of this biological opinion will deal with the effects of implementation of the proposed action on the silvery minnow

Consultation History

The Service received a draft BA on April 9, 2010, for preliminary review and provided comments on that draft BA to Reclamation on April 27, 2010 The Service conducted a site visit of the project location with representatives from the Pueblo of Sandia and Reclamation on May

17, 2010. The Service received a final BA and request for formal consultation on May 28, 2010 The Service requested additional information on the proposed action and received that information on August 24, 2010 On September 8, 2010, the Service provided a draft BO to Reclamation for review and also to the Pueblo of Sandia for review pursuant to our obligations in Secretarial Order 3206 (U.S Department of the Interior 1997). 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* (March 2003 BO)

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

Overview

The Pueblo of Sandia Riverine Habitat Restoration Project will apply several habitat restoration techniques in the Sandia subreach of the Middle Rio Grande, located within the Angostura Reach (also referred to as the Albuquerque Reach). The goal is to restore habitat and provide benefits for the silvery minnow, the southwestern willow flycatcher, and the Middle Rio Grande ecosystem as a whole. The restoration goals of the project include diversifying mesohabitat types, focusing on spawning, egg retention, larval fish, and young-of-year habitat; creating habitat in low-flow conditions; designing strategic inundation of disconnected bosque habitat to encourage and increase the extent of overbank inundation; and encouraging fluvial processes and river dynamics. These goals are in support of Element S of the Reasonable and Prudent Alternative (RPA) in the March 2003 BO

The Pueblo of Sandia plans to implement the habitat restoration work, which is funded through Reclamation as a contribution to the Middle Rio Grande Endangered Species Collaborative Program's (Collaborative Program) goal for habitat restoration in the Middle Rio Grande. Construction will begin in the fall of 2010 and continue through winter 2010-2011. Monitoring by the Pueblo of Sandia is expected for two years after construction The proposed activities will not be conducted between April 15 and August 15

Project Location

The proposed action will occur in the Sandia subreach of the Angostura Reach. The Sandia subreach is located between river miles (RM) 194 to 203 The proposed action will occur in the downstream portion of the Sandia subreach between RM 194 and 196 During the proposed action, the following modifications are proposed increase mesohabitat diversity by creating backwaters, embayments, and bankline terraces; create low-flow habitats such as in-channel pools by using large woody debris, widen the river channel and encourage overbank inundation using bankline terraces, and enhance fluvial processes and sediment redistribution by destabilizing and terracing vegetated bars and islands.

Treatment areas include eleven specific sites throughout the project area (see Figures 2-4 on pages 46-48, from May 2010 BA). Treatment locations and designs were selected from the

Pueblo of Sandia Habitat Restoration Analysis and Recommendations report to the Collaborative Program (SWCA 2008 *as cited in* SWCA Environmental Consultants 2010). Those recommendations are based on Light Detection and Ranging (LiDAR) contour mapping and digital elevation model (DEM), HEC-RAS and FLO-2D modeling and mapping, as well as an adaptation of the restoration techniques described in Tetra Tech (2004). Site selection avoided dynamic features in the river system (e.g., unvegetated linguoid bars, braid bars, and low-elevation alternate bars) as well as sited with the potential to negatively impact infrastructure (e.g., pipelines crossing the river, bridges, levees, etc). Site selection favored locations with the following characteristics: areas adjacent to perennial water sources, areas where restoration is likely to increase inundation frequency or expand the inundated area, areas where restoration is likely to provide mesohabitat features currently lacking in the subreach, and areas where restoration is unlikely to adversely affect and/or will improve suitable flycatcher habitat. As-built plan and profile maps will be developed after treatment but before the next spring runoff. Target inundation for restoration work during the proposed action is 25 days of inundation (6.8% exceedance value on the mean daily flow-duration curve) for dry, average, and wet years – representing 1,400, 2,500, and 3,500 cubic feet per second (cfs) respectively Project design was developed to ensure that some restored habitat will be available in most years in the project subreach.

Proposed Restoration Treatments

Specific restoration treatments will be implemented during the proposed action and are designed to create aquatic habitat in the Sandia subreach. Construction is expected to take a total of approximately 45 days over eleven sites (time per site ranging from one to 10 days). Treatments will be monitored during construction and afterward, and evaluated to allow for adaptive management and the planning of potential future restoration work. Treatments that will be used during the proposed action include the creation of backwaters/embayments, bankline benches, island and bar modification, and the use of large woody debris (LWD). Table 1 provides a summary of the restoration treatments in wetted areas at the eleven sites, including existing and target inundation discharges, acreage affected, and duration of restoration treatments. Information in Table 1 is based on the May 2010 BA (SWCA Environmental Consultants 2010) and subsequent correspondence from Reclamation.

Proposed restoration treatments will total approximately 35 5 acres (0 14 km^2) of islands, bars, and riverbank modifications, resulting in effects to a total of 39 02 acres (0 16 km^2) of wetted area, which includes the anticipated disturbance zone around construction activities (i.e., 10% buffer). Riparian vegetation will be removed along bank-attached bars and islands. Vegetation modification will total approximately 31 96 acres (0 13 km^2), mostly consisting of mixed native and exotic riparian species from 5 to 35 ft (1 4 to 10 6 m) in height, with intermittent native vegetation. This does not include areas that were classified as open areas with little or no vegetation, wetland areas, and open water areas. Construction and clearing of vegetation will not occur between April 15 and August 15

During the proposed restoration treatments, woody debris and sediments will be used on site or disposed of in accordance with the Clean Water Act permit. New low-elevation habitat will be created adjacent to the islands and bank-attached bars within the active river channel using evenly distributed excess sediment and woody debris. Sediments and removed vegetation will be placed within silt barriers 2 feet (0.6 m) from the wetted perimeter of the bank to prevent any sediments from falling into the channel. Removed vegetation (woody debris) will be used for the creation of in-channel and bankline debris piles adjacent to the treatment areas. The upstream portion will be filled and compacted first and allow displaced water and fish to move out through a downstream opening. Sediment spoils on bankline features will be spread evenly over the land surface to an uncompacted depth not to exceed 2 feet (0.6 m) and seeded with native grasses and forbs.

Table 1. Proposed Restoration Treatments in Sandia Subreach and Wetted Area Affected (from May 2010 BA and Reclamation)

Restoration Treatment and Site Number	*Existing Inundation (cfs)*	*Target Inundation (cfs)*	*Impact Area[1] (wetted acres)*	*Construction Time (days)*	Total Impact Area (wetted acres)
Backwater/Embayment					
I7	5,958	1,000	2.06	3	**9.45**
C1	5,600	300	2.54	6	
I6	5,858	1,000	4.85	4	
Backwater/Embayment and Bankline Bench					
B1	6,736	1,500	2.26	5	**2.26**
Bankline Benches					
B2	6,736	1,500	2.09	5	**16.91**
I4	5,692	1,500 – 2,500	14.82	10	
Island / Bar Modification					
I8	6,492	No change[2]	4.37	4	**10.4**
I5	6,184	No change[2]	2.52	3	
13a	5,746	No change[2]	1.24	2	
I3	7,468	No change[2]	1.5	2	
I2	3,500	No change[2]	0.77	1	
TOTAL				**45 days**	**Total of 39.02 acres**

1 – Represents impact in wetted areas, including a 10% buffer zone to encompass disturbance zone; 2 – Treatment will include vegetation removal and grubbing and will not substantially lower the elevation for inundation

After monitoring and natural reshaping, any restoration areas that remain void of native vegetation may be replanted with appropriate native species to stabilize the contours to the extent possible. Following restoration, the treated features are expected to have a surface elevation suitable for inundation at a range of river flows, representing dry, moderate, and high water years. Revegetation, whether natural or planted, is also intended to provide suitable roughness to decrease flow velocities and increase egg and larvae retention.

