



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

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Cons. # 22420-2006-F-02

### Memorandum

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

From: State 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  
Middle Rio Grande Riverine Habitat Restoration Project proposed by the  
Interstate Stream Commission

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion on the effects of the action described in the Biological Assessment for the Middle Rio Grande Riverine Habitat Restoration Project for the Albuquerque Reach of the Rio Grande in Bernalillo County, New Mexico. The duration of this action is from the issuance of this biological opinion through December 2006. This biological opinion concerns the effects of the action on the endangered Rio Grande silvery minnow (*Hybognathus amarus*) (silvery minnow), the endangered southwestern willow flycatcher (*Empidonax trailli extimus*) (flycatcher), and the threatened bald eagle (*Haliaeetus leucocephalus*) (eagle). Your request for formal consultation, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 531 *et seq.*), was received on September 15, 2005. The US Bureau of Reclamation (Reclamation) is the lead federal agency in this consultation. The New Mexico Interstate Stream Commission (ISC) is the applicant. An applicant is defined as any entity who requires formal approval or authorization from a Federal agency as a prerequisite to conducting the action [50 CFR §402.2].

This biological opinion is based on information submitted in the biological assessment dated September 2005; meetings between Reclamation, the ISC 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).

You have determined that the proposed project may affect, is not likely to adversely affect, the eagle and the flycatcher. We concur with these determinations for the following reasons:

**Eagle**

The proposed project includes requirements that the project area be surveyed daily prior to activity. If, as a result of those surveys, an eagle is observed within 0.25 mi upstream or downstream of the active project site in the morning before project activity starts, or following breaks in project activity, the contractor will suspend all activity until the bird leaves of its own volition, or a Reclamation or ISC biologist, in consultation with the Service, determines that the potential for harassment is minimal. If an eagle arrives during construction activities or is beyond that distance, construction need not be interrupted. If eagles are found consistently in the immediate project area during the construction period, Reclamation and/or the applicant will contact the Service to determine whether formal consultation is necessary. It is expected that implementation of these actions will reduce effects to the eagle to an insignificant level.

**Flycatcher**

Vegetation removal on the restoration sites will disturb a total of approximately 22.4 acres, mostly composed of native species or mixed native and exotic riparian species less than 15 feet (ft) tall. Site surveys have determined that this habitat is not currently suitable for flycatcher nesting. To reduce effects to potentially occupied habitat (nesting or migratory), vegetation removal work will occur outside the migratory bird nesting season (April 15 to August 15).

The remainder of this biological opinion will deal with the effects of implementation of the proposed action on the silvery minnow.

**Consultation History**

A draft Biological Assessment was provided to the Service to review on August 11, 2005. A final Biological Assessment was received on September 14, 2005. A draft Biological Opinion was provided to Reclamation, the ISC, and per Secretarial Order 3206, to the Pueblo of Sandia for review on November 3, 2005.

**BIOLOGICAL OPINION**

**I. DESCRIPTION OF THE PROPOSED ACTION**

**Purpose and Objective**

The New Mexico Interstate Stream Commission (ISC) seeks to implement Element S of the reasonable and prudent alternative (RPA) in the Service's March 2003 biological and conference opinions on the effects of actions associated with the Programmatic Biological Assessment of Bureau of Reclamation's Water and River Maintenance Operations, the U.S. Army Corps of Engineers' Flood Control Operations, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico and to address priority habitat restoration goals of the Middle Rio Grande Endangered Species Act Collaborative Program (Collaborative Program). The Middle Rio Grande Riverine Habitat Restoration Project (restoration project) will use a phased

approach to restoration activities to satisfy the Federal requirements of RPA Element S, which specifies that agencies, in coordination with the Service, shall "...conduct habitat/ecosystem restoration projects in the Middle Rio Grande to increase backwaters and oxbows, widen the river channel, and/or lower river banks to produce shallow water habitats, overbank flooding, and regeneration of stands of willows and cottonwood to benefit the silvery minnow, the flycatcher, or their habitats" (U.S. Fish and Wildlife Service 2003). The objective of the restoration project is to increase measurable habitat(s) complexity that supports various life stages of silvery minnows by facilitating lateral migration of the river across islands, and bars and river banks during various mid-level and high flows (U.S. Bureau of Reclamation 2005).

This biological opinion addresses Phase 1 of the restoration project, beginning in November 2005 and ending in December 2006. Phase 1 of the restoration project will use a set of restoration techniques on selected areas, monitor and evaluate the outcomes, and incorporate the results into subsequent planned activities. Subsequent phases will continue through 2009, but are not included in this opinion.

### **Project**

Four restoration/rehabilitation techniques will be used to create aquatic habitat within three subreaches of the Albuquerque Reach of the Middle Rio Grande: North Diversion Channel, Central/I-40 Channel, and South Diversion Channel (see Figure 1). Techniques include island, bar, and bank line modification. Bank lowering and scouring techniques are intended to provide for overbank flooding and allow the river to create ephemeral nursery habitat for retention of silvery minnow larvae and eggs. Island modification will increase habitat connectivity to alleviate adverse changes to silvery minnow critical habitat and improve habitat quality and quantity (U.S. Fish and Wildlife Service 2003). The techniques were selected for their theoretical ability to improve available over-wintering, minnow egg retention, and larval-rearing habitat for the minnow at flows ranging from 500 to 3000 cfs (see Table 1 for proposed techniques).

Specific sites on vegetated islands, bars, and riverbanks within each of the three subreaches are proposed for testing the efficiency of the restoration techniques (see Table 2). Treated areas include approximately 24 acres that will be root-plowed and re-contoured, plus an undetermined number of acres of new low-flow habitat that will be created adjacent to the treated sites using spoil sediments (U.S. Bureau of Reclamation 2005). Reclamation's September 14, 2005 biological assessment provides detailed maps of proposed sites.

#### *North Diversion Channel Subreach*

Four treatment islands have been identified for evaluation in the subreach between the North Diversion Channel and the Alameda Bridge, referred to as the North Diversion Channel subreach. Three types of island treatments are planned for this subreach, as well as one site for bank scouring and scalloping. An undisturbed (reference) island has been identified and mapped for comparison with treatment islands. Three ephemeral channels will be also be constructed.

### *Central/I-40 Channel Subreach*

Four sites for vegetated island evaluation and modification are planned within the I-40 to Central Avenue subreach. Three locations for bank scouring and scalloping, and one ephemeral channel site is also proposed.

### *South Diversion Channel Subreach*

Three treatment islands have been identified for evaluation in the subreach between the Rio Bravo Bridge and the South Diversion Channel, referred to as the South Diversion Channel subreach. One island within this subreach will be undisturbed and monitored for comparison with treatment islands. Four ephemeral channels and five bank scours and scallops will also be implemented within the South Diversion Channel subreach.

### Vegetated Island Modification and Evaluation

Three methods of modification are planned for 11 islands (17.6 acres) within the 3 subreaches. For each method, a pre-determined portion of the surface area of the island will be recontoured, removing sediments and vegetation (U.S. Bureau of Reclamation 2005). Unwanted woody debris and sediment generated from the treatments will be used to create low elevation habitat adjacent to the islands. Results of the island modification will be monitored, evaluated, and compared to reference islands for up to 24 months to determine the effectiveness of the treatments. Following monitoring, any unvegetated area will be replanted with native species as appropriate.

### *Island Treatment #1*

Island treatment #1 includes the removal of woody vegetation and sediments on the upstream third of the island. Non-native vegetation will be cut to a depth sufficient to eradicate the species, and sediments will be removed to a depth that will allow for inundation at moderately high flows (2,000 to 3,000 cfs). Removed sediment will be placed alongside the island to create habitat that will inundate at lower flows. The area to be filled will be temporarily cut off from the channel using a silt curtain with a chain-weighted bottom. The downstream end of the enclosure will be left open so that water contained inside and any aquatic species can escape (see Figure 2) (U.S. Bureau of Reclamation 2005). Sediments from the root plowing treatment area will be pushed into the enclosure beginning at the upstream end, and water will be displaced towards the downstream end. The sediment will be used to build up the area to an elevation that will receive inundation at a range of flows from 750 to 1000 cfs. The silt curtain will be removed after the sediments have been compacted in place. The newly created low elevation habitat will not be revegetated artificially. Revegetation should occur naturally with hydrophytic plants from the root material present in the sediment. No additional modifications will be made. Two islands, one within the North Diversion Channel subreach and one within the South Diversion Channel subreach, will receive this treatment method.

### *Island Treatment #2*

Island treatment #2 consists of removing woody vegetation and sediments on the upstream third of the islands, similar to island treatment #1. An undisturbed vegetative

buffer will be left in place on the upstream portion of the island to partially protect the island from scour and to create shallow water eddies behind the buffer (U.S. Bureau of Reclamation 2005). Low elevation habitat will be created using the disturbed sediment from the island, as described in island treatment #1. Two islands, one within the North Diversion Channel subreach and one within the South Diversion Channel subreach, will receive this treatment method.

#### *Island Treatment #3*

Island treatment #3 consists of the removal of non-native vegetation on the upstream half of the island. This disturbed portion of the island will then be recontoured with three or more terraces stepping down in approximately one-foot increments from the highest natural elevation of the island to the water level (See Figure 3) (U.S. Bureau of Reclamation 2005). Native vegetation will be replanted on the newly formed terraces to provide habitat diversity.

Low elevation habitat will be created using the disturbed sediment from the island, as described in island treatment #1. Seven islands within the three subreaches will receive this treatment method.

#### Bank Scouring and Scalloping

Artificial scouring and scalloping (areas cut into the island or point bar banks where the thalweg comes into contact with the bank) will be constructed on approximately 3.3 acres along the bankline at eight sites. Construction of scours and scallops consists of the removal of vegetation and sediments along the bank adjacent to the thalweg to a depth that will allow water to enter at flows of 2,000 cfs and higher. If construction occurs near the current water level in the channel, a silt barrier will be placed 2 feet from the wetted perimeter of the island or point bar bank to prevent any sediments from falling into the channel (U.S. Bureau of Reclamation 2005). Sediments and woody debris will be placed on undisturbed adjacent areas of the island or point bar, to a depth not to exceed two feet. No sediments will be placed in the wetted channel.

#### Ephemeral channels:

Ephemeral channels (1.1 acres) will be created at sites on islands and point bars (See Figure 4). Construction of ephemeral channels consists of the removal of vegetation and sediments along the proposed channel at depths that allow water to enter at flows of 2,000 cfs and higher. Construction may also include mesohabitats, such as pools and backwaters with little or no flow. Removed sediments and woody debris will be placed on undisturbed adjacent dry land on the island or riverbank. No fill will be placed in the wetted channel.

