United States Department of the Interior

FISH AND WILDLIFE SERVICE

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COPY FOR YOUR INFORMATION

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Lt. Colonel Wang, District Engineer
U.S. Army Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, New Mexico 87109-3435

Dear Ms. Rupp and Lt. Colonel Wang:

This letter transmits an amendment to the U.S. Fish and Wildlife Service's (Service) March 17, 2003, Biological Opinion (2003 BO) on the effects of actions associated with the Bureau of Reclamation's (Bureau) Water and River Maintenance Operations, U.S. Army Corps of Engineers' (Corps) Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico. This amendment is pursuant to your request dated April 12, 2006, and evaluates the effects of the action on critical habitat for the Southwestern willow flycatcher (*Empidonax traillii extimus*) (flycatcher) designated within the action area on October 19, 2005, (70 FR 60886). This amendment also provides a modification to the Incidental Take Statement (ITS) for Rio Grande silvery minnow (*Hybognathus amarus*) (silvery minnow) that accompanies the 2003 BO, as amended on August 15, 2005. Included in this section is the estimated incidental take for the 2006 irrigation season. This letter also responds to your June 13, 2006, request to amend Term and Condition 1.1 under Reasonable and Prudent Measure 1 of the 2003 BO. Finally, as agreed to in communications among the Service, the Bureau, and the Corps, by this letter, the Service evaluates the effects of recent river drying on the silvery minnow. Intermittency occurred between May 22 and May 27, 2006, during which up to 4.7 miles of river in the San Acacia Reach dried. Amended sections to the 2003 BO are enclosed.

Flycatcher Critical Habitat

Relying on the best available science, the Service has updated the status of the species for the flycatcher and silvery minnow, the environmental baseline, cumulative effects, and the conclusion. These sections are enclosed. Also enclosed are new sections that incorporate

analysis of impacts to flycatcher critical habitat. As discussed in the enclosed amended sections to the 2003 BO, after reviewing the current status of the species, the current status of habitat in the action area, the environmental baseline for the action area, and the cumulative effects, it is the Service's biological opinion that water operations and river maintenance of the Middle Rio Grande, as proposed in the February 19, 2003, Biological Assessment, do not result in destruction or adverse modification to critical habitat for the flycatcher. All other determinations contained within the 2003 BO with regard to the silvery minnow and its critical habitat and flycatcher are unchanged.

Amendment to the ITS

The ITS that accompanies the 2003 Biological Opinion was amended on August 15, 2005. Take is now estimated annually using a formula that incorporates October monitoring data, habitat conditions during the spawn (spring runoff), and augmentation. Under the August 15, 2005, amended ITS, an annual estimated take number was to be issued on July 1 of each year to allow the calculation to incorporate the effect of spring flows on population size. We have determined that the time period for measuring take should be changed to align incidental take of a given year with population estimates from the year class that will be affected by river drying. Thus, we are adjusting the dates for measuring take from April 1 to March 30 of each year.

In our previous amendment to the ITS, the estimated take limit in effect prior to July 1 carried over from the previous year. It was based on spring runoff from that previous year and augmentation and population numbers from the October of 2 years prior. Given the degree of population variation that this species may exhibit (Dudley and Platania 2005), the Service has determined that this approach might substantially over- or under-estimate the level of incidental take that could occur during the early part of the irrigation season. For example, the estimated permitted observed incidental take for 2006 is 265,935 (see below). Under the August 15, 2005, amendment, if hypothetically the observed mortality of silvery minnows this year is 100,000, take would not be exceeded even if an additional 165,935 silvery minnows die in the spring of 2007. If, however, the population decreases substantially this summer, the total amount of allowable take may be much lower (by an order of magnitude or more). By the same token, if a low population year is followed by a year of high population, the 'carry over' take may be too low to adequately reflect the number of silvery minnows that could die as a result of river drying. By moving the date to correspond to the irrigation season, we avoid these problems and use an estimate of incidental take that corresponds to the number of silvery minnows in the river that year.

Therefore, by this amendment, we are modifying the issuance date for incidental take to April 1 of a given year. April 1 corresponds to both the start of the irrigation season and the date by which the Service determines the hydrologic year (Service 2003). We expect that runoff forecasts for March and April will allow an accurate prediction of spring flows. The Service will estimate take by April 1, taking into account the most probable forecast for spring runoff acquired to date. If actual runoff or augmentation numbers lead to a change in total estimated take, an amended estimate may be provided.

The August 15, 2005, amendment to the ITS also provided for an upper (20,000) bound (or "cap") on the annual estimated take regardless of the calculated value. This value was set using the assumption that the population was unlikely to increase by more than twice that observed in 2004, and that such population increases might only be observed when threats to the species were significantly reduced. Dudley et al. (2005) reported that silvery minnow numbers in October 2005 increased more than 50 times over those observed in 2004. These values far exceed what was predicted and indicate a much larger population of silvery minnows than was expected. Nevertheless, threats to the species remain and a proportionate amount of incidental take due to river drying is still expected. These high population numbers suggest that take associated with river drying will reasonably exceed 20,000. The Service believes the cap is inappropriate given the current status and trend of the species and is not disproportionate to the actual size of the silvery minnow population. In the enclosed amended ITS, the paragraph that describes the cap on take is removed to reflect current knowledge about the biology of silvery minnows.

The Service has determined that the level of take in this amended ITS is not likely to result in jeopardy to the silvery minnow with implementation of the Reasonable and Prudent Alternative (RPA). The formula provided for estimated take due to channel drying in the August 15, 2005, amendment is directly tied to the original amount of estimated take in the ITS that accompanies the 2003 BO (38,000). Estimated take is still calculated as a proportion of 38,000 and will fluctuate according to changes in the number of silvery minnows present during channel drying. Changing the date of issuance and removing the cap refine this concept and do not change the overall determination that the level of take anticipated in this amended ITS will not result in jeopardy to the silvery minnow.

2006 Take Estimate

The permitted amount of incidental take due to channel drying for the 2006 irrigation season (April 1, 2006 through March 30, 2007) is 13,296,774 silvery minnows larger than 30 millimeters (mm) standard length, or 35 mm total length. If observed mortality (the number of dead silvery minnows found) exceeds 265,935 (13,296,774 divided by 50), the levels of anticipated take will have been exceeded.

This number was calculated using the following formula (Service, 2005):

$$Take = [(c \times fall\ recruitment) \times (spring\ runoff)] + (augmentation)$$

Where $c = 3341$, *fall recruitment* = 3,899, *spring flows* = 1, and *augmentation* = 270,215.

All documented incidental take in the main channel of the Middle Rio Grande that has occurred since first reports of lateral pooling on March 29, 2006, will be applied toward this total.

Amendment to Term and Condition 1.1

Pursuant to your June 14, 2006, request, the Service is amending Term and Condition 1.1 (associated with Reasonable and Prudent Measure #1) of the 2003 BO, to read as follows:

> 1.1) Ramp down river flows as slowly as possible during the time periods set forth in the RPA to minimize intermittency. Even under the worst of circumstances, every effort shall be made to ensure that no more than 8 miles of river dry per day. This can be accomplished by drying 2, 4-mile sections per day, or by other combinations totaling 8 miles per day with concurrence of the Service. The location and distribution of these sections shall be determined through coordination with the Service. Ramping down the flows will allow about a month for the silvery minnow larvae to grow. It will also make salvage operations more manageable and allow time for monitoring the effects of drying.

The purpose of Term and Condition 1.1 is to minimize the level of incidental take associated with the effects of the action. Ramping down flows allows silvery minnow eggs and larvae time to develop into larger, heartier fish that may better withstand the stress of river drying and salvage operations. It also provides time for salvage crews to rescue silvery minnows as the river recedes. Limiting the total amount of river drying that occurs facilitates salvage operations by constraining the number of miles that require rescue efforts in a given day. When drying occurs in two different reaches simultaneously, keeping within the four mile limit is critical to successful rescue since crews can be deployed to locations over 100 miles apart. In 2006, the Service is prepared to salvage up to 8 miles per day in one reach and finds the option of working one reach at a time preferable. Conversations among our staff have resulted in a river drying/silvery minnow salvage plan that can increase salvage efficiency and save supplemental water.. This plan requires an adjustment to the Term and Condition so that salvage operations can occur first in the San Acacia Reach and second in the Isleta Reach (rather than two reaches concurrently). Coordination among river operators and salvage crews is the best method to ensure a reduction in take associated with river drying. We believe that limiting drying to no more than 8 miles of river per day, regardless of whether it occurs in two reaches or one, results in the same reduction and minimization of take. Therefore, this modification to the Term and Condition does not change the intent or effect of implementing Reasonable and Prudent Measure 1.

Effects of 2006 Channel Drying

On Monday, May 22, 2006, the river became discontinous in the San Acacia Reach just north of the south boundary of Bosque del Apache National Wildlife Refuge. Supplemental releases were increased on May 20, 2006, and again on May 23, 2006. In addition, the Middle Rio Grande Conservancy District and Bosque del Apache National Wildlife Refuge assisted with supplies in the Low Flow Conveyance Channel. Both efforts were needed to reverse the intermittency. The river was reconnected by May 27, 2006. In total, 4.7 miles of river dried.

Silvery minnows were salvaged from the main channel from May 22, 2006, through May 23, 2006, resulting in the rescue of 4,220 silvery minnows. A total of 38 silvery minnows were found dead as a result of intermittency (M. Hatch, *pers. comm.*).

The 2003 BO does not evaluate the effects of river drying during the spawn. Rather, the conclusion that jeopardy is alleviated with implementation of the RPA relies on the assumption that flows will be continuous from Cochiti to Elephant Butte from November 16 to June 15 of any year. The period from March until June of any given year is critical to ensuring the successful spawn of the silvery minnow. Maintaining flows during this period allow silvery minnow eggs and larvae to develop to the sub-adult stage. Sub-adult fish are heartier and more capable of surviving adverse river conditions as well as capture and relocation, than are eggs or larval fish. The requirement to meet flow targets until June 15 of each year, therefore, provides the biological justification for river drying that occurs (at various levels, based on the hydrologic year) later in the irrigation season. Providing water during key silvery minnow life history stages (pre-spawn, spawn, and post-spawn), minimizes the overall effects of river drying during the irrigation season, and is a central component of the RPA to jeopardy.

River drying causes direct mortality to silvery minnows when the pools in which they are trapped dry. The combination of low dissolved oxygen and high water temperatures in drying pools can be lethal to silvery minnows. Changes in pH, salinity, carbon dioxide, and ammonia increase the vulnerability of silvery minnows to changes in dissolved oxygen, or can be lethal on their own. Additionally, fish trapped in isolated pools may be eaten by predatory fish also trapped in the pool or by terrestrial and avian predators.

The indirect effect of river drying is reduced fitness associated with increased stress. As water quality in isolated pools decreases, silvery minnows trapped in those pools become increasingly susceptible to viral, bacterial, or fungal infections, as well as internal and external parasites. Even if they survive the drying event, silvery minnows may die sooner or experience reduced reproduction (smaller or fewer eggs) as a result of isolation or the stress of handling during salvage.