Backwater/Embayment. This treatment will be used to create moderate- to high-flow backwater (i.e., no upstream inlet) and embayment areas that increase the amount of shallow, low-velocity habitat available for retaining drifting silvery minnow eggs and providing habitat for developing silvery minnow larvae. Riverbank and island vegetation will be removed and soils will be excavated to prescribed depths. Backwater areas will be constructed on the downstream end of large point bars, already low-velocity areas, and at a range of elevations to allow for inundation at various river flows. Backwater areas will slope slightly with the downstream end lower in elevation, and some backwaters will be terraced to create two distinct target inundation discharges.

Bankline Benches. Bankline benches are intended to inundate during different stages of moderate and high flows, increase the frequency and duration of inundation, and provide additional low-velocity habitat, resulting in improved egg retention and larval fish development during periods of high river flow These areas will not remain flooded for significant periods of time and are not intended to provide habitat for adult silvery minnow Constructing bankline benches will involve lowering the bank by removing bankline vegetation and excavating soils to increase the potential for overbank flooding. The target elevation for excavated and terraced banks will vary depending on the height of the bank, the bank-full level, and the target inundation discharge frequency and duration. Bankline benches will be created in areas where removal of the naturally-formed berms along the bankline could increase inundation in the overbank areas. The bankline modifications will be implemented in the dry, except when breaching berms and connecting the backwater outlet to the river channel.

Island/Bar Modification. Islands and bank-attached bars will be modified to help alleviate adverse changes and improve the quality and quantity of available habitat. This treatment will also help increase the potential for re-deposition of sediment in downstream subreaches of the Rio Grande. Island and bar features to be modified include those that have become (or have the potential to become) permanent channel features – e.g., infrequently inundated, stabilized by vegetation, or otherwise armored and more resistant to sediment mobilization. Modification will involve removing vegetation, destabilizing soil and sediment, mowing vegetation, root-plowing vegetation and sediment, and raking vegetation and surface sediment, as well as creating shelves inundated at lower flows. Treated islands will be allowed to naturally expand or contract in response to flows and available sediment load. Sediment removed as a result of the modification will be placed in the river behind silt fences.

Large Woody Debris (LWD). This treatment involves placing LWD (root wads, trees, and large branches) in the main channel or near the banks to create diverse aquatic habitats. LWD will be placed in the project area within the areas disturbed by other restoration treatments; specific locations will be determined during construction. The Pueblo of Sandia has a stockpile of LWD pieces that will be used and strategically placed to enhance the benefits from other restoration treatments. All LWD used during the proposed action will be placed naturally and not anchored or fastened to the channel bed.

Monitoring
All habitat restoration treatments will be monitored to determine the effectiveness of the methods implemented and identify any project-related hydrologic and geomorphic alterations. Monitoring will be conducted by the Pueblo of Sandia for two years after construction. The Pueblo also received funding from the Collaborative Program in 2008 for long-term monitoring efforts, which will be coordinated with the Collaborative Program and incorporate interagency objectives. A habitat restoration monitoring plan was submitted with the May 2010 BA.

Equipment, Staging and Access
Equipment proposed for construction on point bars and banks that are accessible from the shore include a D6 bulldozer and amphibious excavator An amphibious Caterpillar 325 excavator will be used for access to islands and less accessible banks and bars. Personnel and other equipment will be transported using air boats. Work conducted in wetlands and other sensitive aquatic areas will require the use of low-impact amphibious equipment. The amphibious equipment is designed to disperse weight and minimize impact of the treads when operating in water. The amphibious excavator is about 18 feet (5.5 m) wide and 34 feet (10 m) long, and is equipped with a 60-foot (18-m) boom, allowing the machine to perform extensive work with a minimal footprint. The excavator exhibits a gross pressure of 1 7 pounds per square inch (psi) and maximum speeds of 1.2 mph (1.9 km per hour) on level ground and 1.0 mph (1.6 km per hour) in water In water more than 3 feet (1 m) deep, the amphibious excavator will be in full flotation, in shallower water, the excavator will move along the riverbed surface. Secondary equipment will include a D6 bulldozer that will access sites via levee roads and existing roads through the bosque. The dozer will compliment the work being completed by the excavator, primarily focusing on clearing vegetation and dressing treated areas by smoothing the sites to grade.

Equipment and personnel staging and access locations are identified in the May 2010 BA, and anticipated river crossings are described in Table 2. Access to restoration sites from the east side of the river will be through the Pueblo of Sandia and across the North Diversion Channel, managed by the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA). Access to the west side of the river will be through Dixon Road in the Village of Corrales; the Pueblo will receive permission and access from AMAFCA and the Village of Corrales prior to initiating the project. No new roads will be constructed, as designated access routes will be over existing roads and trails. No mature native vegetation will be removed, and work will be scheduled to minimize crossing the river channel, taking the shortest path in crossing wetted portions of the channel. Wherever possible, equipment will operate on riverbanks, bars, and islands to avoid contact with silvery minnow habitats. North-South crossings listed in Table 2 represent movement of equipment between islands; equipment will take the shortest distance possible between islands to minimize crossing the river channel. In addition, water quality parameters – primarily turbidity – will be measured prior to and after river crossing.

Table 2. River Crossings During the Proposed Action (from May 2010 BA)

Trip Type	# Crossings	Excavator Width (ft)	Wetted Channel Width (ft)	Impact Area per Crossing (sq ft)	Total Impact Area (sq ft)
North – South	2	18	5,280	95,040	190,080
West –East	55	18	250	4,500	247,500
				TOTAL	**437,580**

Conservation Measures

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

Timing of the Proposed Action

- The proposed activities (including construction and vegetation removal) will not be conducted between April 15 and August 15 to avoid impacts to listed species and migratory birds during this window If work is planned within two weeks before April 15, or two weeks after August 15, the Pueblo will consult with the Service and/or Reclamation and will conduct additional surveys if warranted to determine the presence of breeding flycatchers or other birds. Any positive survey results or observation of affected species will be discussed with the Service to coordinate nesting area avoidance.

Equipment and Operations

- Wherever possible, equipment will operate on the riverbanks, bars, and islands to avoid contact with silvery minnow habitat. Work will be scheduled to minimize crossing the river channel
- All equipment will be steam-cleaned before arriving and departing the job site.
- Prior to leaving contractor facilities, all equipment will be thoroughly inspected, and any leaky or damaged hydraulic hoses will be replaced.
- To avoid any potential impacts to listed species or their habitat, all fuels, hydraulic fluids, and other hazardous materials will be stored outside the normal floodplain and refueling will take place on dry ground with a spill kit ready Extra precautions will be taken when refueling because of the environmentally sensitive location.
- A spill kit will be maintained on every rig in the river, with spill pans, containment diapers, oil booms, absorbent pads, oil mats, plastic bags, gloves, and goggles.
- An environmental specialist trained in spill prevention and spill cleanup will be on site during all construction activities.
- Steel-mesh guards will cover all external hydraulic lines.
- Upstream gages will be monitored during the days prior to and during operation in the channel, and equipment will be removed from the channel in the event of high storm surges detected at the upstream gages.