#### Equipment, Staging, and Access

Equipment proposed for construction on point bars and banks that are accessible from shore include a dozer, excavator, backhoe, and root plow of standard width. An amphibious Caterpillar 325 excavator has been selected for access to islands and less accessible bars and banks. Such low impact amphibious equipment is used to keep

ecological disturbance to a minimum. Reclamation has outlined specifications to be met by the construction contractor in order to avoid or reduce impacts to silvery minnows and its habitat (Reclamation 2005, p. 25).

The South Diversion channels will serve as staging and access areas for the South Diversion subreach. Access at the North Diversion channel will, in consultation with the Pueblo of Sandia, be routed to minimize or avoid travel in wetted pools or flowing water. Access and staging areas for the Central Avenue/I-40 Channel subreach will utilize existing roads and existing disturbed areas at Campbell Road. No vegetation will be removed, and construction will occur outside the southwestern willow flycatcher breeding season. The amphibious caterpillar will access the river using the North and South Diversion Channels. An amphibious personnel carrier or airboat will be used to transfer equipment and personnel to the excavator.

#### Conservation Measures

The applicant has included conservation measures as part of the proposed action, as a means of minimizing adverse effects to silvery minnows, flycatchers, and eagles within the action area. Environmental commitments include:

- 1) Impacts to terrestrial habitats will be minimized by using existing roads and cleared staging areas. In general, equipment operation will take place in the most open area available and will minimize damage to native vegetation.
- 2) Silvery minnow critical habitat encompasses the entire project area (FR 2003) in the river channel. Best management practices will be enforced to minimize potential impacts to the silvery minnow from direct construction impacts and erosional inputs into the river during periods of work.
- 3) To avoid direct impacts to migratory birds protected by the Migratory Bird Treaty Act (16 U.S.C. 703, et seq.), construction and clearing of vegetated islands will be scheduled between August 15 and April 15, outside of the normal breeding season for most avian species. Should vegetation removal be required during the breeding season, pre-construction breeding bird surveys will be conducted to assure that no breeding birds are affected. Any positive preconstruction survey results or observation of affected species during construction will be coordinated with Service to discuss nesting area avoidance.
- 4) To mitigate potential short-term construction impacts to flycatcher, clearing of dense woody vegetation will be avoided and conducted only between August 15 and April 15. Should vegetation removal be required during the breeding season, pre-construction breeding bird surveys will be conducted to assure that no breeding birds are affected. Any positive preconstruction survey results or observation of affected species during construction will be coordinated with the Service to discuss nesting area avoidance.

- 5) Construction will cease in the location if flycatcher is observed, and the Service would be notified.
- 6) The shortest crossing path will be used to cross the North Diversion Channel and South Diversion wetted channel, and silt fencing will be installed downstream of all wetted crossings. Water quality will be monitored before silt fencing is installed, and the fencing will not be removed until water quality has returned to within 10 percent of the values measured during preconstruction monitoring.
- 7) If a bald eagle is observed within 0.25 mile of the proposed project area in the morning when activity starts, or arrives during breaks in activity, the contractor would be required to suspend all construction activity until the bird leaves on its own volition, or until the project biologist, in consultation with the Service, determines that the potential for harassment is minimal. However, if a bald eagle arrives during construction activities, or is observed more than 0.25 mile from the construction site, activity would not be interrupted.
- 8) Clean Water Act (CWA) compliance is required for all aspects of the Project, and since most work associated with the Proposed Action will be completed within aquatic areas regulated by this law, a 404 permit is required. A state water quality certification permit under Section 401 of the CWA is also required, including consultation with the Pueblo of Sandia. The 404 and 401 permitting processes will be completed prior to commencement of the Proposed Action.
- 9) Storm water discharges under the Proposed Action will be limited to ground-disturbing activities outside the mean high water mark. All such activities would be evaluated for compliance with National Pollutant Discharge Elimination System (NPDES) guidance, an NPDES permit, or a Storm Water Pollution Prevention Plan.
- 10) Additional evaluation of the net depletion effects of each proposed technique will be included in the monitoring of project elements. Restoration techniques that are determined to increase depletions to the surface waters of the Rio Grande will be curtailed.
- 11) All necessary permits for access points, staging areas, and study sites will be acquired prior to construction activity. Access coordination is required with the City of Albuquerque Open Space Division, the Middle Rio Grande Conservancy District (MRGCD), Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), Reclamation, and the Pueblo of Sandia.

## **Action Area**

The action area is defined as the area from the Angostura Diversion Dam to the Isleta Diversion Dam and the entire width of the 100 year floodplain within that reach. Silvery minnow that are present at island modification, scouring, and scalloping activity sites, are likely to be affected by the presence and operation of construction equipment, when vegetation and sediment are mobilized below the water line, and during the placement of sediment and woody debris adjacent to the islands.

## II. STATUS OF THE SPECIES

### Species Description

The silvery minnow currently occupies a 170-mile (275 km) reach of the middle Rio Grande, New Mexico, from Cochiti Dam, Sandoval County, to the headwaters of Elephant Butte Reservoir, Socorro County (U.S. Fish and Wildlife Service 1994). The silvery minnow is a stout minnow, with moderately small eyes, a small, sub-terminal mouth, and a pointed snout that projects beyond the upper lip (Sublette *et al.* 1990). The back and upper sides of the silvery minnow are silvery to olive, the broad mid-dorsal stripe is greenish, and the lower sides and abdomen are silver. Maximum length attained is about 3.5 inches (90 millimeters [mm]). The only readily apparent sexual dimorphism is the expanded body cavity of ripe females during spawning (Bestgen and Propst 1994).

The silvery minnow has had an unstable taxonomic history, and in the past was included with other species of the genus *Hybognathus* due to morphological similarities. Phenetic and phylogenetic analyses corroborate the hypothesis that it is a valid taxon, distinctive 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 jemezianus*), phantom shiner (*Notropis orca*), and bluntnose shiner (*Notropis simus simus*) are either extinct or have been extirpated from the Middle Rio Grande (New Mexico Game and Fish Department 1998b, Bestgen and Platania 1991).

### Legal Status

The silvery minnow was federally listed as endangered under the ESA on July 20, 1994 (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 involved a number of factors, described in the Reasons for Listing section (below).

Critical habitat was proposed for the silvery minnow on June 6, 2002 (67 FR 39205) and was finalized on February 19, 2003 (68 FR 8088). The critical habitat designation extends approximately 157 mi (252 km) from Cochiti Dam, Sandoval County, New Mexico downstream to the utility line crossing the Rio Grande, a permanent identified landmark in Socorro County, New Mexico. The critical habitat designation defines the lateral extent



(width) as those areas bounded by existing levees or, in areas without levees, 300 ft (91.4 meters) or 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 exterior boundaries of the critical habitat designation, but not considered critical habitat include: developed flood control facilities, existing paved roads, bridges, parking lots, dikes, levees, diversion structures, railroad tracks, railroad trestles, water diversion and irrigation canals outside of natural stream channels, the Low Flow Conveyance Channel, active gravel pits, cultivated agricultural land, and residential, commercial, and industrial developments. The Pueblo lands of Santo Domingo, Santa Ana, Sandia, and Isleta within this area are not included in the critical habitat designation. Except for these Pueblo lands, the remaining portion of the silvery minnow's occupied range in the Middle Rio Grande in New Mexico is designated as critical habitat (68 FR 8088).

### **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 per second, 10 centimeters/second [cm/sec]) areas over silt or sand substrate that are associated with shallow (< 15.8 inches, 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 silvery minnow (Sublette *et al.* 1990, Bestgen and Platania 1991).

Adult minnows are most commonly found in backwaters, pools, and habitats associated with debris piles; whereas, Young of Year (YOY) 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 at Rio Rancho and 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 inches (50 cm). Over 85 percent were collected from low velocity habitats (<0.33 ft/sec, 10 cm/sec) (Dudley and Platania 1997, Watts *et al.* 2002).

### Critical Habitat

The Service has determined the primary constituent elements (PCEs) of silvery minnow critical habitat based on studies on silvery minnow habitat and population biology (68 FR 8088). The PCEs of critical habitat for the silvery minnow include:

1. A hydrologic regime that provides sufficient flowing water with low to moderate currents capable of forming and maintaining a diversity of aquatic habitats, such as, but not limited to the following: backwaters (a body of water connected to the main channel, but with no appreciable flow), shallow side channels, pools (that portion of the river that is deep with relatively little velocity compared to the rest of the channel), and runs (flowing water in the

river channel without obstructions) of varying depth and velocity – all of which are necessary for each of the particular silvery minnow life-history stages in appropriate seasons ( e.g., the silvery minnow requires habitat with sufficient flows from early spring (March) to early summer (June) to trigger spawning, flows in the summer (June) and fall (October) that do not increase prolonged periods of low or no flow, and relatively constant winter flow (November through February));

2. The presence of eddies created by debris piles, pools, or backwaters, or other refuge habitat within unimpounded stretches of flowing water of sufficient length (i.e., river miles) that provide a variation of habitats with a wide range of depth and velocities;
3. Substrates of predominantly sand or silt; and
4. Water of sufficient quality to maintain natural, daily, and seasonally variable water temperatures in the approximate range of greater than 1 °C (35 °F) and less than 30 °C (85 °F) and reduce degraded conditions (e.g., decreased dissolved oxygen, increased pH).

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

### **Life History**

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event (Platania 1995, Platania and Altenbach 1996). Adults spawn in about a one-month period in late spring to early summer (May to June) in association with spring runoff. Platania and Dudley (2000, 2001) found that the highest collections of silvery minnow eggs occurred in mid- to late May. In 1997, Smith (1999a or b) collected the highest number of eggs in mid-May, with lower frequency of eggs being collected in late May and June. These data suggest multiple silvery minnow spawning events during the spring and summer, perhaps concurrent with flow spikes. Artificial spikes have apparently induced silvery minnows to spawn (Platania and Hoagstrom 1996). It is unknown if individual silvery minnows spawn more than once a year or if some spawn earlier and some later in the year.