River drying during the spawn has the added effect of causing mortality to any eggs and larvae that are present in drying pools. These early life stages are fragile (Hoar and Randall 1969) and unlikely to withstand the stress of drying or salvage operations. All silvery minnow eggs and larvae present in the segment that dried almost certainly died. Thus, this reproductive effort was lost, although given the large number of silvery minnows present in the river this year (Dudley et al. 2005), the overall effect on the population is expected to be minimal. Over 800,000 silvery minnow eggs were collected for captive propagation in the San Acacia Reach in early June (C. Altenbach, *pers. comm.*). While the Service considers the effects of early river drying to be adverse, they do not result in a change in the determination of no jeopardy with the implementation of the RPA.

Assuming a 50:50 sex ratio, the Service assumes that half of the silvery minnows that died during the early drying (38) were female (19) and would have successfully spawned had the river remained continuous. Each silvery minnow produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event (Platania 1995, Platania and Altenbach 1998). We estimate that during the spawn those females would have each produced a minimum of 3,000 eggs and that on average 0.5 percent of those eggs would have survived to maturity (Service 2003). Therefore, we estimate the total number of silvery minnows that were not recruited to the population, as a result of the May 2006 intermittency was 342. This mortality, in addition to the 38 observed dead (above) will be counted against the 2006 take limit (265,935, above). This level of take is not likely to result in jeopardy to the silvery minnow when the RPA is implemented.

The river drying also had adverse effects on silvery minnow critical habitat. Two of the four primary constituent element of critical habitat necessary to ensure the conservation of the silvery minnow are 1) sufficient flows to reduce the formation of lateral pools, and 2) flows adequate to provide protection from degraded water quality. These effects were contemplated in the 2003 BO which determined that the proposed action adversely modified critical habitat (Service 2003). This determination is not changed by the channel drying of May 22-27, 2006.

To minimize the likelihood of any future river intermittency during the spawn, the Bureau shall, in consultation with the Service, and in coordination with other parties to the 2003 BO, develop river operations protocols that include but are not limited to: improvements to monitoring at key gages, the identification of additional monitoring, including on-the-ground condition assessment, in order to provide decision makers tools for potential changes to supplemental releases, and plans for increased coordination among water users to maintain adequate flows during crisis situations. This protocol must be submitted to the Service no later than July 31, 2006.

This concludes formal consultation on the Amendment to the Programmatic Biological Assessment of the Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operations, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico.

If you have any questions or concerns about this consultation or the consultation process in general, please contact Steve Spangle, Acting Assistant Regional Director, Ecological Services, at 505-248-6671.

Sincerely,

Acting Regional Director

Enclosures

cc: Director, New Mexico Department of Game and Fish, Santa Fe, NM

Literature Cited

Dudley, R.K., S.P. Platania, and S.J. Gottlieb. 2005. Summary of the Rio Grande Silvery Minnow Population Monitoring Program Results from December 2005. American Southwest Ichthyological Research Foundation, Albuquerque, New Mexico.

Hoar, W. S. and D. J. Randall. 1969. Fish Physiology, Volume III. Academic Press, New York.

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., and C. Altenbach. 1998. Reproductive Strategies and Egg Types of Seven Rio Grande Basin Cyprinids. Copeia 1998(3): 559–569.

U.S. Fish and Wildlife Service. 2003. 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, March 17, 2003.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

The area of action is the same as stated in the 2003 BA and BO (Reclamation 2003, Service 2003): the "Middle Rio Grande," defined as the area of the Rio Chama watershed and the Rio Grande, including all tributaries, from the Colorado/New Mexico State-line downstream to the headwaters of Elephant Butte Reservoir. The downstream limit is equivalent to the power-line crossing the Rio Grande near river-mile 62, which is the downstream limit of designated critical habitat for the flycatcher and the Rio Grande silvery minnow.

Reclamation did not change the proposed action from what was analyzed in the March 17, 2003 BO. Therefore, the description of the previous proposed action is hereby incorporated by reference. Summarizing, the proposed actions include Rio Grande Compact deliveries, non-federal depletions, Reclamation water management and river maintenance, and Corps flood control operation.

II. STATUS OF THE SPECIES

RIO GRANDE SILVERY MINNOW

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, Soccorro 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 jemezanus*), 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 1999). 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 (1999b) 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 (Platania 2000). Approximately three days after hatching the larvae move to low velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce. Young-of-year attain lengths of 1.5 to 1.6 inches (39 to 41 mm) by late autumn (U.S. Fish and Wildlife Service 1999). Age-1 fish are 1.8 to 1.9 inches (45 to 49 mm) by the start of the spawning season. Most growth occurs between June (post spawning) and October, but there is some growth in the winter months. In the wild, maximum longevity is about 25 months, but very few survive more than 13 months (U.S. Fish and Wildlife Service 1999). Captive fish have lived up to four years (C. Altenbach, City, *pers. comm.* 2003).

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 1998). 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 (U.S. Fish and Wildlife Service 1999). As recently as 1978, the silvery minnow was collected upstream of Cochiti Lake; however surveys since 1983 suggest that the fish is now extirpated from this area (U.S. Fish and Wildlife Service 1999).

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 fish 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. Catch rates in 2005 were even higher. October catch rates in 2005 (3,899) increased nearly 50 times over catch rates for 2004 (78) (Dudley *et al.* 2005).

The silvery minnow was the most abundant taxon in October 2005 captures; it comprised about 72 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 improved conditions for both spawning and recruitment.

Middle Rio Grande Distribution

Since the early 1990's, the density of silvery minnows generally increased from upstream (Angostura Reach) to downstream (San Acacia Reach). During surveys in 1999, over 98 percent of the silvery 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 and 2005, however, Dudley *et al.* (2005 and 2006) found that this pattern reversed. Catch rates were 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). The pattern was likely caused by good spawning conditions (i.e., high and sustained spring runoff) throughout the Middle Rio Grande during April and May followed by

wide-scale drying in the Isleta and San Acacia reaches from June-September. High spring runoff and perennial flow in the Angostura Reach appeared to result in relatively high survival and recruitment of larval and juvenile RGSM compared to previous drought years (2002-2003). In contrast, large portions of the Rio Grande south of Isleta Diversion Dam were dewatered in 2004 and young RGSM in these areas were either subjected to poor recruitment conditions (i.e., lack of nursery habitats during low flows) or they were trapped in drying pools where they perished.

Sampling in early 2006 indicates populations are again higher downstream. Of the 6,143 silvery minnows caught in March 2006, 33 were found in Angostura, 2,445 were found in the Isleta Reach, and 3,665 were caught in the San Acacia Reach. Silvery minnow catch rates were 0.19 per $100m^2$ in the immediate project area.

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.

SOUTHWESTERN WILLOW FLYCATCHER

Throughout this document, the term territory and site are used to help describe flycatcher population biology. A "territory" is the area occupied by a single male or pair of flycatchers throughout the breeding season. Territories are the unit of measurement used by the Service in determining population numbers. Flycatchers tend to cluster their territories; a flycatcher site may include clusters or only one territory. A flycatcher pair equals a territory, but a territory may be a pair or single bird.

Species Description
The flycatcher is a small grayish-green passerine bird (Family Tyrannidae) measuring approximately 5.75 inches. It has a grayish-green back and wings, whitish throat, light gray-olive breast, and pale yellowish belly. Two white wingbars are visible (juveniles have buffy wingbars). The eye ring is faint or absent. The upper mandible is dark, and the lower is light yellow grading to black at the tip. The song is a sneezy "fitz-bew" or a "fit-a-bew" and the call is a repeated "whitt".

The flycatcher is one of four currently recognized willow flycatcher subspecies (Phillips 1948, Unitt 1987, Browning 1993). It is a neotropical migrant that breeds in the southwestern U.S. and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Stiles and Skutch 1989, Peterson 1990, Ridgely and Tudor 1994, Howell and Webb 1995). The historic breeding range of the flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja) (Unitt 1987).

Listing, Critical Habitat, and Primary Constituent Elements
The final rule listing the flycatcher as endangered was published on February 27, 1995 (60 FR 10694). At that time, the final designation of critical habitat was deferred, pursuant to 16 U.S.C. 1533(b)(6)(C), citing issues identified in public comments, new information, and the lack of the economic information necessary to perform an economic analysis. On July 22, 1997, a final critical habitat designation for the flycatcher, along 964 river km (599 river mi) in AZ, CA, and NM, was published (62 FR 39129). As a result of a suit from the New Mexico Cattlegrower's Association initiated in March 1998, on May 11, 2001, the 10th Circuit Court of Appeals vacated (i.e., set aside) the designation of critical habitat, citing a faulty economic analysis, and instructed the Service to issue a new critical habitat designation.

A final recovery plan for the flycatcher was signed by the U.S. Fish and Wildlife Service's Region 2 Director on August 30, 2002, and was released to the public in 2002 (Service 2002). The Plan describes the reasons for endangerment, current status of the flycatcher, addresses important recovery actions, includes detailed issue papers on management issues, and provides recovery goals. Recovery is based on reaching numerical and habitat related goals for each specific Management Unit established throughout the subspecies range and establishing long-term conservation plans (Service 2002).

A proposal for the designation of critical habitat was published in the Federal Register on October 12, 2004 (69 FR 60706), with a final rule published October 19, 2005 (70 FR 60886). A total of 737 river miles across southern California, Arizona, New Mexico, southern Nevada, and southern Utah were included in the final designation. The lateral extent of critical habitat includes areas within the 100-year floodplain. The primary constituent elements of critical habitat include riparian plant species in a successional riverine environment (for nesting, foraging, migration, dispersal, and shelter), specific structure of this vegetation, and insect populations for food. A variety of river features such as broad floodplains, water, saturated soil, hydrologic regimes, elevated groundwater, fine sediments, etc. help develop and maintain these constituent elements (Service 2005).

The critical habitat designation includes the following sections of the Middle Rio Grande in New Mexico in the project action area: Between the Taos Junction Bridge in Taos County and the north boundary of San Juan Pueblo in Rio Arriba County, from the south boundary of the Pueblo of Isleta in Valencia County to the north boundary of Sevilleta NWR in Socorro County, from the south boundary of Sevilleta NWR to the north boundary of Bosque del Apache NWR in Socorro County, and from the south boundary of Bosque del Apache NWR to the powerline crossing of the Rio Grande near Milligan Gulch, immediately north of the pool of Elephant Butte Reservoir in Socorro County.

As discussed in the final rule (70 FR 60886), the Pueblos of San Juan, Santa Clara, San Ildenfonso, and Isleta were excluded from the critical habitat designation, as were the City of Albuquerque (Rio Grande State Park), Sevillta NWR, and Bosque Del Apache NWR.

The Service designated stream "segments" as critical habitat for the southwestern willow flycatcher (Service 2005). The designated segments provide for flycatcher habitat, (nesting, foraging, migration, dispersal, and shelter), and allow for changes in habitat locations or conditions from those that presently exist. The actual riparian habitat in these areas is expected to expand, contract, or change as a result of flooding, drought, inundation, and changes in floodplains and river channels, as discussed in the Final Recovery Plan (USFWS 2002: 18, D-13 to 15), that result from current flow management practices and priorities. Stream segments include breeding sites with high connectivity and other essential flycatcher habitat components needed to conserve the subspecies. Those other essential components of flycatcher habitat (foraging habitat, habitat for non-breeding flycatchers, migratory habitat, regenerating habitat, streams, elevated

groundwater tables, moist soils, flying insects, and other alluvial floodplain habitats, etc.) adjacent to or between sites, along with the dynamic process of riparian vegetation succession and river hydrology, provide current and future habitat for the flycatcher which is dependent upon vegetation succession.