- Each individual operator will be briefed on and will sign off on local environmental considerations specific to the project tasks, including specific Stormwater Pollution Prevention Plans (SWPPPs).

Staging and Access

- Impacts to terrestrial habitats will be minimized by using existing roads, trails, and cleared staging areas. In general, equipment operation will take place in the most open area available, and all efforts will be made to minimize damage to native vegetation and wetlands.
- No mature native vegetation will be removed.
- Wherever possible, equipment will operate on riverbanks, bars, and islands to avoid contact with silvery minnow habitat. The bankline modifications will be implemented in the dry, except when breaching berms and connecting the backwater outlet to the river channel.
- Work will be scheduled to minimize crossing the river channel. In addition, water quality parameters will be measured prior to and after river crossing.

Water Quality

- Equipment operation will minimize sediment displacement by river flow
- Silt fencing will be installed downstream of any site where equipment crossings take place, such as canals, arroyos, or drains. River crossings will take the shortest path across wetted portions of the channel and avoid crossing during high flows. Water quality parameters, including dissolved oxygen (DO), will be measured before, during, and after equipment crosses the waterway, and the fencing will not be removed until water quality has returned to within 10 percent of the original levels.
- Water-quality testing will be conducted prior to entering the water and periodically during the operating day to ensure that standards are being maintained. Water-quality parameters to be tested include pH, temperature, DO, and turbidity, both upstream and downstream of the work area. Responses to changes in water quality measures exceeding the Pueblo's water quality standards will include reporting the measurements to the Pueblo.
- Stormwater discharges under the proposed action will be limited to ground-disturbing activities outside the mean high water mark. All such activities will be evaluated for compliance with National Pollutant Discharge Elimination System (NPDES) guidance, an NPDES permit, or a Stormwater Pollution Prevention Plan (SWPPP).
- Sediment spoils and debris as a result of the proposed action will be placed in the river behind silt fences.

Other Measures

- Vegetation removal during the proposed action will be done using mechanical techniques. No herbicide or chemicals will be applied during the project.
- Clean Water Act (CWA) 404 and 401 permitting processes will be completed prior to commencement of the proposed action.

Action Area

The action area includes all areas to be affected directly or indirectly by the proposed action (see 50 CFR §402.02). The proposed action will be conducted within the Angostura Reach of the

Middle Rio Grande. Habitat restoration activities will be conducted specifically in the downstream portion of the Sandia subreach between river miles (RM) 194 to RM 196. For this consultation, the action area is defined as the entire width of the 100-year floodplain of the Rio Grande from RM 194 to RM 196.

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). A description of this species, its status, and its 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 was also introduced into the Rio Grande near Big Bend, Texas, in December 2008 as an experimental, non-essential population under section 10(j) of the ESA. The silvery minnow is a stout minnow, with moderately small eyes, a small, sub-terminal mouth, and a pointed snout that projects beyond the upper lip (Sublette *et al.* 1990). The back and upper sides of the silvery minnow are silvery to olive, the broad mid-dorsal stripe is greenish, and the lower sides and abdomen are silver. Maximum length attained is about 3.5 inches (90 millimeters). The only readily apparent sexual dimorphism is the expanded body cavity of ripe females during spawning (Bestgen and Propst 1994).

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

<u>Legal Status</u>
The silvery minnow was federally listed as endangered under the ESA on July 20, 1994 (58 FR 36988, see U.S. Fish and Wildlife Service 1994). The species is also listed as an endangered species by the State of New Mexico. Primary reasons for listing the silvery minnow are

described below in the *Reasons for Listing/Threats to Survival* section. The Service designated critical habitat for the silvery minnow on February 19, 2003 (68 FR 8088). See description of designated critical habitat below

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

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

Designated Critical Habitat
The action area for this consultation does not occur within designated critical habitat because it is located on Pueblo of Sandia lands. However, a description of critical habitat is included here as it informs the overall status of the silvery minnow. The Service designated critical habitat for the silvery minnow on February 19, 2003 (68 FR 8088, see U.S. Fish and Wildlife Service 2003b). The critical habitat designation extends approximately 157 mi (252 km) from Cochiti Dam in Sandoval County, New Mexico, downstream to the utility line crossing the Rio Grande, which is a permanent identified landmark in Socorro County, New Mexico. In addition to the Pueblo of Sandia, the Pueblo lands of Santo Domingo, Santa Ana, and Isleta within this area are also not included in the critical habitat designation. Except for these Pueblo lands, the remaining portion of the silvery minnow's occupied range in the Middle Rio Grande in New Mexico is designated as critical habitat.

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

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

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

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

3 Substrates of predominantly sand or silt; and

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

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

Life History

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

The spawning strategy of releasing semi-buoyant eggs can result in the downstream displacement of eggs, especially in years or locations where overbank opportunities are limited. The presence of diversion dams (Angostura, Isleta, and San Acacia Diversion Dams) prevents the recolonization of upstream habitats (Platania 1995a) 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 may also be transported downstream to Elephant Butte Reservoir It is believed that none of these fish survive because of poor habitat and predation from reservoir fishes (U.S Fish and Wildlife Service 2010).

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

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

Population Dynamics

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

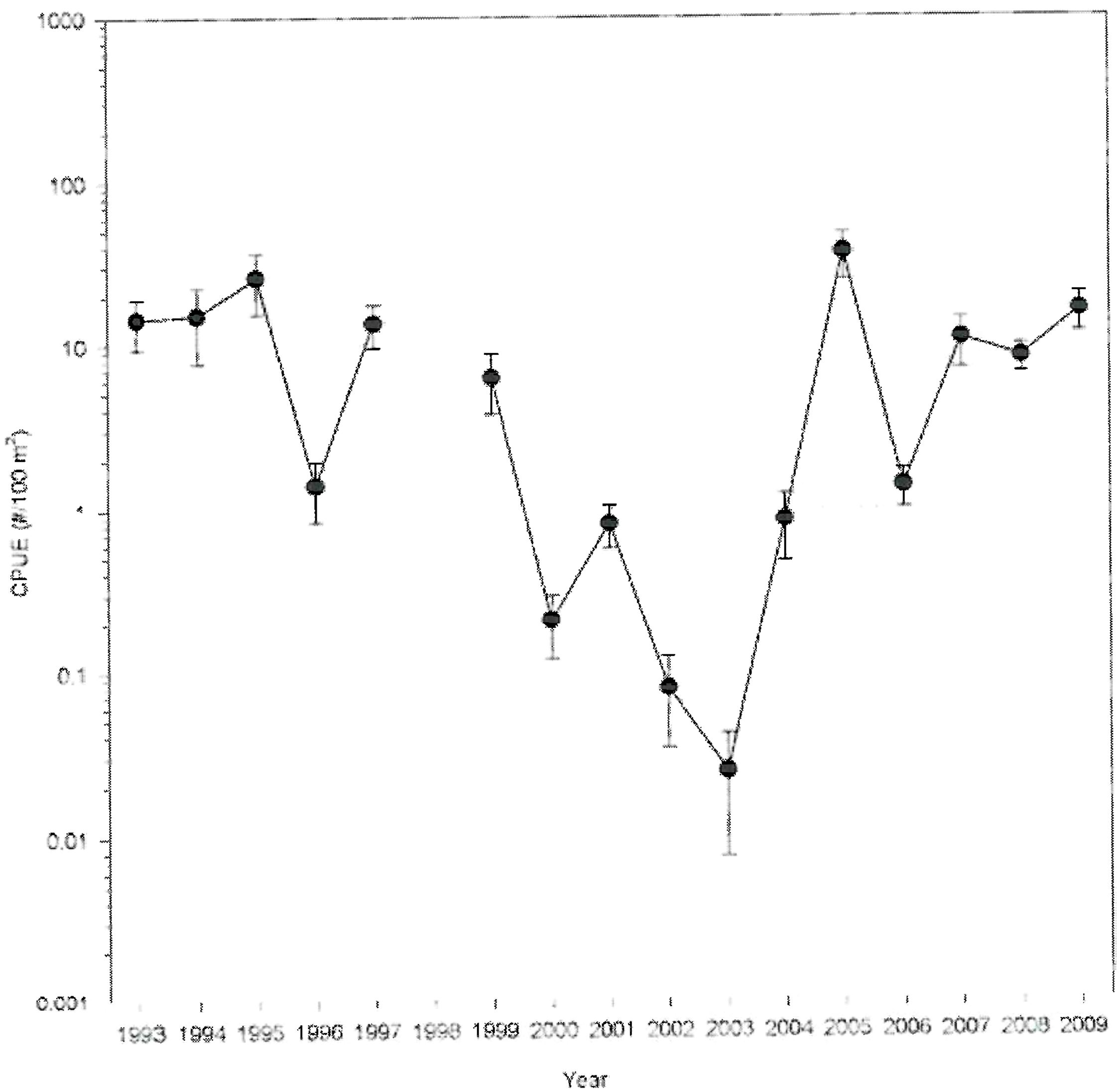
Platania (1995a) found that a single female in captivity could broadcast 3,000 eggs in eight hours. Females produce 3 to 18 clutches of eggs in a 12-hour period. The mean number of eggs in a clutch is approximately 270 (Platania and Altenbach 1998). In captivity, silvery minnows have been induced to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