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 (1.6 mm) in size upon fertilization, but quickly swelled to 0.12 inches (3 mm). Recently hatched larval fish are about 0.15 inches (3.7 mm) in standard length and grow about 0.005 inches (0.15 mm) in size per day during the larval stages. Eggs and larvae have been estimated to remain in the drift for 3-5 days, and could be transported from 134 to 223 miles (216 to 359 km) downstream depending on river flows. Approximately three days after hatching the larvae move to low velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce. Young-of-year attain lengths of 1.5 to 1.6 inches (39 to 41 mm) by

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Platania (1995) suggested that historically the downstream transport of eggs and larvae of the silvery minnow over long distances was likely beneficial to the survival of their populations. This behavior may have promoted recolonization of reaches impacted during periods of natural drought (Platania 1995). The spawning strategy of releasing floating eggs allows the silvery minnow to replenish populations downstream, but the current presence of diversion dams (Angostura, Isleta, and San Acacia Diversion Dams) prevents recolonization of upstream habitats (Platania 1995). As populations are depleted upstream, and diversion structures prevent upstream movements, isolated extirpations of the species through fragmentation may occur (U.S. Fish and Wildlife Service 1999). Adults, eggs and larvae are also transported downstream to Elephant Butte Reservoir. It is believed that none of these fish survive because of poor habitat and predation from reservoir fishes (U.S. Fish and Wildlife Service 1999).

The silvery minnow is herbivorous (feeding primarily on algae); this is indicated indirectly by the elongated and coiled gastrointestinal tract (Sublette *et al.* 1990). Additionally, detritus, including sand and silt, is filtered from the bottom (Sublette *et al.* 1990, U.S. Fish and Wildlife Service 1999).

### **Population Dynamics**

Generally, a population of silvery minnows consists of only two age classes: YOY and Age-1 (U.S. Fish and Wildlife Service 1999). The majority of spawning silvery minnows are one year old. Two year old fish comprise less than 10 percent of the spawning population. High silvery minnow mortality occurs during or subsequent to spawning, consequently very few adults are found in late summer. By December, the majority (> 98 percent) of individuals are YOY (Age 0). This population ratio does not change appreciably between January and June, as Age 1 fish usually constitute over 95 percent of the population just prior to spawning.

Platania (1995) found that a single female in captivity could broadcast 3,000 eggs in eight hours. Females produce 3 to 18 clutches of eggs in a 12-hour period. The mean number of eggs in a clutch is approximately 270 (Platania and Altenbach 1996). In captivity, silvery minnows have been induced to spawn as many as four times in a year (C. Altenbach, City, *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 the dry reaches of the river (U.S. Fish and Wildlife Service 1999).

### **Distribution and Abundance**

Historically, the silvery minnow occurred in 2,465 mi (3,967 km) of rivers in New Mexico and Texas. They were known to have occurred from Española 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 River between Cochiti Dam and Elephant Butte Reservoir, which amounts to approximately 5 percent of its historic range.

The construction of mainstem dams, such as Cochiti Dam and irrigation diversion dams have contributed to the decline of the silvery minnow. The construction of Cochiti Dam in particular has 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. Flow in the river at 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 inches) 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. As recently as 1978, the silvery minnow was collected upstream of Cochiti Lake; however surveys since 1983 suggest that the fish is now extirpated from this area (U.S. Fish and Wildlife Service 1999).

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Silvery minnow catch rates have declined two to three orders of magnitude between 1993 and 2004. Additionally, relative abundance of silvery minnows declined from approximately 50 percent of the total ichthyofaunal community in 1995 to about 5 percent in 2004. However, in 2004, the October density of silvery minnows was significantly higher ( $p < 0.05$ ) than in 2003 and autumnal catch rates increased by over an order of magnitude between those years. Silvery minnow catch rates in 2004 were comparable to those in 2001. Although population levels in 2004 only approached the lows observed following extensive river drying in 1996, it is noteworthy that the percent increase between 2003 and 2004 was the single largest (i.e., over an order of magnitude) observed since the onset of systematic sampling (1993). Similar trends were also evident from a comparison of annual catch rates (Platania and Dudley 2005).

The silvery minnow was the most abundant taxon in September 2005 captures; it comprised about 47 percent of the total catch (Dudley *et al.* 2005). The species was nearly twice as abundant as the next most-abundant taxon (western mosquitofish). The increase in abundance of silvery minnow in 2005 has been comparable to previous years with above average precipitation (e.g., mid 1990s) (Dudley *et al.* 2005). These monitoring results from 2005 indicate that the status of the species has improved markedly compared to fall of 2004.

Increased discharge in the Rio Grande during 2004 contrasted with the extended low-flow conditions observed throughout the Middle Rio Grande during 2003 and 2002. The timing of the 2004 runoff flow was typical of a flow increase that would normally occur at the onset of the spring runoff period. Elevated and extended flows during 2004 likely resulted in more favorable conditions for the growth and survivorship of newly hatched silvery minnow larvae. It is possible that even low numbers of eggs and larvae could have resulted in greatly increased recruitment success because of the inundation of shoreline habitats, abandoned side channels, and backwaters. Low velocity and shallow areas provide the warm and productive habitats required by larval fishes to successfully complete their early life history.

Spring runoff in 2005 was also 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 likely resulted in improved conditions for spawning and recruitment.

#### Middle Rio Grande Distribution

Generally, the density of silvery minnows increases from upstream (Angostura Reach) to downstream (San Acacia Reach). During surveys in 1999, over 98 percent of the silvery minnows captured were downstream of San Acacia Diversion Dam (Dudley and Platania 2002). This distributional pattern has been observed since 1994 (Dudley and Platania 2002) and is attributed to downstream drift of eggs and larvae and the inability of adults to repopulate upstream reaches because of diversion dams.

In 2004, Dudley *et al.* (2005) found that catch rates were generally highest in the Angostura Reach and approximately equal in the Isleta and San Acacia reaches. The Angostura Reach yielded the most silvery minnow (n=2,226) in 2004, followed by the Isleta Reach (n=442), and San Acacia Reach (n=371). This pattern is explained by the addition of hatchery and salvaged fish to the Angostura Reach (see Environmental Baseline, below) as well as perennial flow in Angostura. By contrast, the Rio Grande south of San Acacia Diversion Dam has been routinely dewatered. Fish in the San Acacia Reach are generally trapped in drying pools, and unless rescued and returned to flowing water, die.

#### **Reasons for Listing/Threats to Survival**

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

1. Regulation of stream waters, which has led to severe flow reductions, often to the point of dewatering extended lengths of stream channel;
2. Alteration of the natural hydrograph, which impacts the species by disrupting the environmental cues the fish receives for a variety of life functions, including spawning;

3. Both the stream flow reductions and other alterations of the natural hydrograph throughout the year can severely impact habitat availability and quality, including the temporal availability of habitats;
4. Actions such as channelization, bank stabilization, levee construction, and dredging result in both direct and indirect impacts to the silvery minnow and its habitat by severely disrupting natural fluvial processes throughout the floodplain;
5. Construction of diversion dams fragment the habitat and prevent upstream migration;
6. Introduction of nonnative fishes that directly compete with, and can totally replace the silvery minnow, as was the case in the Pecos River, where the species was totally replaced in a time frame of 10 years by its congener the plains minnow (*Hybognathus placitus*); and
7. Discharge of contaminants into the stream system from industrial, municipal, and agricultural sources also impact the species (U.S. Fish and Wildlife Service 1993b, 1994).

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

#### **Recovery Efforts**

The final recovery plan for the silvery minnow was released in July 1999 (U.S. Fish and Wildlife Service 1999) and is currently undergoing revision. The primary objectives for recovery are to increase numbers of the silvery minnow, enhance its habitat in the Middle Rio Grande valley, and to reestablish the species in at least three other areas of its historic range.

### **III. ENVIRONMENTAL BASELINE**

Drought, as an overriding condition of the last decade in the southwest, is an important factor in the environmental baseline. The Rio Grande basin has received below normal precipitation, only adding to the long-term moisture deficits. The wet fall and early winter of 2002 provided some drought relief; however, long term moisture deficits averaging 9 inches over the past three years and deficits as high as 15 inches over the past 5 years contribute to current drought conditions in northern New Mexico, an area that supplies water to the Rio Grande basin (National Weather Service 2003).

Stream conditions in 2004 and 2005 were improved over previous years. The United States Geological Survey (USGS) in Albuquerque, New Mexico reported that stream flow conditions for April 2005 were well above average to significantly above average statewide. The 2005 water year to date percent of average stream flow volumes range from average to significantly above average. Stream flow for April 2005 improved significantly compared to the April 2004

(National Weather Service 2005). Nevertheless, while the runoff forecasts are good, reservoir levels continue to be below average across the state. It would take a least another year or two of well above average precipitation to reach pre-drought reservoir conditions.

### **Status of the Species within the Action Area**

Past actions have eliminated and severely altered habitat conditions for the silvery minnow. These actions can be broadly categorized as changes to the natural hydrology of the Rio Grande and changes to the morphology of the channel and floodplain. Other factors that influence the environmental baseline are water quality, the release of captively propagated silvery minnows, on-going research efforts, and past projects in the Middle Rio Grande. Also of importance is the current drought, the expected weather pattern for the near future, and how it may affect flow in the Rio Grande. Each of these topics is discussed below.

### Changes in Hydrology

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

### *Loss of Water*

Prior to measurable human influence on the system, up to the fourteenth century, the Rio Grande was a perennially flowing, aggrading river with a shifting sand substrate (Biella and Chapman 1977). There is now strong evidence that the Middle Rio Grande first began drying up periodically after the development of Colorado's San Luis Valley in the mid to late 1800s (Scurlock 1998). After humans began exerting more 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 greater geographical distribution, and there were oxbow lakes, cienegas, and sloughs that supported fish until the river became connected again.

Water management and use has resulted in a large reduction of suitable habitat for the silvery minnow. Agriculture accounts for 90 percent of surface water consumption in the Middle Rio Grande (Bullard and Wells 1992). The average annual diversion of water in the Middle Rio Grande by the MRGCD was 535,280 af (65,839 hectare-meters) for the period from 1975 to 1989 (U.S. Bureau of Reclamation 1993). In 1990, total water withdrawal (groundwater and surface water) from the Rio Grande Basin in New Mexico was 1,830,628 af, significantly exceeding a sustainable rate (Schmandt 1993). Water withdrawals have not only reduced overall flow quantities, but also caused the river to become locally intermittent and/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. Geological Survey 2002c). In addition, a portion of the water diverted by the MRGCD returns to the river and may be re-diverted (in some cases more than once) (Bullard and Wells 1992; MRGCD, *in litt.* 2003).