All river segments designated as flycatcher habitat are within the geographical area occupied by the species and contain at least one of the primary constituent elements (PCEs) (the known physical and biological features essential to the conservation of the species) (Service 2005). These PCEs, especially the vegetation components, are acknowledged to be dynamic in their occurrence and may not serve all life history functions (nesting, foraging, migration dispersal, and shelter) at any given time due to unsuitability caused by age of the vegetation, hydrology, soil conditions, etc. (Service 2005). The PCEs are the result of the dynamic river environment that develops, maintains, and regenerates the riparian forest and provides food for breeding, non-breeding, dispersing, territorial, and migrating southwestern willow flycatchers. Anthropogenic factors such as dams, irrigation ditches, or agricultural field return flow can assist in providing conditions that support flycatcher habitat. Because the flycatcher exists in disjunct breeding populations across a wide geographic and elevation range, and is subject to dynamic events, critical habitat river segments are essential for the flycatcher to maintain metapopulation stability, connectivity, gene flow, and protect against catastrophic loss (Service 2005).

The PCEs listed in the final rule for the flycatcher are:

(1) Riparian habitat in a dynamic successional riverine environment that comprises:

(a) Trees and shrubs that include Gooddings willow (*Salix gooddingii*), coyote willow (*S. exigua*), Geyers willow (*S. geyerana*), arroyo willow (*S. lasiolepis*), red willow (*S. laevigata*), yewleaf willow (*S. taxifolia*), pacific willow (*S. lasiandra*), boxelder (*Acer negundo*), tamarisk (*Tamarix ramosissima*), Russian olive, buttonbush (*Cephalanthus occidentalis*), cottonwood (*Populus fremontii*), stinging nettle (*Urtica dioica*), alder (*Alnus rhombifolia*, *A. oblongifolia*, *A. tenuifolia*), velvet ash (*Fraxinus velutina*), poison hemlock (*Conium maculatum*), blackberry (*Rubus ursinus*), seep willow (*Baccharis salicifolia*, *B. glutinosa*), oak (*Quercus agrifolia*, *Q. chrysolepis*), rose (*Rosa californica*, *R. arizonica*, *R. multiflora*), sycamore (*Platinus wrightii*), false indigo (*Amorpha californica*), Pacific poison ivy (*Toxicodendron diversilobum*), grape (*Vitus arizonica*), Virginia creeper (*Parthenocissus quinquefolia*), Siberian elm (*Ulmus pumila*), and walnut (*Juglans hindsii*).

(b) Dense riparian vegetation with thickets of trees and shrubs ranging in height from 2 m to 30 m (6 to 98 ft). Lower-stature thickets (2 to 4 m or 6 to 13 ft tall) are found at higher elevation riparian forests and tall-stature thickets are found at middle- and lower elevation riparian forests;

(c) Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only at the shrub level, or as a low, dense tree canopy;

(d) Sites for nesting that contain a dense tree and/or shrub canopy (the amount of cover provided by tree and shrub branches measured from the ground) (i.e., a tree or shrub canopy with densities ranging from 50 percent to 100 percent);

(e) Dense patches of riparian forests that are interspersed with small openings of open water or marsh, or shorter/sparser vegetation that creates a mosaic that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 ac) or as large as 70 ha (175 ac); and

(2) A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, including: flying ants, wasps, and bees (Hymenoptera); dragonflies (Odonata); flies (Diptera); true bugs (Hemiptera); beetles (Coleoptera); butterflies/moths and caterpillars (Lepidoptera); and spittlebugs (Homoptera).

It is important to recognize that the PCEs, (PCE 1a and 2), are present throughout the river segments selected, but the specific quality of riparian habitat for nesting (PCE 1b, 1c, 1d, 1e), migration (PCE 1), foraging (PCE 1 and 2), and shelter (PCE 1) will not remain constant in their condition or location over time due to succession (i.e., plant germination and growth) and the dynamic environment in which they exist (Service 2005).

The following analysis (i.e., the determination whether an action destroys or adversely modifies critical habitat) will evaluate whether the loss, when added to the environmental baseline, is likely to appreciably diminish the capability of the critical habitat to satisfy essential requirements of the flycatcher. In other words, activities that may destroy or adversely modify critical habitat include those that alter the primary constituent elements (defined above) to an extent that the value of the critical habitat for both the survival and recovery of the flycatcher is appreciably reduced (50 CFR 402.02).

Rangewide Distribution and Abundance

Unitt (1987) documented the loss of more than 70 flycatcher breeding locations rangewide (peripheral and core drainages within its range), estimating the rangewide population at 500 to 1000 pairs. From 1993-2004, 265 flycatcher breeding sites were detected in California, Nevada, Arizona, Utah, New Mexico, and Colorado. These include approximately 1256 territories (Durst *et al.* 2004). It is difficult to calculate the flycatcher abundance since not all sites are surveyed annually. Also, sampling errors (e.g., incomplete survey effort, double-counting males/females, composite tabulation methodology, natural population fluctuation, and random events) may bias population estimates and it is likely that the total breeding population of flycatchers fluctuates from year to year.

Rangewide, the population is comprised of extremely small, widely-separated breeding groups, including unmated individuals. The population size at most flycatcher breeding sites is small, five or fewer territories, and habitat patch size is small. These small sites are theoretically more susceptible to extirpation. Data gathered supports this theory, as surveys results show that flycatchers no longer occupy 122 of the 265 sites tracked since 1993 (Durst *et al.* 2004). All but two of these extirpated sites were composed of five or

fewer territories. Not all birds at these extirpated sites necessarily died, some relocated to other sites (Durst *et al.* 2004).

If we exclude the extirpated sites and look at the size of breeding sites, the vast majority of sites (99 of 143:69%) still have five or fewer territories. Because most of the 122 extirpated sites usually had only one or two territories, their loss does not greatly affect the overall rangewide territory estimates and statistics reported (Durst *et al.* 2004). The number of territories and sites has increased since the bird was listed and there is still habitat that has not been surveyed. The increase should not be interpreted entirely as a flycatcher population increase. To a great extent, it is a function of increased survey effort/reporting over time. However, after nearly a decade of intensive surveys, the existing numbers are consistent with the upper end of Unitt's (1987) estimate of 500 to1000 pairs.

The distribution of breeding groups is also highly fragmented. For example, in New Mexico the flycatchers at Los Ojos on the Rio Chama are approximately 60 miles from the closest known site at San Juan Pueblo, and the Radium Springs site is approximately 70 miles south of the flycatchers at San Marcial. The large distances between flycatcher breeding groups and small population sizes decrease stability and increase the risk of local extirpation due to stochastic events, predation, cowbird parasitism, and other factors (Service 2002a). Almost 50 percent of the territories (Durst *et al.* 2004) are within three management units (Roosevelt with 196 - AZ, Upper Gila with 228 – AZ/NM, Middle Gila/San Pedro with 186 – AZ.) Having 50 percent of the entire subspecies at just three management units could have dire effects on the species should catastrophic events occur that would remove or significantly reduce habitat suitability at the sites with the highest number of territories.

The survival and recovery of the flycatcher is not dependent on having a few locations with large numbers of birds, but rather properly distributed populations throughout the subspecies' range placed close together (Service 2002). Southwestern willow flycatchers are believed to function as a group of meta-populations (Service 2002). Esler (2000) describes Levins' meta-population theory as that which addresses the demography of distinct populations (specifically extinction probabilities), interactions among sub-populations (dispersal and recolonization), and ultimately persistence of the aggregate of sub-populations, or the meta-population. Meta-population theory has been applied increasingly to conservation problems, in particular those cases where species' ranges have been fragmented by habitat alteration by humans. An incidence function analysis completed for the southwestern willow flycatcher incorporated a spatial component to estimate probabilities of habitat patch extinction and colonization (Lamberson *et al.* 2000). Modeling indicated that persistence of flycatcher populations is reduced when populations are small and widely distributed. Conversely, meta-populations are more stable when sub-populations are large and close together. However, where populations exceed 10 pairs, it is best to colonize a new site, rather than risk the effects of catastrophic events (fire, disease, flood, etc.). In other words, there needs to be considerable progress to reach greater meta-population stability through developing larger sites in closer proximity to each other (Service 2002).

Table 1. Rangewide population status for the southwestern willow flycatcher based on 1993 to 2004 survey data for Arizona, California, Colorado, New Mexico, Nevada, Utah, and Texas, (There is no recent survey data or other records to know the current status and distribution within the state of Texas.), (Durst *et al.* 2004).

State	Number of sites with WIFL territories 1993-04[1]	Percentage of sites with WIFL territories 1993-04	Number of territories[2]	Percentage of total territories
Arizona	112	42.3 %	544	43.3 %
California	91	34.3 %	200	15.9 %
Colorado	5	3.8 %	65	5.2 %
Nevada	13	4.9 %	68	5.4 %
New Mexico	36	13.6 %	372	29.6 %
Utah	3	1.1 %	7	0.6%
Texas	?	?	?	?
Total	265	100 %	1256	100 %

1 Site boundaries are not defined uniformly throughout the bird's range.
2 Total territory numbers recorded are based upon the most recent years survey information from that site between 1993 and 2004.

New Mexico Distribution and Abundance

Unitt (1987) considered New Mexico as the state with the greatest number of southwestern willow flycatchers remaining. After reviewing the historic status of the flycatcher and its riparian habitat in New Mexico, Hubbard (1987) concluded, "[it] is virtually inescapable that a decrease has occurred in the population of breeding flycatchers in New Mexico over historic time. This is based on the fact that wooded sloughs and similar habitats have been widely eliminated along streams in New Mexico, largely as a result of the activities of man in the area." Unitt (1987), Hubbard (1987), and more recent survey efforts have documented very small numbers and/or extirpation in New Mexico on the San Juan River (San Juan County), near Zuni (McKinley County), Blue Water Creek (Cibola County), and the Rio Grande (Doña Ana County and Socorro County).

In New Mexico, surveys and monitoring from1993-2002 documented approximately 173 to 400 flycatcher territories in 8 drainages (Service 2003 BO). During the 2003 survey season two new sites were detected in New Mexico, both were in the upper reaches of the Canadian River drainage, one in Colfax County and one in Mora County. Two more new sites were detected during the 2005 survey season, one in Mora County and one near the Mimbres River in Grant County. Flycatchers have been observed at a total of 38 sites in New Mexico along the Rio Grande, Chama, Canadian, Gila, San Francisco, San Juan, and Zuni drainages, however, the approximate number of territories has not changed since the Service 2003 BO.

Arizona Distribution and Abundance

Unitt (1987) concluded that "...probably the steepest decline in the population level of *E.t. extimus* has occurred in Arizona..." Historic records for Arizona indicate the former range of the southwestern willow flycatcher included portions of all major river systems (Colorado, Salt, Verde, Gila, Santa Cruz, and San Pedro) and major tributaries, such as the Little Colorado River and headwaters, and White River.