Distribution and Abundance

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

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

Figure 1. Rio Grande Silvery Minnow Population Trends 1993-2009 based on October CPUE data



Long-term monitoring for the Rio Grande silvery minnow and fish communities in the Middle Rio Grande began in 1993 and has continued annually, with the exception of 1998 and the majority of 2009 This includes monitoring at river mile 200 near the action area. The most recent data from this site indicate a density of 18.29 minnows per 100 square meters within the action area in October of 2009 (Dudley and Platania 2009). The long-term monitoring of silvery minnows has recorded substantial fluctuations (order of magnitude increases and decreases) in the population. Rio Grande silvery minnow catch rates declined two to three orders of magnitude between 1993 and 2003, but then increased three to four orders of magnitude by 2005 and continue to fluctuate (see Figure 1). Population density data presented in Figure 1 indicate that silvery minnow catch rates – after declining through the early 2000's – have increased and are back at equivalent levels as those at the time of its listing as an endangered species in 1994 Population size is highly correlated with hydrologic conditions, particularly the magnitude and duration of the spring runoff (Dudley and Platania 2008b). 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.

Augmentation has likely sustained the silvery minnow population throughout its range. Over 1,136,100 silvery minnows have been released since 2002. Captively propagated and released fish supplement the native adult population, most likely prevented extinction during the extremely low water years of 2002 and 2003, and allowed for quicker and more robust population response in all reaches due to improved water conditions observed in recent years. Since 2001, the Angostura Reach has been the focus of augmentation efforts; however, beginning in 2008, augmentation shifted focus to the Isleta and San Acacia Reaches only (J Remshardt, Service, *pers. comm.* 2010). To accurately determine the success of these efforts and the continued effects of these releases, a period of five years (2008-2012) without intensive stocking is being evaluated. If the overall catch rate for Angostura Reach drops to below 0.1 silvery minnows per 100 m^2 during October, then augmentation will be re-initiated for this reach the following year (Remshardt 2008)

Middle Rio Grande Distribution Patterns

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 (the focus of augmentation efforts starting in 2001) may partially explain this pattern. Transplanting of silvery minnows rescued from drying reaches (approximately 802,700 through 2009) has also occurred since 2003, however, it is not possible to quantify the effects of those efforts on silvery minnow distribution patterns (J Remshardt, Service, *pers. comm.* 2010). Good recruitment conditions (i.e., high and sustained spring runoff) throughout the Middle Rio Grande during April and May followed by wide-scale drying in the

Isleta and San Acacia reaches from June-September in these years, may also explain the shift. High spring runoff (>3,000 cfs for 7-10 days) and perennial flow lead to increased availability of nursery habitat and increased survivorship in the Angostura Reach. In contrast, south of Isleta and San Acacia Diversion Dams, large stretches of river (30+ miles) have been routinely dewatered and young silvery minnows in these areas were either subjected to poor recruitment conditions (i.e., lack of nursery habitats during low-flows) or were trapped in drying pools where they perished.

In 2006, densities 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 2,300 cfs in 2006 (U.S. Geologic Survey 2010) and likely very little nursery habitat was inundated during critical recruitment times.

Distribution patterns for silvery minnows shifted again in 2007 and again in the recent years of 2008 and 2009. In 2007, population monitoring of silvery minnow densities indicated the highest densities occurred in the Angostura Reach. Available reports for 2008 indicated high recruitment, with silvery minnows occurring at all 20 sampling sites along the Middle Rio Grande, and flow conditions (i.e., strong runoff over an extended duration from May to July) leading to elevated numbers of this species. Sampling in October 2009 also indicated high recruitment, with silvery minnows present at 19 of the 20 sampling sites. The highest densities were noted to persist in the San Acacia Reach during the population monitoring census in October of both 2008 and 2009, and the lack of extensive river drying these years, combined with favorable spring flows, was likely an important factor in this distribution shift compared to 2007 (i.e., from highest densities in the Angostura Reach in 2007 to highest densities in the San Acacia Reach in 2008 and 2009)(Dudley and Platania 2008a, 2009).

Distribution and Abundance in Sandia Subreach

Monitoring for silvery minnows has been carried out on the Pueblo of Sandia since 2002, with approximate monthly sampling at five sites along the Sandia Subreach and additional locations close to Pueblo boundaries. Sampling sites include the Highway 550 Bridge (RM 203.8), the Pueblo of Sandia Bosque Line 14 (RM 202), the Sandia PNM Gasline (RM 200), at Lomitas Negras (RM 198.3), at Dixon Road (RM 195.5), and at the North Diversion Channel (North AMAFCA Channel) (RM 193.2) (Remshardt and Davenport 2003, Remshardt 2005, 2006, 2008, 2009 – all *as cited in* SWCA Environmental Consultants 2010). This monitoring is reported to show an increase in numbers of silvery minnow sampled in the Sandia subreach since 2002, with considerable annual and seasonal variation within and between sites (SWCA Environmental Consultants 2010). The most consistent seasonal peak was noted to occur during June–July, following silvery minnow spawning. This monitoring also indicated annual variation in the number and timing of peak counts, along with site to site variation (SWCA Environmental Consultants 2010)

Reasons for Listing/Threats to Survival
The silvery minnow was federally listed as endangered for the following reasons

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

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

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

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

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

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

7. Discharge of contaminants into the stream system from industrial, municipal, and agricultural sources also impact the species (U.S. Fish and Wildlife Service 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 was updated and revised, and a draft revised Recovery Plan (U.S. Fish and Wildlife Service 2007) was released for public comment on January 18, 2007 (72 FR 2301). Based on public comment and peer review comments on the 2007 draft Recovery Plan, the recovery criteria were revised and released for an additional period of public comment on April 9, 2009 (74 FR 16232). Incorporating public comments and peer review comments the Service received on the draft revision, the First Revision of the Rio Grande Silvery Minnow Recovery Plan was finalized and issued on February 22, 2010 (75 FR 7625) The revised Recovery Plan describes recovery goals for the Rio Grande silvery minnow and actions to complete these (U.S. Fish and Wildlife Service 2010). The three goals identified for the recovery and delisting of the Rio Grande silvery minnow are.