River reaches particularly susceptible to drying are 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 (C. Shroeder, Service, *pers. comm.* 2002). Since 1996, an average of 32 miles of the Rio Grande has dried, mostly in the San Acacia Reach. The most extensive drying has occurred in the last two years when 70 and 68 miles, respectively, were dewatered. Most documented drying events lasted an average of two weeks, before flows returned.

Predatory birds have been seen hunting and consuming fish from isolated pools during river intermittence (J. Smith, NMESFO, *pers. comm.* 2003). Although the number of fish present in any pool is unknown, it must be assumed that many of the fish preyed upon in these pools are silvery minnows. Thus, while some dead silvery minnows were collected during the shorter drying events, it is assumed that many more mortalities occurred than were documented.

#### *Changes to Size and Duration of Peak Flows*

Water management has also resulted in a loss of peak flows that historically initiated spawning. The reproductive cycle of the silvery minnow is tied to the natural river hydrograph. A reduction in peak flows and/or improper 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 (Shupe and Williams 1988). 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. The releases depart significantly from natural conditions, and can substantially alter the natural habitat. At other times, 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).

Again in the spring of 2002, there was concern that silvery minnows would not spawn because of a lack of spring runoff due to an extended drought. Runoff for the year was predicted to be the lowest in 100 years at around 2 percent of normal at San Marcial (National Weather Service 2002). Water was released (1650 cfs) from Cochiti Dam on May 14, 2002, to provide a cue for silvery minnow spawning. In response to the release, a significant silvery minnow spawning event occurred and was documented in all reaches except the Cochiti Reach (S. Gottlieb, UNM, *in litt.* 2002). Fall populations continued to decrease despite the large spawning event, indicating a lack of recruitment.

Mainstem dams and the altered flows they create can affect habitat by preventing overbank flooding, trapping nutrients, altering sediment transport regimes, prolonging summer base



flows, 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 the species. 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 is discussed below.

#### Changes in Channel 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 affect the silvery minnow. These effects result directly from constraints placed on channel capacity by structures built in the floodplain. These environmental 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 1993a).

The active river channel through the reaches where the silvery minnow persists in the Angostura and San Acacia Reaches is 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 narrowing of the channel. When water is confined to a narrower cross-section, its velocity increases, which gives it more power. Fine sediments such as silt and sand are 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 are decreasing. Narrow channels have few backwater habitats with low velocities that are important for silvery minnow fry and juveniles.

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 miles (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 miles (290 km) of river, only 1 mile (1.6 km), or 0.6 percent of the flood plain has remained undeveloped.

Development in the flood plain, 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

Both point (pollution discharges from a pipe) and non-point (diffuse sources of pollution) sources affect the Middle Rio Grande. Major point sources are waste water treatment plants (WWTPs) and feedlots. Major non-point sources include agricultural activities (e.g., fertilizer and pesticide application, livestock grazing), storm water run off, and mining activities.

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 in the lower portion of the Angostura Reach during extended periods of intermittency. For that reason the water quality of the effluent is extremely important. In the project area, the largest WWTP discharges are from Albuquerque, followed by Rio Rancho (2 WWTP) 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.

Albuquerque WWTP effluent discharge records show that during November 1999, the monthly maximum chlorine concentration in the outfall was 0.49 milligrams per liter (mg/L). Additionally, on February 23, 2003, the concentration of chlorine in the outfall was reported to be 0.70 mg/L (C. Abeyta, Service, *in litt.* 2003; D.S. Dailey, City, *in litt.* 2003). Concentrations of chlorine as low as 0.013 mg/L are harmful to the silvery minnow. Records also show that the monthly maximum concentration of ammonia during July 2001 was 14 mg/L. At pH 8 and a water temperature of 25 °C, concentrations of ammonia as low as 3.1 mg/L are harmful to larval fathead minnow (USEPA 1999). The fathead minnow has been suggested as a surrogate to evaluate the effects of various chemicals on the silvery minnow (Buhl 2002).

Although we do not have complete records for the other WWTPs, in the summer of 2000, the Rio Rancho WWTP released approximately one million gallons of raw sewage into the Rio Grande. Chlorine treatment was maximized in an attempt to reduce the public health risk. Ammonia was reported at 37 mg/L on July 13, 2000, and at 17.1 mg/L on July 27, 2000 (City of Rio Rancho, *in litt.* 2000). Nonetheless, no violations of chlorine or ammonia effluent limits were recorded. This suggests that the averaging of measurements and/or the frequency of water quality measurements is insufficient to detect water quality situations that would be toxic to silvery minnows. The Rio Rancho WWTP now uses ultraviolet disinfection (Dee Fuerst, City of Rio Rancho, *pers. comm.* 2003) so the release of chlorine should no longer occur. However, high concentrations of ammonia could still be discharged during an upset. The Bernalillo WWTP is still operating under a permit issued in 1988 that does not restrict the discharge of lethal concentrations of chlorine to the Rio Grande. The extent of impact from this discharge to

the Rio Grande is unknown. A new permit is under review that will regulate chlorine and ammonia discharges, although the risk of accidental discharges would remain.

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

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, the pueblo requested that the Environmental Protection Agency conduct toxicity tests on water in the Rio Grande collected below the Floodway. Aquatic crustaceans exposed to this water were found to have significant reproductive impairment and mortality when compared with controls. Additionally, larval fish also experienced significant mortality and/or narcosis when exposed to water and bed sediment collected from this same area on April 22, 2002 ([http://oaspub.epa.gov/enviro/pcs\\_det\\_reports.detail\\_report?npdesid=NM0022250](http://oaspub.epa.gov/enviro/pcs_det_reports.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 PECs provide an accurate basis for predicting sediment toxicity to aquatic life and a reliable basis for assessing sediment quality in freshwater ecosystems. Although PECs 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 the Cities of Albuquerque and Santa Fe. Polycyclic aromatic hydrocarbons and other semi-volatile compounds affect the sediment quality of the Rio Grande and may affect silvery minnow behavior, habitat, feeding, and health.

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

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

#### Silvery Minnow Propagation and Augmentation

In 2000, the Service identified captive propagation as an appropriate strategy to assist in the recovery of the silvery minnow. Consistent with Service policy (65 FR 183), captive propagation is conducted in a manner that will, to the maximum extent possible, preserve the genetic and ecological distinctiveness of the silvery minnow and minimize risks to existing wild populations.

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

Since 2000 more than 600,000 silvery minnows have been propagated using both adult wild silvery minnows and wild caught eggs and then released into the wild. Wild gravid adults are successfully spawned in captivity at the City of Albuquerque's propagation facilities. Eggs are

raised and released as larval fish. Marked fish have been released by the NMFRO since 2002 under a formal augmentation effort funded by the Collaborative Program. Silvery minnows are released into the Angostura reach of the river near Alameda Bridge to ensure downstream repopulation. Eggs left in the wild have a very low survivorship and this ensures that an adequate number of spawning adults are present to repopulate the river each year. While hatcheries continue to successfully spawn silvery minnows, wild eggs are collected to ensure genetic diversity within the remaining population.

#### Ongoing Research

There is ongoing research by the NMFRO and University of New Mexico (UNM) to examine the movement of silvery minnows. Augmented fish are marked with a visible fluorescent elastomer tag and released in large numbers in a few locations. Crews sample upstream and downstream from the release site in an attempt to capture the marked fish. Preliminary results indicate that the majority of silvery minnows disperse a few miles downstream. One individual was captured 15.7 miles (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.

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

Due to the increased efforts in captive propagation, recent studies by UNM have focused on the genetic composition of the silvery minnow. This research indicates that the net effective population size ( $N_e$ ) (the number of individuals that contribute to maintaining the genetic variation of a population) of the silvery minnow in the wild is between 60-250 fish (T. Turner, UNM, *pers. comm.* 2003). It has been suggested that a  $N_e$  of 500 fish is needed to retain the long-term adaptive potential of a population (Franklin 1980). No significant genetic differences have been found in populations isolated in the different reaches of the Rio Grande (D. Alo UNM, *pers. comm.* 2002). Because the number of wild fish in the river appears to be low, the addition of thousands of silvery minnows raised in captivity could impact the genetic structure of the population. The propagation effort should be sufficient to maintain 100,000 to 1,000,000 fish in the wild (T. Turner, UNM, *pers. comm.* 2003). For instance if it were determined that 50,000 silvery minnow were in the wild, a minimum of 50,000 adult fish should be in propagation facilities. We do not know how many fish are in the wild so it is difficult at this time to determine the exact number needed in propagation facilities. However, to insure against a catastrophic event where most wild fish are lost, it is suggested that 100,000 to 1,000,000 silvery minnow should be kept in propagation facilities to maintain a sufficient amount of genetic variability for propagation efforts (T. Turner, UNM, *pers. comm.* 2003).

Approximately 300,000 silvery minnows are currently being maintained in captivity (M. Ulibarri, USFWS *pers. comm.* 2005).

#### Permitted and/or Authorized Take

Take is authorized by section 10 and incidental take permitted under section 7. These permits and/or authorizations are issued by the Service. Applicants for section 10 permits must also acquire a permit from the State to “take” or collect silvery minnows. Many of the permits issued under section 10 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. Since 2000, the Service has reduced the amount of take permitted for voucher specimens as a result of the increasingly precarious status of the species in the wild.

Incidental take of silvery minnows is authorized through section 7 consultation associated with the March 2003, programmatic biological opinion on water operations and maintenance in the Middle Rio Grande, the City of Albuquerque Drinking Water project, the Isleta Island Removal Project, and the Tiffany Plug Removal Project.

#### **Factors Affecting Species Environment within the Action Area**

On the Middle Rio Grande, the following past and present federal, state, private, and other human activities, in addition to those discussed above, have affected the silvery minnow and its critical habitat:

1. Release of Carryover Storage from Abiquiu Reservoir to Elephant Butte Reservoir: The Army Corps of Engineers (Corps) consulted with the Service on the release of water during the winter of 1995. Ninety-eight thousand af (12,054 hectare-meters) of water was released from November 1, 1995 to March 31, 1996, at a rate of 325 cfs (9.8 cm). This discharge is above the historic winter flow rate. Substantial changes in the flow regime that do not mimic the historic hydrograph can be detrimental to the silvery minnow.
2. Corrales, Albuquerque, and Belen Levees: These levees contribute to floodplain constriction and habitat degradation for the silvery minnow. Levees at these sites result in a reduction in the amount and quality of suitable habitat for the silvery minnow.
3. Santa Ana River Restoration Project: In August 1999, Reclamation consulted with the Service on a restoration project located on Santa Ana Pueblo in an area where the river channel was incising and eroding into the levee system. This project included a Gradient Restoration Facility (GRF), channel re-alignment, bioengineering, riverside terrace lowering, and erodible bank lines. The primary component of the Santa Ana Restoration Project is the GRF, which should control river hydraulics upstream of its location and also river bed control. The GRF was designed to: (1) store more sand sediments at a stable slope for the current sediment supply; (2) decrease the velocities and

depths and increase the width in the river channel upstream; (3) be hydraulically submerged at higher flows while simultaneously increasing the frequency and duration of overbank flows upstream; (4) provide velocities and depths suitable for passage of the silvery minnow through the structure; and (5) halt or limit further channel degradation upstream of its location. The channel re-alignment involved moving the river away from the levee system and over the grade control structure, and involves excavation of a new river channel and floodplain. Another significant component of the Santa Ana Restoration project is riverside terrace lowering for the creation of a wider floodplain. The bioengineering and deformable bank lines also assist in establishing the new channel bank and regenerating native species vegetation in the floodplain.