In 2004, 522 territories were known from 40 sites along 12 drainages in Arizona (Munzer *et al.* 2005). The lowest elevation where territorial pairs were detected was 98 feet along the Lower Colorado River; the highest elevation was in eastern Arizona in the White Mountains (8329 feet).

As reported by Munzer *et al.* (2005), the largest concentrations of breeding willow flycatchers in Arizona in 2004 were at the Salt River and Tonto Creek inflows to Roosevelt Lake (374 flycatchers, 209 territories); near the San Pedro/Gila river confluence (352 flycatchers, 186 territories); Gila River, Safford area (6 flycatchers, 3 territories); Alamo Lake on the Bill Williams River (includes lower Santa Maria and Big Sandy river sites) (51 flycatchers, 31 territories); Topock Marsh on the Lower Colorado River (57 flycatchers, 34 territories); Big Sandy River, Wikieup (54 flycatchers, 28 territories); Horseshoe Lake, Verde River (28 flycatchers, 19 territories), and Alpine/Greer on the San Francisco River/Little Colorado River (7 flycatchers, 4 territories). Combined, Roosevelt Lake and the San Pedro/Gila confluence make up 395 (76%) of the 522 territories known in the state.

Soon after listing, following the 1996 breeding season, 145 territories were known to exist in Arizona. In 2001, the known statewide population was 346 territories and in 2004, 522 territories were detected. From 1996 to 2004, there was a statewide increase of 377 territories. Over this 9 year period, some sites became unoccupied or had reductions in number of territories, other new sites were detected, and some sites grew in numbers and better surveys provided more comprehensive information on actual abundance (Durst *et al.* 2005). Since 1996, the increase of 320 territories (75 to 395) at Roosevelt Lake and at San Pedro/Gila River confluence represents 85 percent of the statewide growth. Survey effort was initially a factor in detecting more birds at San Pedro/Gila river confluence (more recently, habitat growth has occurred), but the Roosevelt population

grew as a result of increased habitat development and bird reproduction in the conservation pool of the reservoir.

While a numbers have significantly increased in Arizona, overall distribution of flycatchers throughout the state has not changed much. Note that 85% of the growth of flycatchers in Arizona since listing has occurred at two locations. Recovery and survival of the flycatcher depends not only on numbers of birds, but territories/sites that are well distributed (Service 2002). Currently, population stability in Arizona is believed to be largely dependent on the presence of two large populations (Roosevelt Lake and San Pedro/Gila River confluence). Therefore, the result of catastrophic events or losses of significant populations either in size or location could greatly change the status and survival of the bird. Conversely, expansion into new habitats or discovery of other populations, would improve the known stability and status of the flycatcher.

California Distribution and Abundance

The historic range of flycatcher in California apparently included all lowland riparian areas in the southern third of the State. It was considered a common breeder where suitable habitat existed (Wheelock 1912, Grinnell and Miller 1944). Unitt (1987) concluded that it was once common in the Los Angeles basin, the San Bernardino/Riverside area, and San Diego County. Specimen and egg/nest collections confirm its former distribution in all coastal counties from San Diego County north to San Luis Obispo County, as well as in the inland counties (i.e., Kern, Inyo, Mohave, San Bernardino, and Imperial). Unitt (1987) documented that the flycatcher had been extirpated, or virtually extirpated (i.e., few territories remaining) from the Santa Clara River (Ventura County), Los Angeles River (Los Angeles County), Santa Ana River (Orange and Riverside counties), San Diego River (San Diego County), lower Colorado River (Imperial and Riverside counties and adjacent counties in Arizona), Owen's River (Inyo County), and the Mohave River (San Bernardino County). The flycatcher's former abundance in California is evident from the 72 egg and nest sets collected in Los Angeles County between 1890 and 1912, and from Herbert Brown's 34 nests and nine specimens taken in June of 1902 near Yuma.

The primary flycatcher drainages in California are the Kern, Owen's, San Luis Rey, Santa Ana, and Santa Margarita rivers. As of the 2004 survey season, California had 91 sites and 200 territories (Durst *et al.* 2004).

Texas Distribution and Abundance

The Rio Grande and Pecos River in western Texas are considered the easternmost boundary for the flycatcher. Unitt (1987) found specimens from four locations in Brewster, Hudspeth (Rio Grande), and Loving (Pecos River) Counties where the subspecies is no longer believed to be present. Landowner permission to survey riparian areas on private property has not been obtained; thus current, systematic survey data are not available for Texas. There have been no other recent reports, anecdotal or incidental, of flycatcher breeding attempts in the portion of western Texas where the subspecies occurred historically. It is unknown at this time whether the flycatcher has been extirpated from Texas, but it is unlikely that there are significant numbers.

Nevada Distribution and Abundance
Unitt (1987) documented three locations in Clark County from which flycatchers had been found prior to, but not after 1970. In 1998, two pairs of flycatchers were documented. Current survey efforts have documented breeding birds along the Amargosa, Pahranagat, Muddy, and Virgin Rivers (McKernan and Braden 1997, 1998) in southern Nevada. As of the 2004 survey season, Nevada had 13 sites and 68 territories (Durst *et al.* 2004).

Colorado Distribution and Abundance
In 2002, 23 flycatcher territories were located in the San Luis Valley of the Rio Grande. Preliminary data on song dialects suggest that the few birds recently documented in southwestern Colorado may be the southwestern willow flycatcher. Surveys since 1993 have documented flycatchers at six locations in Delta, Mesa, and San Miguel Counties. As of the 2004 survey season, Colorado had 10 sites and 65 territories (Durst *et al.* 2004).

Utah Distribution and Abundance
Specimen data reveal that the flycatcher historically occurred in southern Utah along the Colorado River, San Juan River, Kanab Creek, Virgin River, and Santa Clara River (Unitt 1987). The flycatcher no longer occurs along the Colorado River in Glen Canyon, where Lake Powell inundated historically occupied habitat, nor in unflooded portions of Glen Canyon near Lee's Ferry where flycatchers were documented nesting in 1938. Similarly, recent surveys on the Virgin River and tributaries, and Kanab Creek have failed to document their presence (McDonald *et al.* 1995). As of the 2004 survey season, Utah had 3 sites and 7 territories (Durst *et al.* 2004).

III. ENVIRONMENTAL BASELINE

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

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 2003a).

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 in 2005 were well above average to significantly above average statewide leading to a peak of over 6,000 cfs at Albuquerque and sustained high flows (> 3,000 cfs) for more than two months. These flows improved conditions for both spawning and recruitment. Despite good runoff, 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. The 2006 spring runoff has been well below average. Streamflow conditions have ranged from 10 to 67 percent of average (NRCS; http://www.nm.nrcs.usda.gov/snow/watersupply/nr0604.html).

Rio Grande Silvery Minnow

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, silvery minnow rescue efforts, 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 2002). 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 (Scurlock 1998). Construction and operation of these dams, which are either irrigation diversion dams (Angostura, Isleta, San Acacia) or flood control and water storage dams (Elephant Butte, Cochiti, Abiquiu, El Vado), have modified the natural flow of the river. Mainstem dams store spring runoff and summer inflow, which would normally cause flooding, and release this water back into the river channel over a prolonged period of time. These releases are often made during the winter

months, when low flows would normally occur. 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).

In the spring of 2002 and 2003, there was concern that silvery minnows would not spawn because of a lack of spring runoff due to an extended drought. River discharge was artificially elevated through short duration reservoir releases during May to induce spawning by Rio Grande silvery minnow. In response to the releases, significant silvery minnow spawning occurred and was documented in all reaches except the Cochiti Reach (S. Gottlieb, UNM, *in litt.* 2002; Dudley *et al.* 2004). Fall populations in 2003 and 2004 continued to decrease despite large spawning events, 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 are 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, it's velocity increases. 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 is 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). Chlorine concentrations of 0.013 mg/L can be 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 water temperature of 25 °C, ammonia concentrations as low of 3.1 mg/L can be harmful to larval fathead minnow (U. S. Environmental

Protection Agency 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 tetracholoroethene (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). 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 (Ne) (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 Ne 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 is 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, the Tiffany Plug Removal Project, and the Interstate Stream Commission's (ISC) Habitat Restoration 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. Los Lunas Habitat Restoration Project: On February 6, 2002, the Service completed this consultation, which tiered from the programmatic biological opinion on water management on the Middle Rio Grande issued June 29, 2001. This project is intended to partially fill element J of the Reasonable and Prudent Alternative from the programmatic biological opinion to conduct habitat/ecosystem restoration projects in the Middle Rio Grande to benefit the silvery minnow and flycatcher. Approximately 37 acres of native riparian and 40 acres of aquatic habitat have been created by this project. This project includes side-channels resulting in increased inundation frequency and will result in inundation of the area at flows greater than or equal to 2,500 cfs. A variety of substrate elevations will also allow inundation of some areas when flows are less than 2,500 cfs.

8. Temporary Channel to Elephant Butte: This Reclamation project involves the construction of a temporary channel through the delta area of Elephant Butte Reservoir to increase the efficiency of sediment and water conveyance. An additional project goal was to initiate some degradation of the river bed through the San Marcial Reach to increase overall channel capacity and potentially allow for higher peak releases from Cochiti dam during subsequent spring runoff periods.

9. 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.

10. 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. Additionally, this winter, the ISC started a multi-year habitat restoration program that implements several island, bar, and bank line modification techniques throughout the Albuquerque Reach. Approximately 24 acres of habitat were restored in the Phase I

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 (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 (Reclamation 2002). 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 (Reclamation 2002). 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. The increased abundance of silvery minnow in 2004 and 2005 is a positive sign. Nevertheless, the threats that endanger this species have not been eliminated.

Southwestern Willow Flycatcher

Status of the Species Within the Action Area

Within the Rio Grande, flycatchers were reported at Elephant Butte State Park in the 1970s; the majority nesting in saltcedar, although the exact location of the sightings was not reported (Hundertmark 1978, Hubbard 1987). In recent years, breeding pairs have been found within the Middle Rio Grande Project action area from Elephant Butte Reservoir upstream to the vicinity of Taos, on both the mainstem Rio Grande and on the Rio Grande de Rancho, a tributary to the upper Rio Grande. Breeding pairs have also been found on the Chama River in the vicinity of Los Ojos (Service 2003 BO).

Over the past 7 years, a total of 597 flycatcher nests have been monitored along the Middle Rio Grande (Moore *et al.* 2006). Between 1999 and 2005, 45 nests (7.5 percent) were in saltcedar-dominated territories, 487 (81.6 percent) were in *Salix*-dominated territories, and 65 (10.9 percent) were in mixed-dominance territories. Saltcedar- and *Salix*-dominated territories are defined as >90 percent saltcedar or *Salix*, respectively. Mixed-dominance occurs when a dominant vegetation type is not obvious. In considering nest success for these situations, flycatcher nests in *Salix*-dominated (55.1 percent, n = 472) areas were no more successful than those placed in saltcedar-dominated (57.6 percent, n = 33) or mixed-dominance areas (50.0 percent, n = 60) (Moore *et al.* 2005).