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

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

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

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

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

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

III. ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the ESA, when considering the effects of the action on federally listed species, we are required to take into consideration the environmental baseline. Regulations implementing the ESA (50 FR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal actions in the action area that have already undergone formal or early section 7 consultation, and the impact of State and private actions that are contemporaneous with the consultation in process. The environmental baseline defines the effects of these activities in the action area on the current status of the species and its habitat to provide a platform to assess the effects of the action now under consultation.

Several activities have contributed to the current status of the silvery minnow and its habitat in the action area, and are believed to potentially affect the survival and recovery of silvery minnows in the wild. These include the current weather patterns, changes to the natural hydrology of the Rio Grande, changes to the morphology of the channel and floodplain, water quality, storage of water and release of spike flows, captive propagation and augmentation, silvery minnow salvage and relocation, ongoing research, and past projects in the Middle Rio Grande.

Changes in Hydrology

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

Loss of Water in Minnow Habitat

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

Water management and use has resulted in a large reduction of suitable habitat for the silvery minnow Agriculture accounts for 90 percent of surface water consumption in the Middle Rio Grande (Bullard and Wells 1992). The average annual diversion of water in the Middle Rio Grande by the Middle Rio Grande Conservation District (MRGCD) was 535,280 af (65,839 hectare-meters) for the period from 1975 to 1989 (U.S Bureau of Reclamation 1993). In 1990, total water withdrawal (groundwater and surface water) from the Rio Grande Basin in New Mexico was 1,830,628 af, significantly exceeding a sustainable rate (Schmandt 1993). Water withdrawals have not only reduced overall flow quantities, but also caused the river to become locally intermittent or dry for extended reaches. Irrigation diversions and drains significantly reduce water volumes in the river. However, the total water use (surface and groundwater) in the Middle Rio Grande by the MRGCD may range from 28 – 37 percent (S.S Papadopulos & Associates, Inc. 2000; U.S. Geologic Survey 2002). A portion of the water diverted by the MRGCD returns to the river and may be re-diverted, sometimes more than once (Bullard and Wells 1992, 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 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 (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 was considered a wet year, with above average runoff and at least an average monsoon season. As a result, there was no river intermittency and no minnow salvage that year, which is the first time there has been no river drying since at least 1996

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, 2008, and 2009 were average or above average.

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

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

Changes in Channel and Floodplain Morphology

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

The active river channel within occupied habitat is also being narrowed by the encroachment of vegetation, resulting from continued low-flows and the lack of overbank flooding. The lack of flood flows has allowed non-native riparian vegetation such as salt cedar and Russian olive to encroach on the river channel (U.S. Bureau of Reclamation 2001). These non-native plants are very resistant to erosion, resulting in channel narrowing and a subsequent increase in water velocity. Higher velocities result in fine sediment such as silt and sand being carried away, leaving coarser bed materials such as gravel and cobble. Habitat studies during the winter of 1995 and 1996 (Dudley and Platania 1996), demonstrated that a wide, braided river channel with low velocities resulted in higher catch rates of silvery minnows, and narrower channels resulted in fewer fish captured. The availability of wide, shallow habitats that are important to the silvery minnow is decreasing. Narrow channels have few backwater habitats with low velocities that are important for silvery minnow fry and 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, including the action area. Water quality in the Middle Rio Grande varies spatially and temporally throughout its course primarily due to inflows of groundwater, as well as surface water discharges and tributary delivery to the river Factors that are known to cause poor fish habitat include temperature changes, sedimentation, runoff, erosion, organic loading, reduced oxygen content, pesticides, and an array of other toxic and hazardous substances. Both point source pollution (e.g., pollution discharges from a pipe) and non-point source pollution (i.e., diffuse sources) affect the Middle Rio Grande. Major point sources include waste water treatment plants (WWTPs) and feedlots. Major non-point sources include agricultural activities (e.g., fertilizer and pesticide application, livestock grazing), urban storm water run-off, and mining activities (Ellis *et al.* 1993).

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

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

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

Semi-volatile organic compounds are a large group of environmentally important organic compounds. Three groups of compounds, polycyclic aromatic hydrocarbons (PAHs), phenols, and phthalate esters, were included in the analysis of bed sediment collected by the USGS

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

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

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

Pipelines

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

Silvery Minnow Propagation and Augmentation

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

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

Since 2002, over 1,136,100 silvery minnows have been propagated and then released into the wild (J Remshardt, Service, *pers. comm.* 2010). 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 into the Middle Rio Grande by the FWCO since 2002 under a formal augmentation effort funded by the Collaborative Program. Eggs left in the wild have a very low survivorship and this ensures that an adequate number of spawning adults are present to repopulate the river each year While hatcheries continue to successfully spawn silvery minnow, wild eggs are collected to maximize 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 Through 2009, approximately 802,700 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. Caldwell et al (2009) reported on studies that assessed the physiological responses of wild silvery minnows subjected to collection and transport associated with salvage. The authors examined primary (plasma cortisol), secondary (plasma glucose and osmolality), and tertiary indices (parasite and incidence of disease) and concluded that the effects of stressors associated with river intermittency and salvage resulted in a cumulative stress response in wild silvery minnows. Caldwell et al. also concluded that fish in isolated pools experienced a greater risk of exposure and vulnerability to pathogens (parasites and bacteria), and that the stress response and subsequent disease effects were reduced through a modified salvage protocol that applied specific criteria to determine which wild fish are to be rescued from pools during river intermittency (Caldwell et al 2009).

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

Ongoing Research

There is ongoing research by the New Mexico FWCO and University of New Mexico (UNM) to examine the movement of silvery minnows. Augmented fish are marked with a visible fluorescent elastomer tag and released in large numbers in a few locations. Crews sample upstream and downstream from the release site in an attempt to capture the marked fish. Preliminary results indicate that the majority of silvery minnows disperse a few miles downstream. One individual was captured 15 7 mi (25.3 km) upstream from its release site (Platania *et al* 2003). Monitoring within 48 hours after the release of the 41,500 silvery minnows resulted in the capture of 937 fish. Of these, 928 were marked and 927 were collected downstream of the release point. The farthest downstream point of recapture was 9 4 mi (15 1 km). Studies are also currently underway by New Mexico FWCO using Passive Integrated Transponder (PIT) tags to examine silvery minnow movement and use of the fishway at the Albuquerque Bernalillo County Water Utility Authority's drinking water diversion site near the Alameda Bridge in Albuquerque. Preliminary results indicate use of the fishway and both upstream and downstream movement of minnows in that location.