4. Creation of a Conservation Pool for Storage of Native Water in Abiquiu and Jemez Canyon Reservoirs and Release of a Spike Flow: The City of Albuquerque created space (100,000 af) in Abiquiu Reservoir and the Corps created space in Jemez Canyon Reservoir to store Rio Grande Compact credit water for use in 2001, 2002, and 2003 for the benefit of listed species. The conservation pool was created with the understanding that the management of this water would be decided in later settlement meetings or during water operations conference calls. In addition, a supplemental release (spike) occurred in May 2001 to accommodate movement of sediment as a part of habitat restoration and construction on the Rio Grande and Jemez River on the Santa Ana Pueblo.
5. Programmatic Biological Opinion on the Effects of Actions Associated with the U. S. Bureau of Reclamation's, U.S. Army Corps of Engineers', and non-Federal Entities' Discretionary Actions Related to Water Management on the Middle Rio Grande: The Service completed this biological opinion on March 17, 2003, determining the effects of water management by the applicants on the silvery minnow and flycatcher. This biological opinion had one RPA with several elements. These elements set forth a flow regime in the Middle Rio Grande and described habitat improvements necessary to alleviate jeopardy to both the silvery minnow and flycatcher.
6. Albuquerque Drinking Water Project: The Drinking Water Project, involves the construction and operation of: (1) A new surface diversion dam north of Paseo del Norte Bridge, (2), conveyance of raw water from the point of diversion to the new water treatment plant, (3) a new water treatment plant on Chappell Road NE, (4) transmission of treated (potable) water to residential and commercial customers throughout the Albuquerque metropolitan area, and (5) aquifer storage and recovery. During typical operations, the project will divert a total of 94,000 acre-feet per year (afy) of raw water from the Rio Grande (47,000 afy of City San Juan-Chama water and 47,000 afy of Rio Grande native water) at a near constant rate of about 130 cubic-feet per

second (cfs) (3.68 cms). Peak diversion operations will consist of up to 103,000 afy being diverted at a rate of up to 142 cfs (4.02 cms). A new water treatment plant with a normal operating rate of 84 million gallons per day (mgd) (381.9 million liters per day [mld]) and a peak capacity of about 92 mgd (418.2 mld) or 142 cfs (4.02 cms) will be constructed as part of the proposed action. Consultation on this project was completed in October, 2003. Construction is currently underway.

7. Silvery minnow salvage and relocation: During river drying, the Service's silvery minnow salvage crew captures and relocates silvery minnows. Since 1996, nearly 700,000 silvery minnow have been rescued and relocated to wet reaches, the majority of which were released in the Angostura Reach.
8. Habitat Restoration Projects: Several habitat restoration projects have been completed in the Albuquerque reach through the Collaborative Program. These projects include two woody debris installation projects to encourage the development of pools and wintering habitat, and a river bar modification project south of the I-40 Bridge designed to create side and backwater channels on an existing bar as well as modify the top surface of the bar to create habitat over a range of flows.

Comment [MSOffice3]: 400,000 juveniles were returned to the Isleta & San Acacia reaches.

### **Summary**

The remaining population of the silvery minnow is restricted to approximately 5 percent of its historic range. Every year since 1996, there has been at least one drying event in the river that has further reduced the silvery minnow population. The population is unable to expand its distribution because three diversion dams currently block upstream movement and Elephant Butte Reservoir blocks downstream movement (U.S. Fish and Wildlife Service 1999). Augmentation of silvery minnows with captive-reared fish will continue, however, continued monitoring and evaluation of these fish is necessary to obtain information regarding the survival and movement of individuals.

Water withdrawals from the river and water releases from dams severely limit the survival of silvery minnows. The consumption of shallow groundwater and surface water for municipal, industrial, and irrigation uses continues to reduce the amount of flow in the Rio Grande and eliminate habitat for the silvery minnow (U.S. Bureau of Reclamation 2002b). However, under 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 their surface water depletions with 60,000 af per year (U.S. Bureau of Reclamation 2002b). The combined effect of water withdrawals and the drought mean that discharge 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.



Although various conservation efforts have been undertaken in the past and others are currently being carried out in the middle Rio Grande, and abundance in recent years is increasing, the threat of extinction for the silvery minnow continues because of the high probability of continued drought, the fragmented and isolated nature of currently occupied habitat, and the absence of silvery minnows in other parts of the historic range. While some of the threats to the silvery minnow have, in some circumstances, been reduced, they have not been removed. The increased abundance of Rio Grande silvery minnow in 2004 and 2005 is a positive sign, nevertheless, the threats that endanger this species have not been eliminated.

#### **IV. EFFECTS OF THE ACTION**

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and 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. Silvery minnows are present in high abundance in the Albuquerque reach (Dudley *et al.* 2005), and are expected to be present within the Action Area. The primary adverse effects of the proposed action on the silvery minnow result from the presence of heavy equipment in the water during construction, excavation below the bankline, and deposition of sediment into the river. Adverse effects may also result from the mobilization of contaminants in the channel and along access points. The project is also expected to have beneficial effects as larval and wintering habitat for the silvery minnow is created.

##### **Direct Effects**

Direct effects to the silvery minnow are likely to occur during island modification, bank scouring, and scalloping. With the removal of vegetation and sediment, silvery minnows may be harassed by the operation of construction equipment. Silvery minnows have the potential to be crushed or removed from the water by the excavator anytime sediment below the water line is moved or removed. The construction phase will be conducted between August 15 and April 15, when flows range from 400-800 cfs, but may sometimes exceed 1000 cfs; sediment will be removed to a depth that allows for inundation at higher flows, 2,000-3,000 cfs. Thus, the potential for equipment contact below the water line is reduced.

Silvery minnows may be harmed or harassed with the creation of low-flow habitats adjacent to the islands. Sediment and woody debris from root plowing will be placed into defined areas contained by a silt curtain. Although a downstream opening allows displaced water and fish to move out of the area, the potential exists for silvery minnows to be crushed or displaced during this process.

While accessing the islands, riverbanks, and bars, the amphibious excavator and personnel carrier will be in partial contact with submerged sediment in waters shallower than three feet. In waters more than three feet deep, the excavator will be in full flotation (U.S. Bureau of Reclamation 2005). The slow speed and sound of the amphibious equipment may disturb or harass silvery minnows. However, silvery minnows are

capable of swimming much faster (up to 70.8 m/minute) than the average speed of the Caterpillar 325 (26 m/minute), allowing them to avoid the excavator as it moves through the water. Thus, it is unlikely that silvery minnows will be harmed by the amphibious equipment in open water.

#### **Indirect Effects**

Reduced water quality through the disturbance of sediment may have an indirect effect on silvery minnows. During access to the river channel, equipment may cross wetted portions of the North and South Diversion channels, creating the potential for disturbed sediment and associated contaminants to disperse downstream and affect water quality. The applicant has committed to take the shortest path through wetted portions of the channels, avoid crossing during high flows, and install silt fences to reduce downstream dispersal of sediment and allow sediments to resettle before they are removed (U.S. Bureau of Reclamation 2005). Also water quality monitoring (pH, temperature, dissolved oxygen, and turbidity,) will be used to monitor water quality during access to the river channel at the North and South Diversion channels. These commitments will help avoid adverse indirect effects from reduced water quality.

Sediment disturbance may also occur as amphibious equipment moves through the river channel, and in areas adjacent to islands where new low-flow habitat is being created. When in shallow water, equipment may disturb the water-sediment interface (U.S. Bureau of Reclamation 2005). Water quality will be monitored prior to, during, and after these activities to manage possible effects of reduced water quality. The increase in sediment disturbance and turbidity is expected to have minimal effects to silvery minnows.

#### **Beneficial Effects**

The proposed action is anticipated to have long-term beneficial effects on the silvery minnow and its habitat. Beneficial effects include: improved egg and larval retention, increased recruitment rates, and increased survival of YOY and adult minnows through improvements to nursery and over-wintering habitats. As a result, it is likely that an increase in number of eggs and larvae will be retained in this portion of the river where flows are more predictable throughout the summer.

River morphology in the Albuquerque Reach lacks a complete suite of the habitat types needed for all life stages of the silvery minnow. The proposed restoration techniques are expected to establish diverse mesohabitats within the Albuquerque Reach, at a range of river flows between 500 and 3,000 cfs that support silvery minnows (U.S. Bureau of Reclamation 2005). In the short term, the proposed action may adversely affect individual silvery minnows; yet, in the long term, the amount of nursery and over-wintering habitat in this reach of the river will increase, leading to improvements in the status of silvery minnows far into the future.

#### **Critical Habitat**

The entire action area of the proposed restoration project encompasses designated critical

habitat for the silvery minnow from the Angostura Diversion Dam to the Isleta Diversion Dam, excluding Santa Ana and Sandia Pueblo lands. Direct and indirect effects of the proposed action are likely to have a positive impact on three of the four PCEs of critical habitat for the silvery minnow. Island modification, scouring and scalloping, and the creation of ephemeral channels provides habitat types included as primary constituent elements of silvery minnow critical habitat. Such habitat types include backwaters, shallow side channels, pools, and runs of varying depth and velocity; substrates of predominantly sand or silt; and the presence of eddies created by debris piles, pools, or backwaters, or other refuge habitat within unimpounded stretches of flowing water of sufficient length (i.e., river miles) that provide a variation of habitats with a wide range of depth and velocities. The proposed restoration project contributes to the PCEs, which provide for the physiological, behavioral, and ecological requirements essential to the conservation of the silvery minnow.