Productivity of nests, defined as number of birds fledged per successful nest, in *Salix*-dominated habitats was slightly greater (2.67 fledged birds/nest, n = 260) than nests located in both mixed-dominance territories (2.16 fledged birds/nest, n = 30) and saltcedar-dominated habitats (2.4 fledged birds/nest, n = 19) (Moore *et al.* 2006). Based on these data, flycatchers appear to select native-dominated habitat when available, and appear to have more productive nests in native habitat.

Nest substrate is defined as the species of tree where a flycatcher nest is physically located. Though 81.6 percent of flycatcher nests over the past 7 years were found in *Salix*-dominated areas, 37.0 percent of all nests and 29.8 percent of nests in *Salix*-dominated habitats were physically located in a saltcedar. Nest success is similar in three substrate categories: 55.5 percent (*Salix*), 53.4 percent (saltcedar), and 70.0 percent (Russian olive). No statistically significant difference was found to exist between any substrate classes. Additionally, parasitism rates between nests placed in the three different substrates (*Salix* 14.5 percent, saltcedar 17.0 percent, and Russian olive 15.0 percent) were similar. Productivity of SWFL nests in *Salix* (2.66 fledged birds/nest, n = 188) and saltcedar (2.46 fledged birds/nest, n = 109) substrates was slightly greater than those located in Russian olive substrate (2.14 fledged birds/nest, n = 14) (Moore *et al.* 2006).

Lastly, addling or removal of brown-headed cowbird (BHCO) eggs from parasitized flycatcher nests is a practice that was begun in 2002 and continued through 2005. Of the 79 flycatcher nests parasitized during that period with known outcomes, BHCO eggs

were addled or removed from 38 nests, 7 of which successfully fledged flycatcher young (18.4 percent success). Parasitized nests over the past six seasons in the Middle Rio Grande that were unaltered were just as successful. Of 41 parasitized nests monitored, 32 failed, 8 successfully fledged young, and 1 BHCO egg was built-over by the adult flycatchers and subsequently fledged young—a 22 percent success rate. This is not a statistically significant difference and addling has not been detrimental to parasitized flycatcher nests (Moore *et al.* 2006).

Chama River

Surveys for presence/absence and habitat suitability along the Rio Chama below Abiquiu Dam in 1994 identified no flycatchers, but found small areas of suitable habitat (Eagle Ecological Services 1994). A Service biologist recorded an unidentified willow flycatcher about a quarter-mile from the Rio Chama near Chili, New Mexico (Eagle Ecological Services 1994). More recent data also indicate that the Rio Chama may be used by flycatchers. Several flycatcher territories were identified each breeding season from 1993 –1998 in the Rio Chama drainage until surveys were discontinued, including areas near Parkview, above Heron Reservoir (USGS 1998), and in the vicinity of Los Ojos. Non-protocol surveys in 2001 and 2004 have indicated that at least a few birds have persisted.

Velarde Area

In 1995, several individual flycatchers were observed along the river near Velarde, New Mexico. In 1996, flycatchers were again detected during the breeding season in the Española valley (Ahlers and White 1996). Nesting attempts were documented at three sites in the Española valley (Johnson *et al.* 1999). The three sites in the Velarde section of the Rio Grande had one territory in 2001 and one territory in 2004. Not all sites are surveyed every year.

San Juan Pueblo

In 1995 nesting flycatchers were located on the San Juan Pueblo. In 2000, protocol surveys found 16 territories on San Juan Pueblo lands. Surveys were not conducted in 2001 through 2003. 2004 and 2005 surveys detected a healthy number of territories.

Isleta Pueblo

In 2000, 14 territories were located on Isleta Pueblo lands at five sites identified as suitable breeding habitat for the flycatcher. In 2003, a study was initiated that included protocol surveys for flycatchers and nest monitoring. Since the surveys done in 2000, habitat has been altered for fire prevention/control. In 2003, only three sites had suitable nesting habitat and produced four territories. In 2004 and 2005 there were seven and six territories respectively.

La Joya State Wildlife Refuge

In 2001, seven territories and five nests were located. Three of the nests were successful. Two nests were parasitized, each with a cowbird egg, however, one successfully fledged two flycatcher young. In 2002, six territories and five nests were located. Three nests were successful and two nests were parasitized by cowbirds. One parasitized nest

fledged a flycatcher young. Surveys continued from 2003 through 2005 with seven territories and six nests documented in 2005 with unconfirmed nest success.

Sevilleta National Wildlife Refuge

In 1999, four flycatcher territories within the Sevilleta National Wildlife Refuge were discovered by Reclamation while conducting routine neotropical migrant point counts in late May. Follow-up point counts confirmed the detected individuals to be residents and formal surveys in the area of detection began on June 21, 1999. Nesting was confirmed at three of the territories. Two nests were successful, and the third failed for unknown reasons. Results of surveys for 2000 revealed two nests at this location. These were the first documented occurrences of territory establishment and successful breeding in areas adjacent to the river dominated by saltcedar and Russian olive within Reclamation's study area (Ahlers and White 2000). In 2001, four territories and four nests were located. Three of the nests were successful and one failed (Ahlers *et al.* 2002). Although three nests were parasitized by cowbirds, two of the parasitized nests fledged two flycatcher young. In 2002, six territories and eight nests were located. Five nests were successful and one nest was parasitized. (Reclamation 2002c). Surveys continued from 2003 through 2005 with 11 territories documented in 2005 with unconfirmed nest success.

Bosque Del Apache National Wildlife Refuge

In 2001, one territory was located during surveys of suitable habitat within actively managed wetland and riparian units of the Refuge and/or along water conveyance facilities. In the past, one territory was located in 2000, and two to three territories in 1999. There are two sites on the Refuge that have been used fairly consistently since 1994. Nest searches are not conducted on the Refuge, therefore nest status and productivity cannot be confirmed. In 2002, the river corridor was surveyed in addition to selected areas within the inactive floodplain of the Refuge. Three territories were located along the river however no pairs or nests were found. One territory was located within the Refuge's seasonally flooded marsh units (Taylor 2001, 2002). There was a decrease in the number of territories surveyed in 2003 through 2005. Although willow flycatcher species migrated through the area each year, there was only one southwestern willow flycatcher territory in 2003, two in 2004, and zero in 2005.

San Marcial

In 1994, 11 flycatcher territories were detected in the San Marcial area, all above the San Marcial Railroad Bridge (Mehlhop and Tonne 1994). Survey results show that this area continues to support an increasing number of territories over the years and is the most productive flycatcher population along the Rio Grande.

In 2003, there were 86 territories at this site and nest monitoring was conducted where nesting pairs were detected. Nests were monitored for success rates, productivity, and brown-headed cowbird parasitism. Of the 98 nests at this site at least 127 flycatcher fledglings were produced. (Ahlers and Moore 2004)

In 2004, there were 113 territories at this site and nest monitoring was conducted where nesting pairs were detected. Nests were monitored for success rates, productivity, and

brown-headed cowbird parasitism. Of the 153 nests at this site at least 187 flycatcher fledglings were produced. (Ahlers and Moore 2005)

In 2005, there were 107 territories at this site and nest monitoring was conducted where nesting pairs were detected. Nests were monitored for success rates, productivity, and brown-headed cowbird parasitism. Of the 127 nests at this site at least 197 flycatcher fledglings were produced. (Moore and Ahlers 2006)

Presence/absence and nest monitoring surveys along the Rio Grande have been conducted since 1993. Table 2. presents the results of surveys for flycatchers at these sites from 2000 through 2005.

Table 2. Number of Southwestern Willow Flycatcher territories detected by surveys between 2000 and 2005 at sites on the Middle Rio Grande, New Mexico. (Reclamation data)

River Reach	2000	2001	2002	2003	2004	2005[a]
Velarde	2	1	0	not surveyed	1	0
San Juan Pueblo	16	not surveyed	not surveyed	not surveyed	present	present
Isleta Pueblo	14	not surveyed	not surveyed	4	7	6
Belen reach	2[b]	not surveyed	not surveyed	not surveyed	0	1
Sevilleta NWR / La Joya State WMA	8	11	13	17	19	20
Bosque del Apache NWR	1	2	4	3	1	0
San Marcial / Tiffany areas	4	3	12	34	16	3
Elephant Butte Reservoir Delta	19	22	51	52	113	107
Total	66	39	80	112	150	131

[a] Reclamation unpublished data.
[b] Corps unpublished data.

Habitat Characteristics

Development of a flycatcher habitat suitability model was initiated in 1998 for the Middle Rio Grande Basin and continues to be refined based on changes in hydrology and updated vegetation maps. Riparian vegetation in the Middle Rio Grande Basin between San Acacia Diversion Dam and Elephant Butte Reservoir had been classified using the Hink and Ohmart (1984) classification system through a cooperative effort with the U.S. Forest Service. This system identifies vegetation polygons based on dominant species and structure. Plant community types are classified according to the dominant and/or

codominant species in the canopy and shrub layers. During the summer and fall of 2002, as part of the ESA Collaborative Program, Reclamation personnel updated vegetation maps from Belen to San Marcial using a combination of ground truthing and aerial photo analysis. During the summer of 2004, the conservation pool of Elephant Butte Reservoir was again aerially photographed (true color) and vegetation heights were remotely-sensed using Light Detection and Ranging (LIDAR) methods. The area was ground truthed again during the summer of 2005. These data are currently being processed and will be used to update the current SWFL habitat model.

Riparian habitat within all these reaches includes dense stands of willows and cottonwoods adjacent to or near the river channel. The Cochiti and Angostura Reaches in the Middle Rio Grande support local areas of suitable flycatcher habitat; however, no birds have been documented establishing territories. The Isleta and San Acacia Reaches also contain dense stands of saltcedar. Flycatchers (and many other species of neotropical migrant landbirds) use the Rio Grande riparian corridor as stop-over habitat during migration. Studies have shown that during the spring and fall migration, flycatchers are more commonly found in willow habitats than in other riparian vegetation types, including the narrow band of coyote willows that line the LFCC within the Refuge (Finch and Yong 1997). Recent presence/absence surveys during May have detected migrating flycatchers throughout the project area in vegetation types that are classified as "low suitability" for breeding habitat (Ahlers and White 1997).

Habitat Availability by Reach

The Velarde Reach (from Velarde, NM to the Rio Chama confluence) has a narrow riparian zone with active woody species regeneration and limited non-native vegetation. Habitat quality and vegetation varies considerably within this reach. Some bosque areas contain older, more mature cottonwood trees that are 30 – 50 ft (9 – 15 m) tall. Russian olive and Siberian elm trees occur on some banklines and river bars. Other areas support stands of dense willows with canopy trees. Overbank flooding is localized but regular. The high potential for bank erosion may increase the dynamics of riparian vegetation loss and regeneration. All habitat patches within this reach where flycatchers have been detected in the past were dominated by willow and were inundated by overbank flooding or irrigation return flows. Nearby habitat included mature cottonwoods, open areas and Russian olives.