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

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

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

Preliminary monitoring is currently being conducted to determine the success of the Big Bend reintroduction effort. It is expected to take years of monitoring to fully evaluate if the species is established and will remain viable in this river reach. Monitoring is expected to continue on a quarterly basis to document the success of the stocking program. Post-release monitoring of silvery minnows in proximity to the four release sites began in May 2009 Seven adult silvery minnows were found during monitoring in May, indicating at least some and likely many of the fish released in December 2008 survived over the winter No silvery minnows were found during monitoring efforts conducted in August or October 2009 In February 2010, 84 silvery minnows were found during monitoring efforts, which includes detection at three of the four monitoring locations. During spring 2010 monitoring, the Service documented the presence of Rio Grande silvery minnow eggs at two of the monitoring sites, indicating spawning activity within the 10(j) population. Future monitoring efforts will be targeted to document the survival of these eggs to larval, juvenile, and adult life stages, and the next release of 200,000 silvery minnows is scheduled for late October 2010

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

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

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

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

- In 1999, the Service consulted with Reclamation on a restoration project on the Santa Ana Pueblo in an area where the river channel was incising and eroding into the levee system. The second phase of this Rio Grande Restoration Project at Santa Ana Pueblo underwent consultation in 2008, and the Service anticipated that up to 36,688 silvery minnow would be harassed by construction, fill placement in the river, and movement of equipment, no mortality was expected.
- In 2003, the Service completed consultation with the City of Albuquerque on its Drinking Water Project, which involved the construction and operation of a new surface diversion north of the Paseo del Norte bridge, conveyance of raw water to a new treatment plant, transmission of treated water to customers throughout the Albuquerque metropolitan area, and aquifer storage and recovery The Service anticipated that up to 20 silvery minnows would be killed or harmed during construction, up to 25,000 eggs would be entrained each year at the diversion, and up to 7,000 larval fish would be harmed, wounded, or killed during operational activities.
- The Service consulted on habitat restoration projects on the Rio Grande near Albuquerque, including the 2005 Phase I, the 2007 Phase II, and the 2009 Phase IIa projects. Biological opinions addressing this prior habitat restoration work (see U.S. Fish and Wildlife Service 2005, 2007b, 2009) reviewed the effects on silvery minnows.

Incidental take authorized included 190 silvery minnows in 2005 due to harm or harassment, in 2007 the harassment of up to 3,365 minnows and mortality of up to 341 minnows, and in 2009 the harassment of up to 4,094 minnows and mortality of up to 187 silvery minnows.

- In 2006 and 2007, the Service consulted with Reclamation on the Bernalillo Priority Site Project and the Sandia Priority Site Project for river maintenance activities. The Bernalillo project was anticipated to kill no more than 42 silvery minnows due to channel modification, berm removal, dewatering, and sediment deposition in the river The most recent consultation on the Sandia Priority Site River Maintenance project concluded that direct take of up to 539 silvery minnows, and harassment of 53,853 silvery minnows would occur due to construction activities.
- In 2007, the Service determined through consultation with the Corps on the Rio Grande Nature Center Habitat Restoration Project, that up to 10 silvery minnows would be harassed during construction and that up to 154 silvery minnows would be killed due to entrapment in constructed channels.
- In 2007, consultation on the Corrales Siphon River Maintenance Project concluded that the harassment of up to 244 silvery minnows would occur during construction, fill placement in the river, and movement of equipment.
- In 2008, the Service concluded an intra-Service consultation on the Pueblo of Sandia Management of Exotics for the Recovery of Endangered Species (MERES) Habitat Restoration Project. The Service anticipated that up to 2,449 silvery minnows would be harassed due to construction, and up to 770 killed due to potential entrapment in channels.
- In 2009, the Service concluded a consultation with the Bureau of Reclamation on the Pueblo of Sandia Bosque Rehabilitation Project, which concluded that up to 85 silvery minnows would be harassed during the proposed restoration activities, and up to 269 would be killed due to potential entrapment in a restored channel.

Summary of the Environmental Baseline

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

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

Various conservation efforts have been undertaken in the past and others are currently being carried out in the Middle Rio Grande for the benefit of the silvery minnow Population monitoring indicates that densities of this species have increased compared to extremely low levels seen in 2002–2003 However, current data show catch rates have only recovered to levels comparable to the time of its listing as an endangered species in 1994. The threat of extinction for the silvery minnow continues because of increased reliance on captive propagation, the fragmented and isolated nature of currently occupied habitat, and the absence of the silvery minnow throughout most of its historic range.

IV. EFFECTS OF THE ACTION

Regulations implementing the ESA (50 FR 402.02) define the *effects of the action* as the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, which will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur Interrelated actions are those that are part of a larger action and depend on the larger action for their justification; interdependent actions are those that have no independent utility apart from the action under consideration. The following section describes the anticipated effects on silvery minnow resulting from the proposed action. Designated critical habitat for the silvery minnow does not occur in the action area and therefore, no effects are anticipated.

Effects on Silvery Minnow

As described earlier, the action area for this consultation is defined as the entire width of the 100-year floodplain of the Rio Grande encompassing the disturbance zone boundaries from RM 194 to RM 196, which is located in the downstream portion of the Sandia subreach. Monitoring data are available from river mile 200, which is the closest monitoring site to the action area, and indicate that minnows are likely to occur during habitat restoration activities and may be affected by the proposed action. Recent monitoring data (October 2009) indicate a density of 18.29 minnows per 100 m^2 at that monitoring location (Dudley and Platania 2009), which we use here as the expected density during the proposed action.

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

However, we also expect the proposed action may generate adverse effects on silvery minnows as a result of several different activities: (1) construction of the proposed restoration treatments in wetted areas, (2) proposed river crossings and transit by equipment to access restoration sites, and (3) indirect effects beyond the construction period due to potential stranding of silvery minnows in restored bankline/backwater features.

Short-term adverse effects on silvery minnows are expected due to in-water disturbance during construction and river crossings. We expect silvery minnows will be present during these activities and will be harassed as a direct effect of the proposed action. The Service has defined take by harassment as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (see 50 CFR 17.3). Minnows are expected to exhibit an avoidance response to construction activities and river crossings. Avoidance behavior, or fleeing from the disturbance, represents a disruption in normal behaviors and an expenditure of energy that an individual silvery minnow would not have experienced in the absence of the proposed action. However, this form of harassment is expected to be short in duration, with pre-exposure behaviors to resume after fleeing the disturbance. The potential number of silvery minnows affected within the immediate vicinity of the equipment is minimized, as we expect an initial flight response at the onset of activities, and sustained avoidance during the short duration of construction work (one to ten days per individual site) for each restoration activity. Conservation measures used during the proposed action will help to minimize disturbance, for example by operating equipment on riverbanks, bars, and islands whenever possible to avoid contact with silvery minnow habitats, by using amphibious equipment when in-water; by using silt fencing and allowing a downstream opening for silvery minnow escapement as sediment placement begins in the upstream portion, and by minimizing river crossings and access paths through wetted portions of the channel. In addition, the applicable work window (i.e., not during April 15 to August 15) will avoid adverse effects on pre-spawn and spawning adult silvery minnows, as well as YOY during early growth (i.e., until large enough for sufficient mobility and resilience). Conservation measures and best practices in place for operation of equipment also minimize risk of adverse effects due to accidental introduction of hydrocarbon contaminants such that we expect it to be discountable. As a result, given the mobility of silvery minnows, the limited area and duration where effects are expected, and the proposed work window, we do not expect the anticipated avoidance response to construction and river crossings – or the timing of that response relative to the species' life history – will lead to any long-term significant effects on silvery minnow behaviors such as breeding, feeding, or sheltering.