### **Cumulative Effects**

Cumulative effects include the effects of future state, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. 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. Cumulative effects include:

- 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 minnow prefer. Development also reduces overbank flooding favorable for the silvery minnow.
- Increased urban use of water, including municipal and private uses. Further use of surface water from the Rio Grande will reduce river flow and decrease available habitat for the silvery minnow.
- Contamination of the water (i.e., sewage treatment plants, runoff from 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 (i.e., saltcedar) 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 results in less 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 that these types of activities will continue to threaten the survival and recovery of the silvery minnow by reducing the quantity and quality of habitat through continuation and expansion of habitat degrading actions.

## **VI. CONCLUSION**

After reviewing the current status of the silvery minnow, the environmental baseline for the action area, the effects of the proposed actions, and cumulative effects, it is the Service's biological opinion that Phase 1 of the Middle Rio Grande Riverine Habitat Restoration Project, as proposed in the September 14, 2005 biological assessment, is not likely to jeopardize the continued existence of the silvery minnow. Recent sampling data have shown significant increases in numbers of silvery minnow. The restoration project is likely to have a short-term adverse effect on individual silvery minnows, which may be present in the Action Area, but impacts will be minimal. In addition, the proposed action is anticipated to have a long-term positive impact on the species through improvements to quality and availability of suitable habitat.

Island modification, scouring and scalloping, and the creation of ephemeral channels are expected to have a positive impact on designated critical habitat for the silvery minnow. These activities restore habitat consistent with the primary constituent elements of silvery minnow critical habitat. The short-term impacts to critical habitat do not affect the ability of the primary constituent elements to serve the intended function and conservation role of silvery minnow critical habitat. Therefore, the Service concludes that the proposed action is not likely to destroy or adversely modify designated critical habitat for the silvery minnow.

## **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, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be undertaken by the applicant so that they become binding conditions of any Federal grant or permit issued to the applicant as

appropriate, for the exemption in section 7(o)(2) to apply. The Federal agencies have a continuing duty to regulate the activity covered by this incidental take statement. If the Federal agencies fail to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Federal agencies must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(I)(3)]

#### **Amount or Extent of Take Anticipated**

The Service has developed the following incidental take statement based on the premise that the Middle Rio Grande Riverine Habitat Restoration Project will be implemented as proposed. Take of silvery minnows is expected in the form of harm and harass during: 1) island modification, and scouring and scalloping along riverbanks and point bars (removal of vegetation and sediment below the water line); and 2) placement of sediment and woody debris adjacent to islands.

The Service anticipates that up to 190 silvery minnows may be taken during island modification, and scouring and scalloping of riverbanks and point bars (removal of vegetation and sediment as well as the placement of sediment and woody debris in water adjacent to islands). Up to an estimated 10 silvery minnows are anticipated to be taken at each site from these restoration techniques (11 islands and 8 scouring and scalloping sites). Take is likely to occur as silvery minnows are crushed or removed from the water by the excavator anytime sediment below the water line is moved or removed, and from the placement of sediments and woody debris alongside islands.

Therefore, if more than 190 silvery minnows are found dead, the level of anticipated take will have been exceeded.

The Service notes that this number is only a best estimate of the amount of take that is likely under the proposed action. Thus, estimated incidental take may be modified from the above estimated number should other silvery minnow monitoring information, data from silvery minnow rescue operations, or other research indicate substantial deviations from estimated values. In this case, further consultation, may be necessary.

#### **Effect of the Take**

The Service has determined that this level of anticipated take is not likely to result in jeopardy to the silvery minnow. Monitoring data from 2005 have shown significant increases in the abundance of silvery minnow. The restoration project is likely to have minimal short-term adverse effects on individual silvery minnows, and beneficial effects to silvery minnow habitat.

#### **Reasonable and Prudent Measures**

The Service believes the following RPMs are necessary and appropriate to minimize impacts of incidental take of the silvery minnow due to habitat restoration activities.

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. Continue to work collaboratively with the Service on the Middle Rio Grande Endangered Species Act 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 Middle Rio Grande Riverine Habitat Restoration Project described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

To implement RPM 1, the ISC shall:

1. Monitor presence/absence of silvery minnows at construction sites, and use adaptive management to modify island restoration, scouring and scalloping, and creation of ephemeral channels, as appropriate.
2. The Restoration Monitoring Plan (outlining the results and effectiveness of all treatment islands and reference sites) shall be reported to the Service.
3. Report findings of injured or dead silvery minnows to the Service.

To implement RPM 2, the ISC shall:

1. Schedule, to the extent possible, all crossings during dry or frozen soil conditions.
2. Report to the Service, water quality measurements taken before, during, and after construction activity
3. Report significant spills of fuels, hydraulic fluids, and other hazardous materials to the Service.

To implement RPM 3, the ISC shall:

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

### **Conservation Recommendations**

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

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

**Re-initiation Notice**

This concludes formal consultation on the action(s) described in the September 14, 2005 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 biological opinion; (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 biological opinion; 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 22420-2006-F-02. If you have any questions or would like to discuss any part of this biological opinion, please contact Jennifer Parody of my staff at (505) 761-4710.

Sincerely,

Joy E. Nicholopoulos  
State Supervisor

cc: Assistant Regional Director, Region 2 (ES)  
Regional Section 7 Coordinator, Region 2 (ES)

**LITERATURE CITED**

- Bartolino, J.R. and J.C. Cole, 2002. Ground-Water Resources of the Middle Rio Grande Basin, New Mexico. U.S. Geological Survey Circular 1222. 132 pp.
- Bestgen, K. and S.P. Platania. 1991. Status and Conservation of the Rio Grande Silvery Minnow, *Hybognathus amarus*. Southwestern Naturalist 26(2):225–232.
- Bestgen, K. and D.R. Propst. 1994. Redescription, Geographic Variation, and Taxonomic Status of the Rio Grande Silvery Minnow, *Hybognathus amarus* (Girard, 1856). Contribution 69. Larval Fish Laboratory, Colorado State University.

- Biella, J., and R. Chapman (eds.). 1977. Archeological Investigations in Cochiti Reservoir, New Mexico. Vol. 1: A Survey of Regional Variability. Report submitted to the National Park Service, Santa Fe, for the U.S. Army Corps of Engineers, Albuquerque, New Mexico.
- Buhl, K. J. 2002. The Relative Toxicity of Waterborne Inorganic Contaminants to the Rio Grande Silvery Minnow (*Hybognathus amarus*) and Fathead Minnow (*Pimephales promelas*) in a Water Quality Simulating that in the Rio Range, New Mexico. Final Report to the U.S. Fish and Wildlife Service, Study No. 2F33 9620003. U.S. Geological Survey, Columbia Environmental Research Center, Yankton Field Research Station, Yankton SD.
- Bullard, T.F., and S.G. Wells . 1992. Hydrology of the Middle Rio Grande from Velarde to Elephant Butte Reservoir, New Mexico. U.S. Department of the Interior, U.S. Fish and Wildlife Service Research Publication 179.
- Caldwell, C. 2002. Hybridization Potential and Spawning Behavior of Rio Grande silvery Minnow (*Hybognathus amarus*) and Plains Minnow (*Hybognathus palcitus*). Interim report submitted to U.S. Fish and Wildlife Service Ecological Services Field Office, September 2002. 18 pp.
- Cook, J.A., K.R. Bestgen, D.L. Propst, and T.L. Yates. 1992. Allozymic Divergence and Systematics of the Rio Grande Silvery Minnow, *Hybognathus amarus* (Teleostei: Cyprinidae). *Copeia* 1992(1): 36–44.
- Crawford, C., A. Cully, R. Leutheuser, M. Sifuentes, L. White, and J. Wilber. 1993. Middle Rio Grande Ecosystem; Bosque Biological Management Plan. Middle Rio Grande
- Dudley, R.K., and S.P. Platania. 1996. Rio Grande Silvery Minnow Winter Population Habitat Use Monitoring Project, April 1996. Summary of four trips (December 1995–March 1996). Report to the U.S. Army Corps of Engineers, Albuquerque. 12 pp.
- Dudley, R.K., and S.P. Platania. 1997. Habitat Use of the Rio Grande Silvery Minnow Report to U.S. Bureau of Reclamation, Albuquerque, New Mexico. 88 pp.
- Dudley, R.K., and S.P. Platania. 2002. Summary of Population Monitoring of Rio Grande Silvery Minnow (1994–2002). Report to New Mexico Ecological Services Field Office, September 10, 2002, Albuquerque, New Mexico. 14pp.
- Dudley, R.K., S.P. Platania, and S.J. Gottlieb. 2005. Summary of the Rio Grande Silvery Minnow Population Monitoring Program Results from September 2005. American Southwest Ichthyological Research Foundation, Albuquerque, New Mexico.
- Franklin, I. R. 1980. Evolutionary Change in Small Populations. Pages 135 – 148 in M. E. Soulé and B. A. Wilcox (editors) *Conservation Biology: an evolutionary-ecological perspective*. Sinauer Associates, Inc. Sunderland, Massachusetts.



- Harwood, A.K. 1995. The Urban Stormwater Contribution of Dissolved Trace Metal from the North Floodway Channel, Albuquerque, NM, to the Rio Grande. University of New Mexico, Water Resources Program, Professional Project Report.
- Levings, G.W., D.F. Healy, S.F. Richey, and L.F. Carter. 1998. Water Quality in the Rio Grande Valley, Colorado, New Mexico, and Texas, 1992-95. U.S. Geological Survey Circular 1162. [Http://water.usgs.gov/pubs/circ1162](http://water.usgs.gov/pubs/circ1162) (viewed on May 18, 1998) .
- MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Toxicology and Chemistry 39:20–31.
- National Weather Service. 2002. West Gulf River Forecast Center, 2002 water supply forecast. Issued as of April 1, 2002.  
[Http://www.srh.noaa.gov/wgrfc/watersupply/wgrfc\\_APR\\_espfwr\\_2002.txt](http://www.srh.noaa.gov/wgrfc/watersupply/wgrfc_APR_espfwr_2002.txt) (viewed on April 9, 2002).
- Ong, K., T.F. O'Brien, and M.D. Rucker. 1991. Reconnaissance Investigation of Water Quality, Bottom Sediment, and Biota Associated with Irrigation Drainage in the Middle Rio Grande and Bosque del Apache National Wildlife Refuge in New Mexico 1988–89: U.S. Geological Survey Water-Resources Investigations Report 91-4036, Albuquerque, New Mexico.
- Pflieger, W. 1980. *Hybognathus nuchalis* Agassiz. In D. Lee, C. Gilbert, C. Hucutt, R. Jenkins, McCallister, and J. Stauffer, eds., Atlas of North American Freshwater Fishes. North Carolina State Museum of Natural History, Raleigh, North Carolina. 177 pp.
- Platania, S.P. 1995. Reproductive Biology and Early Life-history of Rio Grande Silvery Minnow, *Hybognathus amarus*. U.S. Army Corps of Engineers, Albuquerque, New Mexico. 23 pp.
- Platania, S. P. 2000. Effects of Four Water Temperatures Treatments On Survival, Growth, and Developmental Rates of Rio Grande Silvery Minnows, *Hybognathus amarus*, Eggs and Larvae. Report to U.S. Fish and Wildlife Service, Albuquerque, New Mexico.
- Platania, S.P., and C. Altenbach. 1998. Reproductive Strategies and Egg Types of Seven Rio Grande Basin Cyprinids. *Copeia* 1998(3): 559–569.
- Platania, S.P., and R. Dudley. 1999. Draft Summary of Aquatic Conditions in the Middle Rio Grande between San Acacia Diversion Dam and San Marcial Railroad Bridge Crossing for the period 14 through 26 April 1999. Prepared for the Bureau of Reclamation and New Mexico Ecological Services Field Office.