The Española Reach (from the Rio Chama confluence to the Otowi Bridge) contains older aged riparian habitat with numerous oxbows and some encroachment of non-natives. A significant geomorphic feature of this reach is the destabilization of the channel and lowering of the river bed and water table caused by within-channel gravel mining. About 20 acres (8 ha) of native vegetation have been lost due to this activity.

The bosque in the Cochiti and Angostura Reaches contains mainly single-aged stands of older cottonwoods and lacks the diversity of a healthy, multi-aged riparian forest. Non-native vegetation such as Russian olives and Siberian elms are also becoming established. Significant channel narrowing and downcutting has limited overbank flooding and

reduced the potential for recruitment of native riparian vegetation, especially cottonwoods and willows. Known flycatcher habitat in some areas of the Isleta Reach consists of dense willow and cottonwood stands associated with floodplain marshes (i.e. below Isleta Diversion Dam). Flycatcher habitat adjacent to the river within the Sevilleta National Wildlife Refuge contains saltcedar and Russian olive. Channel narrowing and degradation in this reach reduces the amount of overbank flooding and the potential sites for existing and new native vegetation. Known flycatcher habitat in the Rio Puerco Reach is dominated by saltcedar.

Vegetation within the reach was mapped using the Hink and Ohmart classification system through a cooperative effort with the U.S. Forest Service. Breeding habitat suitability was refined by identifying all areas that are within 100 meters of existing watercourses, ponded water, or in the zone of peak inundation. The 5 categories of flycatcher habitat that lie within 100 meters of water were defined as:

Highly Suitable Native Riparian - Stands dominated by willow and/or cottonwood.

Suitable Mixed Native/Non-native Riparian - Includes stands of natives mixed with non-natives.

Marginally Suitable Non-native Riparian - Stands composed of monotypic saltcedar or stands of saltcedar mixed with Russian olive.

Potential with Future Riparian Vegetation Growth and Development - Includes stands of very young sparse riparian plants on river bars that could develop into stands of adequate structure with growth and/or additional recruitment. Reclamation believes this category requires regular monitoring to ascertain which areas contain all the parameters to become flycatcher habitat.
Low Suitability - Includes areas where native and/or non-native vegetation lacks the structure and density to support breeding flycatchers, or exceeds the hydrologic parameter of greater than 100 meters from water. The presence of low suitability habitats may be important for migration and dispersal in areas where riparian habitats have been lost (i.e. agricultural and urban areas).

Currently, the Service groups the first three categories listed above as equally suitable habitat for the flycatcher, because a large number of sites are currently occupied in all three categories. At this time, it is not accurate to define those suitable habitats with non-native vegetation as being less suitable than native habitat for flycatchers.

The Rio Grande in the San Acacia Reach supports a high value riparian ecosystem. The native riparian trees and shrubs are interspersed with stands of nonnative riparian plants, primarily saltcedar and Russian olive. There is native desert habitat on both sides of the floodplain. This area is unique on the Rio Grande because of the lack of agricultural and urban development on the outside edges of the floodplain. This area represents a relatively unfragmented landscape with associated high biological values. For this

reason, the San Acacia Reach is considered a priority area for riparian restoration and/or maintenance.

Table 3. Hectares of willow flycatcher habitat categories on the Rio Grande between Highway 60 (Bernardo) and the Delta of Elephant Butte Reservoir as it was delineated in 2001(Ahlers *et al* 2001).

Willow Flycatcher Habitat Category	Sevilleta/ La Joya	Upper north	Upper south (including Tiffany area)	Lower east	Lower west	Delta	**Total**
Highly Suitable	217	19	184	255	77	65	817
Suitable	757	85	192	119	35	46	1,234
Marginally Suitable	898	169	729	59	134	6	1,995
Potential	1081	426	183	50	35	37	1,812
Low Suitability	11,204	2,264	2,372	133	1440	1,678	19,091
Total	14,157	2,963	3,660	616	1721	1,832	24,949

Table 4. Comparison of recent quantifications of flycatcher breeding habitat on the Rio Grande, New Mexico. Habitat delineations from USACE *et al.* (2006) were limited to suitable riparian habitat that occurred within 50 m of surface water while the delineations by Ahlers *et al.* (2001) included all suitable riparian habitats within 100 m of surface water. Delineations by USACE *et al.* (2006) also were limited to two areas—within and outside of a 16-km radius of existing clusters or individual flycatcher territories—whereas the delineations by Ahlers *et al.* (2001) did not use distance limits. A combination of the two delineations by USACE *et al.* (2006) are comparable to that of Ahlers *et al.* (2001).

River reach	**Hectares suitable within 50 m of water, inside 16 km of core population** [a]	**Hectares suitable within 50 m of water, outside 16 km of core population** [a]	**Hectares delineated by Ahlers et al. (2001)** [b]
Velarde to confluence with Rio Chama	34	0	-
Rio Chama/Rio Grande confluence to Otowi Gage	11	0	-
Otowi Gage to Cochiti Dam	0	61	-
Hwy. 550/Bernalillo to Isleta Diversion	120	266	-
Isleta Diversion to Rio Puerco confluence	261	328	-
Rio Puerco confluence to Elephant Butte Reservoir	556	353	752 [c]
Total	982	1008	752

[a] Data from Upper Rio Grande Water Operations Review DEIS (USACE *et al.* 2006).
[b] Refers to "Highly Suitable Native Riparian" category only.
[c] Area of delineation begins at the Highway 60 crossing and continues to the pool of Elephant Butte Reservoir.

Project-Related Flycatcher Habitat Development since 2003 BO

2003

- Pueblo of Santa Ana - 5 acres of plantings
- San Juan Pueblo - 60 acres of riparian habitat restoration for flycatcher

2004

- San Juan Pueblo - 55 acres of native wetland and willow plantings
- Corps of Engineers & City of Albuquerque - 48 acres creation of wetland and bosque restoration at Tingley ponds.

2005

- An additional 331.6 acres of native riparian habitat have been

restored/planted (*pers. comm.* Rob Doster, BOR).

Factors Affecting Species and Critical Habitat within the Action Area

In the Middle Rio Grande, past and present Federal, State, private, and other human activities that may affect the flycatcher include irrigated agriculture, river maintenance, flood control, dam operation, water diversions, and downstream Rio Grande Compact deliveries. The Rio Grande and associated riparian areas are a dynamic system in constant change. Without this change, the riparian community will decrease in diversity and productivity. Sediment deposition, scouring flows, inundation, base flows, and channel and river realignment are processes that help to maintain and restore the riparian community diversity. Habitat elements for the flycatcher are provided by thickets of riparian shrubs and small trees and adjacent surface water, or areas where such suitable vegetation may become established.

The Rio Grande historically had highly variable annual and seasonal discharge patterns (Platania 1993). Since 1973, flows in the Middle Rio Grande have been determined mainly by regulation of dam facilities and irrigation diversions. The highest flows generally result from snow-melt (April-May), irrigation water releases from the upstream reservoirs, and variable thunderstorms. Lowest flows generally occur from July to October, when most of the available river flow is diverted for irrigation. Summer monsoons can elevate river flows during this time period depending on their frequency and intensity. Water and sediment management have resulted in a large reduction of suitable habitat for the flycatcher, as a result of the reduction of peak flows that helped to create and maintain habitat for this species.

Anthropogenic encroachment into the historic floodplain, through conversion of native habitats to cropland, and construction of bridges and houses has reduced peak-flow releases from Cochiti Dam to prevent property damage. Overbank flooding is needed to create shallow, low velocity backwaters, and to maintain and restore native riparian vegetation for flycatcher habitat. Overbank flooding is also currently restricted by the safe channel capacity at the San Marcial Railroad Bridge. There are three houses in the floodplain at Socorro, and a new residential development in the floodplain 0.25 mile (0.15 km) downstream of Bernalillo. These urban developments are not protected by levees.

Levees have greatly restricted the floodplain width and functionally disconnected the river from most of the floodplain. A comparison of river habitat changes between 1935 and 1989 shows a 49 percent reduction of river channel habitat from 22,023 acres (8,916 ha) to 10,736 acres (4,347 ha) (Crawford *et al.* 1993). Between Cochiti Dam and Elephant Butte Reservoir headwaters, there are 235 miles (378 km) of levees (includes distances on both sides of the river).

The Middle Rio Grande channel width has narrowed over the last century. The trend can be attributed to reduced peak flows, channelization, and reduced sediment below Cochiti Dam. Channelization is primarily responsible for the elimination of thousands of acres

of the shallow, low velocity habitats required by the flycatcher. Flow regulation below Abiquiu Reservoir and Cochiti Dam has further decreased channel capacity and reduced peak flows. A channel-forming discharge has never been released from Cochiti Dam. The lack of large peak flows combined with the effects of channelization contributes significantly to channel narrowing and the elimination of overbank flooding. These factors severely limit the development of backwater habitats essential to the survival of the flycatcher.

Fire

Evidence suggests that fire was not a primary disturbance factor in southwestern riparian areas near larger streams (Service 2002a). Yet, in recent time, fire size and frequency has increased on the lower Colorado, Gila, Bill Williams, and Rio Grande rivers. The increase has been attributed to increasingly dry, fine fuels and ignition sources. The spread of the highly flammable plant, saltcedar, and drying of river areas due to river flow regulation, water diversion, lowering of groundwater tables, and other land practices is largely responsible for these fuels. A catastrophic fire in June of 1996, destroyed approximately a half mile of occupied saltcedar flycatcher habitat on the San Pedro River in Pinal County. That fire resulted in the forced dispersal or loss of up to eight pairs of flycatchers (Paxton *et al.* 1997). Recreationists cause over 95 percent of the fires on the lower Colorado River (Service 2002a). Brothers (1984) attributed increased fire along the Owens River in California to increased use of the riparian zones by campers and fishermen in the past 30 years.

High fuel loads that have accumulated over the past 50 years and growth of non-native species have added to the danger of fire in the Middle Rio Grande bosque. Over the last five to ten years, this threat has increased in severity due to drought conditions causing dead material to become extremely dry. In the summer of 2003, two fires occurred in the Albuquerque bosque. The Atrisco fire began on June 24, 2003, near the Interstate-40 Bridge and burned approximately 150 acres. The Montaño fire began on June 26, 2003 near the Montaño Bridge and burned approximately 113 acres. A total of approximately 263 acres within the Rio Grande Valley State Park (RGVSP) and on private land, were burned. A fire on June 10, 2004, burned 63 acres in the south end of the RGVSP; and one on June 23, 2004 burned approximately 18 acres near the National Hispanic Cultural Center (NHCC). Non-Federal efforts by the City of Albuquerque Open Space Division (OSD) for fire prevention and bosque restoration included thinning of dead wood and non-natives in order to prevent fires during the remaining 2004 fire season. Approximately $2 million dollars of both state and City funds were spent to hire contractors and utilize OSD crews to thin high priority areas. The Ciudad Soil and Water Conservation District did some thinning at locations near the Rio Grande Nature Center, the west side of the river south of Montaño Bridge and near the NHCC. Approximately 2000 acres within the RGVSP were cleared or thinned in 2004. Within the Pueblo of Sandia Reservation, several bosque areas have been thinned by the Pueblo. Sandia Pueblo is continuing to pursue fire prevention efforts. Within the Corrales Bosque Preserve, a small amount of thinning work and burn restoration has also taken place. Isleta Pueblo experienced a 315-acre burn in riparian/wetlands habitat in February, 2006. (BIA, Southern Pueblo Agency)

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 flycatcher and its critical habitat:

1. 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 flycatcher.