Adverse effects on silvery minnows may also occur due to sediment disturbance by equipment and placement of materials in the channel. These activities may affect water quality, causing localized increases in turbidity and suspended sediments. Direct effects from excess suspended sediments on a variety of fish species have included alarm reactions, abandonment of cover, avoidance responses, reduction in feeding rates, increased respiration, physiological stress, poor condition, reduced growth, delayed hatching, and mortality (Newcombe and Jensen 1996). In addition, indirect effects from sediment mobilization in the channel are possible, including the potential smothering and mortality of algae and aquatic invertebrates, depressed rates of growth, reproduction, and recruitment or reduced physiological function of invertebrates. Decreases in primary production are also associated with increased sedimentation and turbidity and can produce negative cascading effects through depleted food availability for zooplankton, insects, mollusks, and fish. We expect silvery minnows will exhibit an avoidance response to construction activities as described earlier Conservation measures will help minimize the risk due to dispersal of suspended sediments (e.g., silt fences during placement of sediments and during river crossings, water quality monitoring) and restrict the effects of suspended sediments to within the action area. Therefore, beyond the initial avoidance response to activities, we do not expect suspended sediments will result in significant direct effects on silvery minnows. Those same conservation measures are also expected to reduce the risk of indirect effects on silvery minnows from these activities, in particular because protective silt fencing will not be removed until water quality has returned to within 10 percent of the original levels.

Indirect effects on silvery minnows may also result from the proposed restoration treatments. Beyond the construction period, harassment and mortality of silvery minnows may occur due to potential stranding of fish in restored features. For example, high flows may deposit sediment in or near restored features resulting in isolated pools containing silvery minnows. We expect silvery minnows may become stranded in these isolated pools and die. Although we expect the majority of risk for entrapment of silvery minnows as flows recede will occur in ephemeral channel features that are not part of the proposed action, such entrapment has also been noted to occur in other types of restored features on an infrequent basis (e.g., bankline scallop features similar to the proposed bankline benches/backwaters). Therefore, we cannot discount the probability that some entrapment mortality may occur as an indirect effect of the proposed action.

Given our assessment of anticipated effects on silvery minnows, and the available information on disturbance zones for each activity (see Table 1), we expect silvery minnows will be harassed by construction activities related to habitat restoration treatments in wetted areas over a total area of 39.02 acres (157,908 m^2) The best available information on silvery minnow density in the action area for this consultation indicates 18.29 silvery minnows per 100 m^2 Therefore, we expect that 28,882 silvery minnows would be harassed during construction. We also expect river crossings and transit by equipment will affect silvery minnows due to harassment over a total area of 437,580 ft^2 (40,653 m^2), resulting in harassment of 7,436 silvery minnows. Potential entrapment and stranding of silvery minnows in restored features is expected to result in take of this species due to harassment and mortality Given that no ephemeral channels will be constructed or restored, and the low occurrence of such mortalities in other restoration treatments (e.g., bankline/backwater features) during previous habitat restoration projects, we assume the entrapment take will be very low Given the available information of one mortality at a bankline feature during prior restoration work, we assume one mortality may occur at each bankline/backwater feature during the proposed action. With six such sites proposed, we therefore expect that entrapment-related take would occur resulting in 6 silvery minnow mortalities due to indirect effects from stranding.

V. CUMULATIVE EFFECTS

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

- Increases in development and urbanization in the historic floodplain that result in reduced peak flows because of the flooding threat. Development in the floodplain makes it more difficult, if not impossible, to transport large quantities of water that would overbank and create low velocity habitats that silvery minnows prefer 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 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 Pueblo of Sandia Riverine Habitat Restoration Project, as proposed in the May 2010 BA and subsequent correspondence with the Service during this consultation, is not likely to jeopardize the continued existence of the silvery minnow We expect the level and type of take associated with this project is unlikely to appreciably diminish the population in the Angostura Reach, or the species as a whole We expect harassment of minnows may occur, but the duration and intensity of this effect will be short-term, with no long-term significant effects on silvery minnow behaviors such as breeding, feeding, or sheltering. Any risk of more serious effects or repeated harassment is minimized due to measures employed during the proposed action. A small number of mortalities may occur due to stranding in restored sites as peak flows recede; however, we do not expect this to result in any significant long-term effects on the population in the Angostura Reach or for the species as a whole.

INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary, and must be undertaken by Reclamation so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (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, Reclamation 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 Pueblo of Sandia Riverine Habitat Restoration Project will be implemented as proposed. Take of silvery minnows is expected in the form of harassment and mortality due to the proposed habitat restoration activities, and is restricted to the action as proposed. If actual incidental take meets or exceeds the predicted level, Reclamation must reinitiate consultation.

The Service anticipates that take in the form of harassment may affect up to 36,318 silvery minnows due to proposed construction and river crossings, as well as the harassment and mortality of up to 6 silvery minnows due to potential stranding in restored features after peak flows recede. We base these figures on the best available information on minnow density in the area to be disturbed by the proposed activities.

Effect of Take

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

Reasonable and Prudent Measures

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

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

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

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

Terms and Conditions

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

To implement RPM 1, Reclamation shall

1 Ensure that all restoration treatment work is conducted prior to the initiation of silvery

minnow spawning, i.e., within the timeframes described in this biological opinion (not between April 15 and August 15).
2. Ensure that conservation measures described in this biological opinion are implemented, including those pertaining to equipment and operations, staging and access, water quality, and others.
3. Ensure that the presence/absence of silvery minnows is monitored at construction sites by a permitted biologist, and use adaptive management to modify activities and minimize adverse effects.
4. Implement the project-specific monitoring plan provided to the Service for this consultation, and as appropriate provide to the Service a copy of the full monitoring plan once developed.
5. As appropriate, report to the Service the results and effectiveness of restoration treatments.
6. Report to the Service findings of injured or dead silvery minnows.
7. Monitor the implementation of RPM 1 and its associated Terms and Conditions.

To implement RPM 2, Reclamation shall

1. Ensure that conservation measures described in this biological opinion are implemented, including those pertaining to water quality monitoring, equipment and operations, and staging and access.
2. Schedule, to the extent possible, river crossings during dry or frozen soil conditions.
3. Report to the Service any significant spills of fuels, hydraulic fluids, and other hazardous materials.
4. Monitor the implementation of RPM 2 and its associated Terms and Conditions.

To implement RPM 3, Reclamation shall

1. Encourage adaptive management of flows and conservation of water to benefit listed species.
2. Work to further conduct habitat/ecosystem restoration projects in the Middle Rio Grande to benefit the silvery minnow

CONSERVATION RECOMMENDATIONS

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

1. Evaluate the effectiveness of habitat restoration techniques implemented in the Middle Rio Grande for ESA-listed species, including an evaluation of site longevity and benefits

provided to species.
2. Implement recovery actions identified in the southwestern willow flycatcher and Rio Grande silvery minnow recovery plans.

RE-INITIATION NOTICE

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

In future correspondence on this project, please refer to consultation number 22420-2010-F-0083. 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.