- Platania, S.P., and R. Dudley. 2000. Spatial Spawning Periodicity of Rio Grande Silvery Minnow during 1999, [http://www.uc.usbr.gov/progact/rg/rgsm2002/egg\\_salvage/wrg/aop/rgo/progact/rg/rgsm2002/progact/rg/rgsm2002/index.html](http://www.uc.usbr.gov/progact/rg/rgsm2002/egg_salvage/wrg/aop/rgo/progact/rg/rgsm2002/progact/rg/rgsm2002/index.html).
- Platania, S.P., and R. Dudley. 2001. Summary of Population Monitoring of Rio Grande Silvery Minnow (21–27 February 2001). Report to the Bureau of Reclamation and Corps of Engineers. Albuquerque. 7pp.
- Platania, S.P., and R. Dudley. 2005. 2004 Summary of Population Monitoring of Rio Grande Silvery Minnow. Report to the Bureau of Reclamation and Corps of Engineers. Albuquerque. 193pp.
- Platania, S.P., and C.W. Hoagstrom. 1996. Response of Rio Grande Fish Community to and Artificial Flow Spike: Monitoring Report Rio Grande Silvery Minnow Spawning Peak Flow. New Mexico Ecological Services State Office, Albuquerque, New Mexico.
- Steven P. Platania, Michael A. Farrington, W. Howard Brandenburg, Sara J. Gottlieb, and Robert K. Dudley 2003. Movement Patterns Of Rio Grande Silvery Minnow *Hybognathus amarus*, in the San Acacia Reach of the Rio Grande During 2002 Final Report. 38 pp.
- Rand, G.M., and Petrocelli, S.R. 1985. Fundamentals of Aquatic Toxicology B Methods and Applications. Hemisphere Publishing Corporation, New York. 666 pp.
- Roy, Richard, T.F. O'Brien, and M. Rusk-Maghini. 1992. Organochlorine and Trace Element Contaminant Investigation of the Rio Grande, New Mexico. U.S. Fish and Wildlife Service, New Mexico Ecological Services Office, Albuquerque, NM. 39 pp.
- S.S. Papadopoulos & Associates, Inc. 2000. Middle Rio Grande Water Supply Study. Boulder, CO: August 4, 2000.
- Schmandt, J. 1993. Water and Development in the Rio Grande/Rio Bravo Basin. University of Texas Press, Austin, Texas.
- Scurlock, D. 1998. From the Rio to the Serria: An Environmental History of the Middle Rio Grande Basin. USDA Rocky Mountain Research Station, Fort Collins, Colorado, 80526.
- Sublette, J., M. Hatch, and M. Sublette. 1990. The Fishes of New Mexico. Univ. New Mexico Press, Albuquerque, New Mexico. 393 pp.
- U.S. Bureau of Reclamation. 1993. Final Supplement to the Final Environmental Impact Statement-River Maintenance program for the Rio Grande-Velarde to Caballo Dam-Rio Grande and Middle Rio Grande projects, New Mexico. 140 pp.

- U.S. Bureau of Reclamation. 2001. U.S. Bureau of Reclamation's Discretionary Actions Related to Water Management, U.S. Army Corps of Engineers Water Operations Rules, and Non-Federal Actions Related to Ordinary Operations on the Middle Rio Grande, New Mexico: June 30, 2001, through December 31, 2003. June 8, 2001.
- U.S. Bureau of Reclamation. 2002b. Draft Environmental Impact Statement for the City of Albuquerque Drinking Water Project.
- U.S. Bureau of Reclamation. 2005. Middle Rio Grande Riverine Habitat Restoration Project Biological Assessment.
- U.S. Environmental Protection Agency. 1999. Update of Ambient Water Quality Criteria for Ammonia. Washington, D.C. 153pp.
- U.S. Fish and Wildlife Service. 1993a. Proposal Rule to List the Rio Grande Silvery Minnow as Endangered, with Critical Habitat. 58 Federal Register 11821-11828.
- U.S. Fish and Wildlife Service. 1993b. Notice of 12-month Petition Finding/Proposal to List *Empidonax traillii extimus* as an Endangered Species, and to Designate Critical Habitat. Federal Register 58:39495-39522..
- U.S. Fish and Wildlife Service. 1994. Endangered and Threatened Wildlife and Plants; Final Rule to list the Rio Grande Silvery Minnow as an Endangered Species. Federal Register 59:36988-37001.
- U.S. Fish and Wildlife Service. 1999. Rio Grande Silvery Minnow (*Hybognathus amarus*) Recovery Plan. Region 2, U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 138 pp.
- U.S. Fish and Wildlife Service. 2001. Programmatic Biological Opinion on the Effects of Actions Associated with the U.S. Bureau of Reclamation's, U.S. Army Corps of Engineers', and non-Federal Entities' Discretionary Actions Related to Water Management on the Middle Rio Grande, New Mexico, June 29, 2001.
- U.S. Fish and Wildlife Service. 2002b. Report to the Rio Grande Compact Commission, U.S. Fish and Wildlife Service Activities in the Rio Grande Basin Calendar Year 2001. Prepared for the Rio Grande Compact Commission by the New Mexico Ecological Services Field Office, Albuquerque, New Mexico.
- U.S. Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; Final rule for the Designation of Critical Habitat for the Rio Grande Silvery Minnow. Federal Register 68:8088-8135.
- U.S. Geologic Survey. 2002. Ground-water resources of the Middle Rio Grande basin, New Mexico. Circular 1222.

U.S. Geologic Survey. 2001. Selected Findings and Current Perspectives on Urban and Agricultural Water Quality by the National Water-Quality Assessment Program, FS-047-  
<http://water.usgs.gov/pubs/FS/fs-047-01/pdf/fs047-01.pdf>

Watts, H.E., C.W. Hoagstrom, and J.R. Smith. 2002. Observations on Habitat Associated with Rio Grande Silvery Minnow, *Hybognathus amarus* (Girard). Submitted to U.S. Army Corps of Engineers, Albuquerque District and City of Albuquerque Water Resources Division, June 28, 2002.

## **TABLES AND FIGURES**

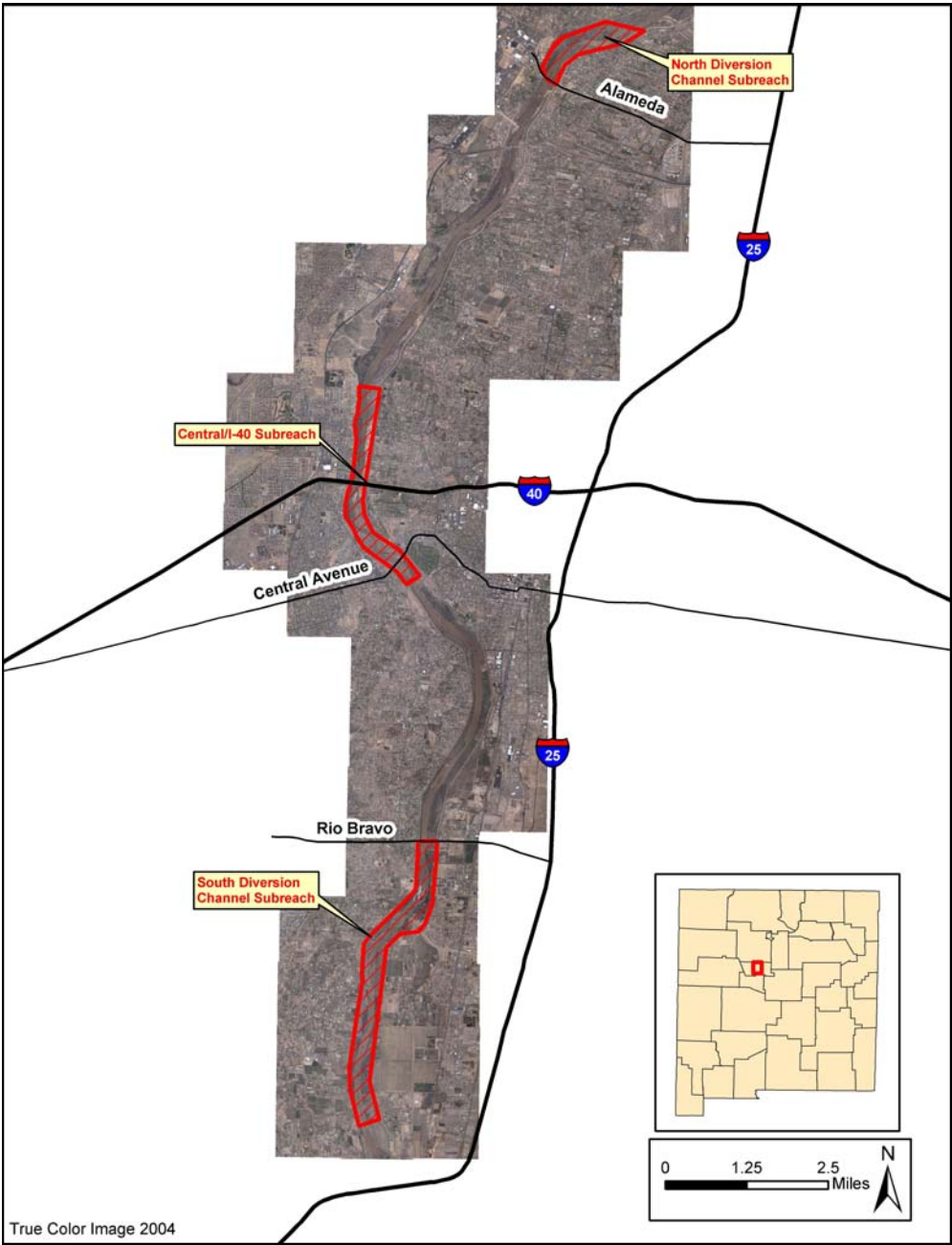


Figure 1. Middle Rio Grande riverine subreaches.