2. Tiffany Plug Removal: Reclamation has, on a recurring basis, cut a pilot channel through an instream sediment plug, in the Rio Grande, upstream of the bridge at San Marcial. The purpose of this project was to direct water through the main channel, rather than allow it to overbank into the adjacent floodplain, thereby reducing the amount of overbank flooded habitat for the flycatcher.

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. Los Lunas Habitat Restoration Project: On February 6, 2002, the Service completed this consultation, which tiered from the programmatic biological opinion on water management on the Middle Rio Grande issued June 29, 2001. This project is intended to partially fill element J of the Reasonable and Prudent Alternative from the programmatic biological opinion to conduct habitat/ecosystem restoration projects in the Middle Rio Grande to benefit the silvery minnow and flycatcher. Approximately 37 acres of native riparian and 40 acres of aquatic habitat have been created by this project. This project includes side-channels resulting in increased inundation frequency and will result in inundation of the area at flows greater than or equal to 2,500 cfs. A variety of substrate elevations will also allow inundation of some areas when flows are less than 2,500 cfs.

7. Temporary Channel to Elephant Butte: This Reclamation project involves the construction of a temporary channel through the delta area of Elephant Butte Reservoir to increase the efficiency of sediment and water conveyance. An additional project goal was to initiate some degradation of the river bed through the San Marcial Reach to increase overall channel capacity and potentially allow for higher peak releases from Cochiti dam during subsequent spring runoff periods.

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. Additionally, this winter, the ISC started a multi-year habitat restoration program that implements several island, bar, and bank line modification techniques throughout the Albuquerque Reach. Approximately 24 acres of habitat were restored in Phase I.

Importance of the Action Area to the Survival and Recovery of the Species

The flycatcher recovery plan identifies five Recovery Units, the Basin and Mojave, Lower Colorado River, Upper Colorado River, Gila River, and Rio Grande. Flycatcher populations are not distributed evenly throughout these Recovery Units, with the majority of individuals found in the Coastal California, Lower Colorado, Gila, and Rio Grande Recovery Units (Service 2002).

The Rio Grande Recovery Unit contains the eastern most population of flycatchers, and currently has approximately18 percent of known territories (Durst *et al.* 2004). Rio Grande Recovery Unit covers a major portion of the flycatcher's previous range. In order to be well protected against disease and catastrophe, the species should be well distributed geographically. The survival and recovery of the flycatcher is dependent on healthy, self sustaining populations of birds, which are able to exchange genetic information on occasion, and act as a source population should one area suffer significant losses (Soule 1986). The loss or reduction of a major population within a Recovery Unit could have potentially significant effects to the surrounding Recovery Units if genetic information is lost or if a source population which has been supporting other sites is significantly reduced.

Summary

Since the bird was listed in 1995 the known number of flycatcher pairs has increased throughout its range, but still remains within the 500 to 1000 pairs estimated by Unitt (1987) (Table 1). Since 1993, extensive survey efforts in Arizona, California, Colorado, Nevada, New Mexico and Utah have greatly increased the number of known breeding sites and breeding territories. From a 1993 estimate of roughly 30 sites and 111 territories, we now have data for 265 sites and 1256 territories (Durst *et al.* 2004), (Table 1). This increase should not be interpreted entirely as a flycatcher population increase. Rather, it is to a great extent a function of increased survey effort over time. Arizona, New Mexico, and California account for the greatest number of known flycatcher sites and territories. Although population increases and decreases undoubtedly occur at some sites, movements of birds among sites and lack of standardized survey effort/reporting make it difficult to separate population trends from variances in survey effort.

The rangewide decline of flycatcher distribution and numbers is a result of habitat loss, modification, and fragmentation (Service 2002). Water diversions, agriculture return flows, flood control projects, development, livestock grazing, and changes in annual flows due to off stream uses of water have affected the ability of the aquatic habitats to support native fish, plants, and wildlife. Riparian habitats by nature are dynamic, with their distribution in time and space governed mostly by flood events and flow patterns. Current conditions along southwestern rivers and streams are such that normal flow patterns have been greatly modified, catastrophic flood events occur with greater frequency as a result of poor watershed conditions, stream channels are highly degraded, floodplains and riparian communities are reduced in extent, wildfires in riparian habitats are increasing, and the species composition of riparian communities are modified with exotic plant species. These conditions have significantly diminished the potential for southwestern rivers and streams to develop suitable habitat for the flycatcher and for

those habitats to remain intact and productive for nesting flycatchers. Active management will be required in some areas. In the Middle Rio Grande, riparian habitat restoration efforts for the benefit of the flycatcher, pursuant to the Reasonable and Prudent Alternative S from the 2003 BO, resulted in a minimum of 168 restored acres through 2004 (Reclamation 2006). An additional 332 acres of native riparian habitat was restored in 2005 (*pers. comm.* R. Doster BOR).

IV. EFFECTS OF THE ACTION

Reclamation did not change the proposed action from what was analyzed in the March 17, 2003 BO. The effects of the action also remain consistent. Therefore, the description of the previous described effects on the silvery minnow and its critical habitat and on the flycatcher are hereby incorporated by reference.

This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. USDI Fish and Wildlife Service (CIV No. 03-35279) to complete the following analysis with respect to critical habitat. This consultation analyzes the effects of the action and its relationship to the function and conservation role of critical habitat to determine whether the proposed action destroys or adversely modifies critical habitat. This document and the relevant analyses from our March 17, 2003 BO represent our biological opinion for the, flycatcher and its designated critical habitat in accordance with section 7 of the Act.

Effects on Designated Flycatcher Critical Habitat

Effects from water operations include reduction of suitable habitat along the Rio Grande during the 10-year life of the project and beyond. Flycatcher habitat is ephemeral. Areas which are currently occupied may not be suitable in future years as the trees mature and the habitat begins to thin. Having areas of riparian vegetation along the Rio Grande that are maturing into suitable habitat while other areas are reaching a maturity level that makes them unsuitable for flycatchers is crucial to the long-term survival of the species. River drying in May and June in any year of the proposed action may affect areas of riparian vegetation that currently supports flycatcher territories. Drying may also affect vegetation that has the potential to become suitable habitat. Reductions in overbank flows, as described in the biological assessment, will likely reduce the quantity and quality of suitable flycatcher habitat along the Rio Grande. The degree to which flycatcher habitat is reduced will depend on several variables, including the amount dried, the length of time they are dry, and the number of years in which these drying events occur.

Lack of overbank flooding in spring, lack of sediment for seed germination, and water management between Cochiti Lake and the headwaters of Elephant Butte Reservoir have resulted in a monotypic age-class structure of native vegetation, particularly older cottonwood trees, and increased encroachment of exotic plant species, such as saltcedar

and Russian olive (Howe and Knopf 1991, Crawford *et al.* 1993). Furthermore, the lateral extent of suitable habitat for the flycatcher is constrained by water operations that limit overbank flooding to sites located close to the river's edge, resulting in a relatively narrow strip of suitable nesting habitat for flycatchers. The narrowness of suitable riparian vegetation increases the risk to flycatchers of adverse effects from flooding, predation, parasitism, and other disturbances. Stromberg (1993) found that the width of riparian vegetation communities and their biomass increases with mean and median annual flow volume and drainage size in alluvial river channels. The flycatcher depends on large patch sizes of riparian vegetation with adequate insect food supply in July, August, and September to raise young.

Effects to Primary Constituent Elements (PCEs)

PCE 1 (a-e): Within the action area, the reaches of the Rio Grande where critical habitat has been delineated contain several of the plant species identified above, notably Gooddings and coyote willows, Russian olive, tamarisk (saltcedar), seepwillow, Siberian elm, and cottonwood. These plant species often occur within the project area with sufficient density, structure, and patch size to support flycatchers.

Several elements of the reasonable and prudent alternative in the 2003 BO specifically address activities to avoid jeopardy to the flycatcher, many of which have been partially fulfilled by, or are ongoing practices of, the action agencies and parties to the consultation. These activities include (but are not limited to): pumping from the Low Flow Conveyance Channel (element D); avoidance of potential or suitable habitat (P); habitat restoration (S); and overbank flooding (V). Additionally, the reasonable and prudent measures of the associated Incidental Take Statement instruct the action agencies and parties to the consultation to minimize the loss of flycatcher territories caused by river drying and minimize the reduction of flycatcher reproductive success due to cowbird parasitism.

Reclamation, the Corps, the parties to the consultation, and non-federal agencies collectively have been implementing the reasonable and prudent alternative, reasonable and prudent measures, scientific investigations, and recovery activities through the Middle Rio Grande Endangered Species Act Collaborative Program. The most succinct summary of habitat improvement activities is the Program's *Habitat Restoration Plan for the Middle Rio Grande* (September 2004) which is included by reference.

PCE 2: The insect fauna that exists within the action area contains members of the insect orders described above as the second primary constituent element of flycatcher critical habitat. The above actions may have an effect on these insect populations through altering river flows via diversions and flood control activities, reducing overbank flooding, and producing ground-disturbances through river maintenance activities and habitat restoration projects. However, these actions are often temporary in nature and the degree to which they will adversely impact the riparian insect fauna can be minimal.

V. 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 flood, which is favorable for flycatcher habitat.

- 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 flycatcher.

- Gradual change in floodplain vegetation from native riparian species to non-native species (i.e., saltcedar). The flycatcher will be adversely affected by the increased risk of wildfire.

- Intentional and unintentional destruction and fragmentation of flycatcher habitat, such as by human-caused wildfires, trash dumping, and cutting and removal of native riparian vegetation.

- Future local actions include farming and grazing in the Middle Rio Grande floodplain and terraces, and water removal from the river. Livestock grazing may adversely impact flycatchers by destroying habitat, negatively impacting native vegetation, and by attracting brown-headed cowbirds. Other human activities that may adversely impact the flycatcher by decreasing the amount and suitability of habitat include dewatering the river for irrigation; increased water pollution from non-point sources; adverse effects from increased recreational use, suburban development, and removal of large woody debris; and logging.

- Increases in private development and urbanization in the historic floodplain that reduce and fragment riparian habitat for the flycatcher on the landward side of the levee, while increasing pressure on riparian habitat and wildlife within the bosque.

The Service anticipates that these types of activities could continue to reduce the quantity and quality of habitat.

VI. CONCLUSION

This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the

statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. USDI Fish and Wildlife Service (CIV No. 03-35279) to complete the following analysis with respect to critical habitat. This consultation analyzes the effects of the action and its relationship to the function and conservation role of flycatcher critical habitat to determine whether the proposed action destroys or adversely modifies critical habitat. This document and the relevant analyses from our March 17, 2003 BO represent our biological opinion for the flycatcher and its designated critical habitat in accordance with section 7 of the Act.

After reviewing the current status of the flycatcher, the current status of habitat in the action area, the environmental baseline for the action area, and the cumulative effects, it is the Service's biological opinion that water operations and river maintenance of the Middle Rio Grande, as proposed in the February 19, 2003, biological assessment, does not result in adverse modification to critical habitat for the flycatcher.