Lori Robertson
for Wally Murphy

cc:
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Figure 2. Pueblo of Sandia Treatment Design for Sites I8, I7, C1, I6, B2, and I5 (from May 2010 BA)

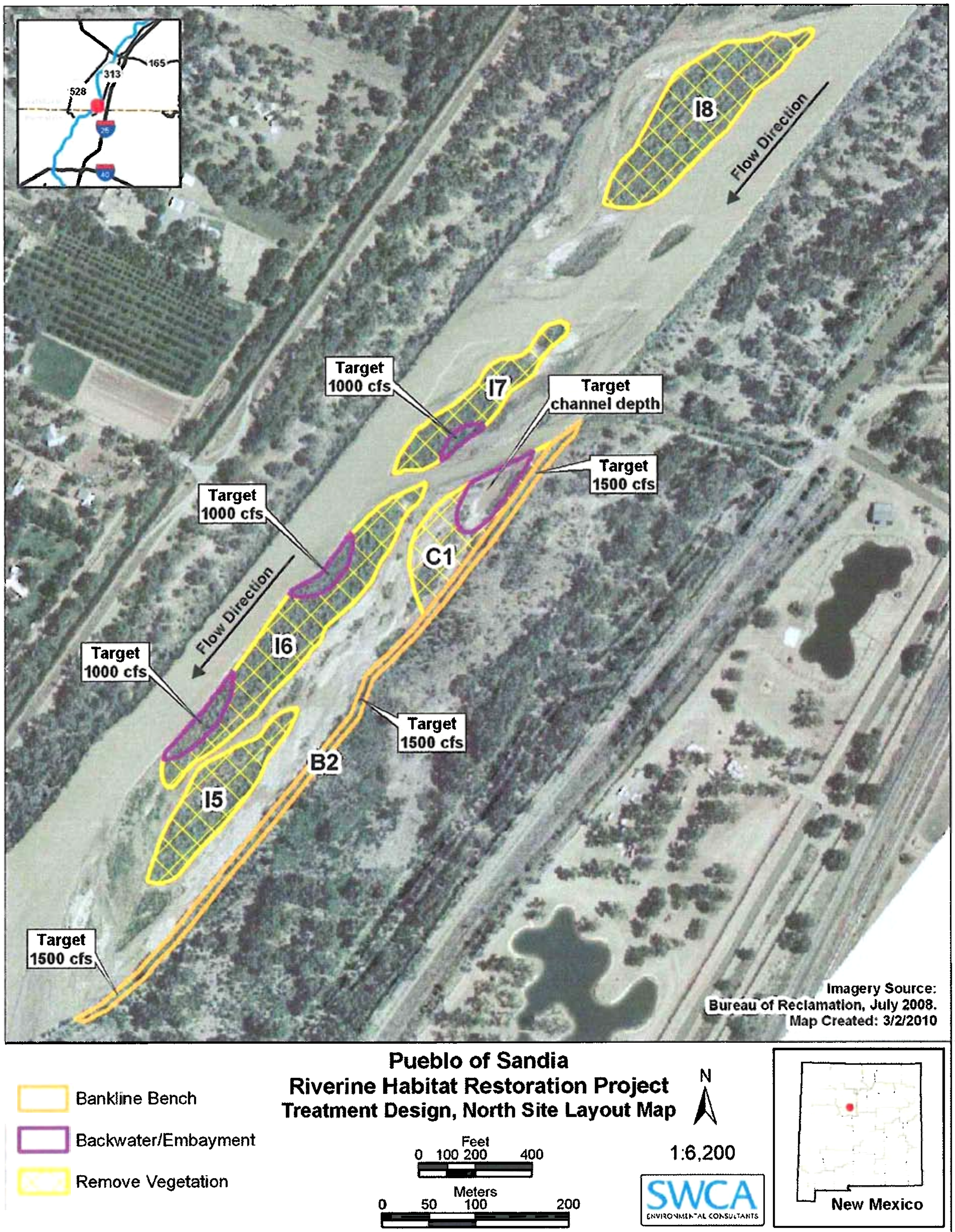

Figure 3. Pueblo of Sandia Treatment Design for Sites I4 and B1 (from May 2010 BA)

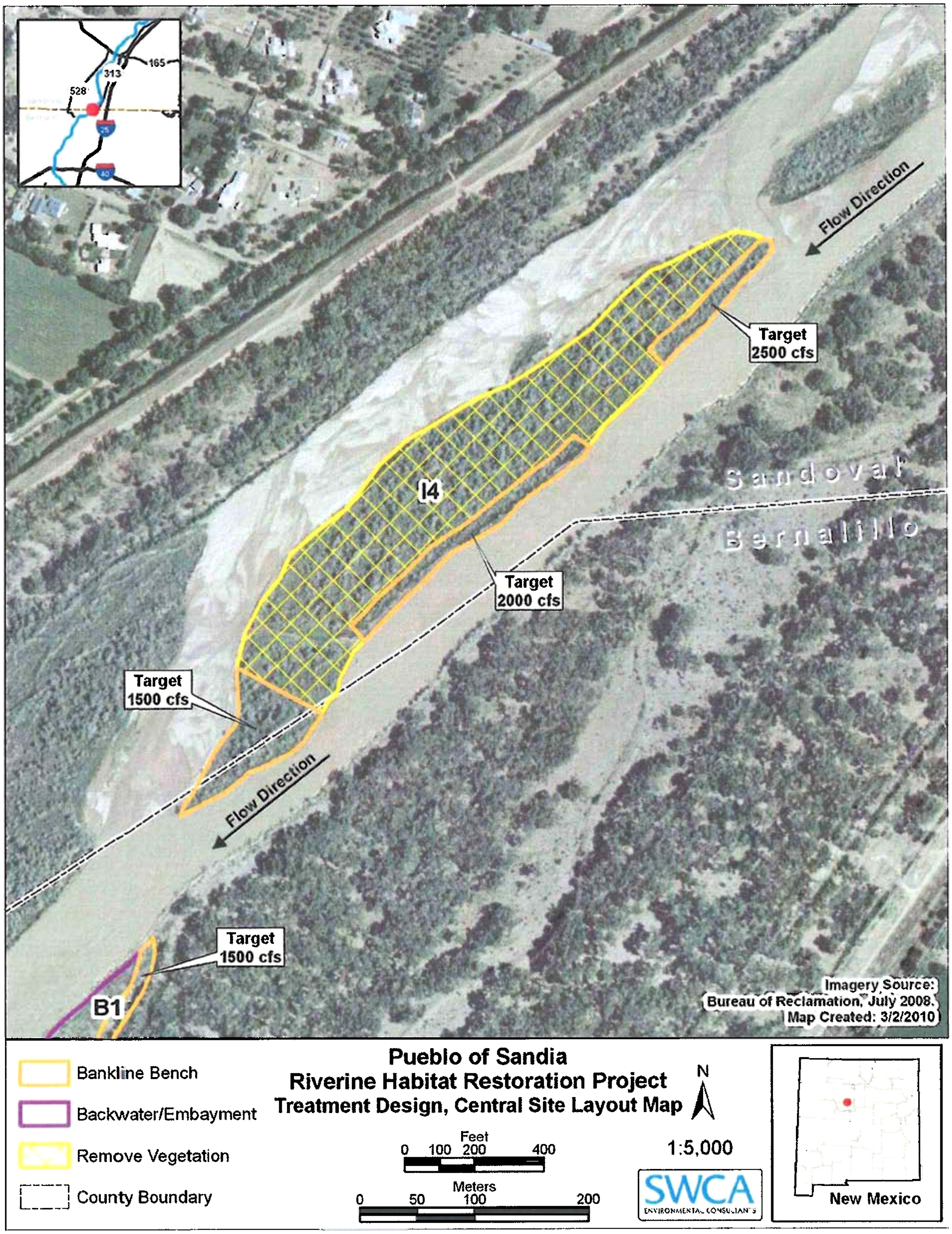

Figure 4. Pueblo of Sandia Treatment Design for Sites I4, B1, I3a, I3, and I2 (from May 2010 BA)