**Table 1.** Potential restoration benefits of proposed techniques.

<b>Technique</b>	<b>Description</b>	<b>Benefits of Technique</b>
Evaluation and modification of islands and bars	Physical disturbance (disking, mowing, root-plowing, raking) of islands or bars to remove vegetation and mobilize features during high flows	Creates more complex habitat for RGSM by reducing average channel depth, widening the channel, and increasing backwaters, pools, eddies, and runs of various depths and velocities. Increased inundation will benefit native vegetation, potentially increasing habitat for WIFL.
High-flow ephemeral channels	Construction of ephemeral channels on islands to carry flow from the main river channel during high-flow events	Creates shallow, ephemeral (normally dry), low-velocity aquatic habitats important for RGSM egg and larval development during high flow time periods. Increased inundation will benefit native vegetation, potentially increasing habitat for WIFL.
High-flow bank-line embayments	Areas cut into banks where water enters, primarily during high-flow events, including spring runoff and floods	Intended to retain drifting RGSM eggs and to provide rearing habitat and enhance food supplies for developing RGSM larvae. Increased inundation will benefit native vegetation, potentially increasing habitat for WIFL.
Terrace and bank lowering	Removal of vegetation and excavation of soils adjacent to the main channel to create potential for overbank flooding	Could provide for increased retention of RGSM eggs and larvae. Increased inundation will benefit native vegetation, potentially increasing habitat for WIFL.

**Table 2.** Restoration technique treatment areas, by subreach.

<b>Restoration Technique</b>	<b>Phase I Action Sites (2005-2006)</b>	<b>Phase I Acres Treated</b>		
		<b>North Diversion Channel</b>	<b>I-40/Central</b>	<b>South Diversion Channel</b>
Vegetated Island Modification and Evaluation				
Technique #1	2 islands	0.7	0	0.3
Technique #2	2 islands	0.6	0	0.9
Technique #3	7 islands	9.3*	4.1*	2.8*
Bank Scouring and Scalloping	8 sites	0.5	0.9	1.9
Ephemeral Channels	7 sites	0.5	0.7	0.5
Large Woody Debris	Multiple sites	TBD	TBD	TBD

\* Acres of created low-flow habitats to be determined.

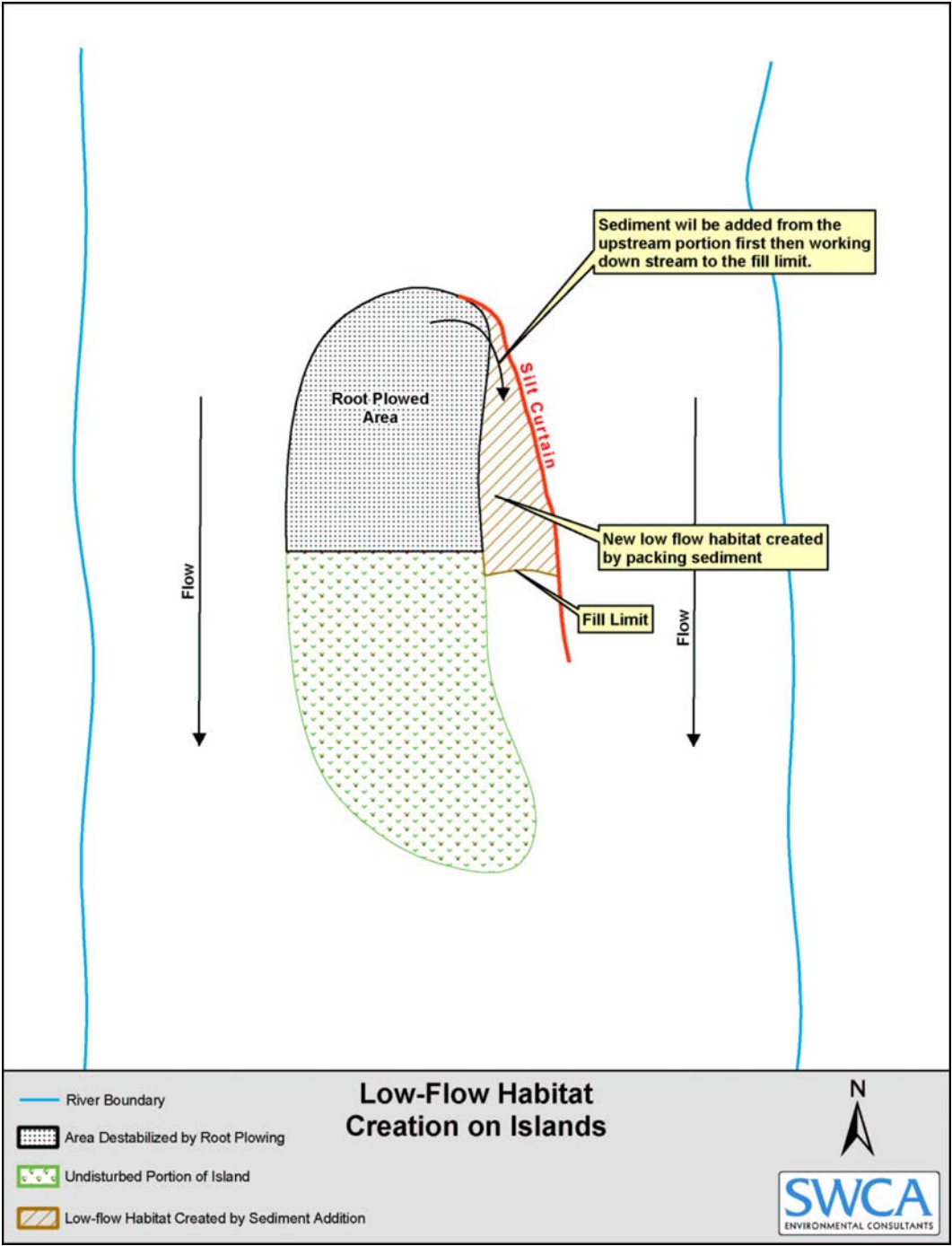


Figure 2. Vegetated island modification, technique #1 example.





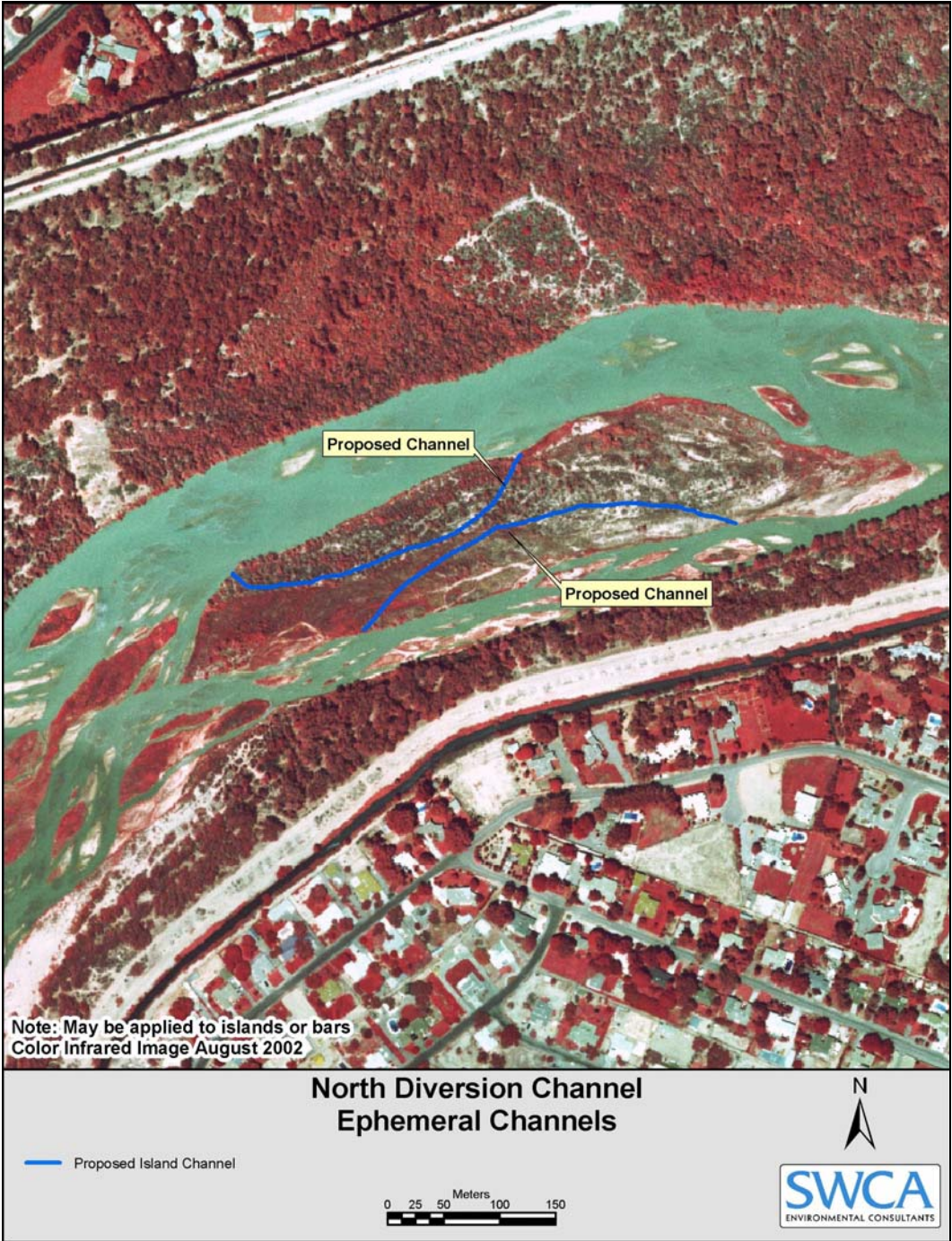


Figure 4. Ephemeral channel restoration detail.