Designated Critical Habitat for the Flycatcher

Even though some effects from water operations include a reduction of suitable habitat along the Rio Grande during the 10-year life of the project and beyond, the proposed action will not destroy or adversely modify critical habitat and the primary constituent elements to an extent that the value of the critical habitat for both the survival and recovery of the flycatcher is appreciably reduced.

Minor modifications to vegetation may occasionally occur within designated critical habitat areas that include trimming of vegetation on survey rangelines away from occupied flycatcher sites in the non-breeding season and continued mowing of narrow strips of vegetation on roadside shoulders and ditches for roadway safety. All of these activities were previously considered in the 2001 and 2003 Biological Assessments and resulting Biological Opinions.

Several elements of the reasonable and prudent alternative in the 2003 BO specifically address activities to avoid jeopardy to the flycatcher, many of which have been partially fulfilled by, or are ongoing practices of, the action agencies and parties to the consultation. These activities include (but are not limited to): pumping from the Low Flow Conveyance Channel (Reasonable and Prudent Alternative [RPA] element D); avoidance of potential or suitable habitat (RPA element P); habitat restoration (RPA element S); and overbank flooding (RPA element V). These activities are conserving critical habitat. In the Middle Rio Grande, riparian habitat restoration efforts for the benefit of the flycatcher, pursuant to the Reasonable and Prudent Alternative S from the 2003 BO, resulted in a minimum of 168 restored acres through 2004 (Reclamation 2006). An additional 332 acres of native riparian habitat was restored in 2005 (*pers. comm.* R. Doster BOR).

Reclamation, the Corps, the parties to the consultation, and non-federal agencies collectively have been implementing the reasonable and prudent alternative, reasonable and prudent measures, scientific investigations, and recovery activities through the

Middle Rio Grande Endangered Species Act Collaborative Program. The most succinct summary of habitat improvement activities is the Program's *Habitat Restoration Plan for the Middle Rio Grande* (September 2004) which is included by reference.

Reduction of some insect populations that are dependent on surface water for a portion of their life cycle may occur as a result of reduced flows due to diversions from the Rio Grande, reducing overbank flooding, and producing ground-disturbances through river maintenance activities and habitat restoration projects. However, these actions are often temporary and the impact would not be to a degree that would adversely affect the flycatcher's food base.

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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 Federal agencies so that they become binding conditions of any Federal grant or permit issued to any non-Federal water users, 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, which was amended on June 15, 2006, for the 2003 Biological Opinion for Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico based on the premise that the RPA will be implemented.

The Service anticipates take will occur due to channel drying and entrainment. Estimated incidental take due to channel drying will be determined by the Service each year no later than April 1 and provided by the Service to the action agencies and parties to the consultation by memorandum. The incidental take number provided on April 1 will be in effect until March 30 of the following year. Estimated incidental take due to entrainment has been provided in this ITS and will not vary annually. Estimated incidental take for channel drying and entrainment are set out below in more detail.

Take due to Channel Drying

Take due to channel drying is separated into two categories: 1) Take of juveniles and young of year less than 30 millimeters (mm) standard length (SL), or 35 mm total length (TL); and 2) Take of adults larger than 30 mm SL (or 35 mm TL).

Juveniles and Young-of-Year < 30 mm SL. The number of juvenile and young-of-year (YOY) silvery minnows that may be taken due to channel drying cannot be determined because these fish are small, fragile, and dessicate quickly. Finding dead silvery minnows of this small size is rare and unlikely to indicate actual mortalities. While the collection and release of juvenile fish is possible, their survival is doubtful. It must be assumed that all silvery minnows less than 30 mm (1.2 in) standard length (from the tip of the snout to the end of the main body) or approximately 35 mm (1.4 in) in total length (from the tip of the snout to the end of the tail), will be taken as a result of the proposed action when the river dries within the Isleta and San Acacia reaches. For the purposes of this ITS, we assume a 30 mm SL minnow is equal to a 35 mm TL minnow. Either measurement may be used. Standard length is preferred as it provides a more accurate measure of fish size. However, in some cases, field conditions may require total length to be used.

Data indicate that until approximately mid-July, the majority of silvery minnows in the channel are less than 30 mm (1.2 in) SL or 35 mm TL (Service 1999, Dudley and Platania 1999) Therefore, if the river dries before mid-July, the majority of silvery minnow mortalities will be of fish smaller than 30 mm SL (or 35 mm TL). Although it is expected that thousands of fish less than 30 mm SL (or 35 mm TL) will be taken, typically only a small percentage of larval fish reach maturity (approximately 0.1 to 1 percent) in the wild. The effect of this mortality on the overall population of silvery minnows in this size class is expected to be minimal.

Adults and YOY > 30 mm SL. The Service anticipates that the number of silvery minnows greater than 30 mm (1.2 in) SL (or 35 mm TL) taken in any year due to channel drying will vary with population size and therefore estimated take should be evaluated annually. We anticipate take to be proportional to the number of fish present in the main channel during drying. This number is most appropriately represented as a function of the number of silvery minnows that will reproduce in the spring and the hydrological conditions in the river during spawning.

Incidental take will be estimated annually using the following formula:

$$Take = [(c \times fall\ recruitment) \times (spring\ runoff)] + (augmentation)$$

Where c is a constant (3341), *fall recruitment* is the total number of silvery minnows caught during population sampling in the month of October of the preceding year, *spring runoff* is an index of spring flows, and *augmentation* is a proportion of the number of fish released into the Middle Rio Grande following October population monitoring. These parameters are further described below.

It is the Service's opinion that approximately 1 of every 50 silvery minnows that are killed will be found because of dying minnows are subject to predation, minnows are generally small and hard to find, and there is high probability of dessication. This approximation was determined based on salvage activities and field observations during the 2002 irrigation season (H. Dale Hall, Service *in litt.* 2002). Therefore, if the number of dead silvery minnows found in any given year (observed mortality) exceeds the estimated *Take* ÷ 50 (e.g. for 2003, 38,000 divided by 50 = 760), the level of anticipated take will have been exceeded.

Fall recruitment. Population values for the silvery minnow are not available under currently used sampling methods. To determine the status of the species, the Service relies on catch per unit effort (CPUE) values from monthly sampling by Platania and Dudley (University of New Mexico) and the New Mexico Fishery Resources Office. The Service recognizes that these methods are useful in documenting overall trends but can be biased and have high potential variance. Therefore, data from other silvery minnow monitoring and fish rescue provide additional indicators of the population status. These data sources provide the best available scientific information for silvery minnow population size and trends over time.

For the purposes of this ITS, *fall recruitment* is the total number of silvery minnows caught in an October sampling period by qualified biologists, under a monitoring program that follows the current sampling protocol, and is approved by the Middle Rio Grande ESA Collaborative Program. The Service believes October monitoring provides the best available scientific data to determine silvery minnow population status at this time. We recognize, however, that population monitoring methods may change before the expiration of this ITS, at which time estimates of *fall recruitment* may need to be revised.

Spring runoff. Spring runoff can have significant effects on silvery minnow reproduction by providing nursery habitat in overbank areas. Dudley et al. (2004) found a significant relationship between CPUE of silvery minnows and days of flow in excess of 3000 cubic feet per second (cfs) at the Albuquerque gage. This relationship suggests that good spring flows (in excess of 3,000 cfs for two weeks or more) may double or, in some cases, quadruple the CPUE of silvery minnows. For example, October CPUE numbers increase more than 400 percent when spring flows exceed 3,000 cfs for 30 days or more. This relationship is strong, however it is not directly tied to the number of fish in the river that may be taken due to channel drying. Therefore, our formula conservatively estimates that increases in silvery minnow numbers are half what was calculated by Dudley et al. The effect of *spring runoff* (to be determined using the NRCS April 1 forecast) in the annually estimated take will be determined as follows:

Spring runoff = 2 in years where flows exceed 3,000 cfs at the Albuquerque gage for 30 consecutive days or more

Spring runoff = 1.25 in years where flows exceed 3,000 cfs at the Albuquerque gage for > 14 consecutive days but < 30 consecutive days

Spring runoff = 1 in years where flows do not exceed 3,000 cfs at the Albuquerque gage for > 14 consecutive days

The spring flow factor in the formula reflects the potential for exponential growth in silvery minnows when conditions are favorable. It is our opinion that this factor allows a more accurate estimation of the number of silvery minnows that are likely to be taken as the river dries.

Augmentation. The survivorship and reproductive success of augmented silvery minnows in the Middle Rio Grande is not well understood. Most fish are stocked deliberately in wet reaches, far upstream of anticipated drying. Studies indicate that most augmented silvery minnows are unlikely to move beyond 15 miles of the release site (Platania et al., 2003). Monitoring of augmented silvery minnows is preliminary and cannot currently provide an estimate of how well these fish survive.

Regardless, in calculating estimated incidental take for the silvery minnow, the Service has attempted to factor in augmented fish that are released after the October sampling period. We have made a best estimate from limited data, and approximate that no more than one percent of augmented silvery minnows are likely to die as a result of river drying. Therefore, *augmentation* in the above formula will be one percent of the number of fish stocked following the October sampling period. The Service recognizes that this value may be modified if augmentation activities expand beyond the Angostura Reach, and as our understanding of the survivorship and reproductive potential of augmented fish improves.

Constant. The constant *c* (3341) was calculated by using the above formula and inputting 2003 biological conditions and the estimated take in the ITS that accompanied the 2003 biological opinion. These values are *Take* = 38,000, *fall recruitment* = 11 (from October 2002 population monitoring), *spring runoff* = 1 (flows did not exceed 3,000 cfs in 2003), and *augmentation* = 1249 (one percent of the 124,880 fish augmented in 2003). The constant *c* provides a consistent multiplier over which the estimated take may be varied to reflect population fluctuations, but kept proportional to the take estimated in the original ITS that accompanied the March 17, 2003 biological opinion.

Incidental take due to channel drying will be estimated by the Service each year no later than April 1 and provided by the Service to the action agencies and parties to the consultation by memorandum. The incidental take number provided on April 1 will be in effect until March 30 of the following year. Take will be in the form of kill. Other categories of take (see below) will not be updated annually.

The Service notes that this formula provides 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 calculation should other silvery minnow monitoring information, data from silvery minnow rescue operations, actual spring flows, or other research indicate substantial deviations from calculated values. The formula itself may also be subject to

revision should a different methodology for evaluating take be determined more accurate than the above approach. In either case, further consultation may be necessary.

Rescued silvery minnows will count toward the Service's Regional Director's 10(a)(1)(A) permit. Silvery minnows found dead in lateral isolated pools created by river flow fluctuations resulting from storm events will not count toward incidental take for this consultation because they are considered "acts of nature." Silvery minnows found dead in lateral isolated pools caused by water management count toward incidental take. This take will be in the form of kill and harm.

Take due to Entrainment

Juveniles and Young-of-Year < 35 mm TL. The Service anticipates that no more than 100,000 silvery minnow eggs each year will be taken through entrainment at the diversion facilities on the river. Since each silvery minnow female can release up to 6,000 eggs per spawning event (Platania 1995, Platania and Altenbach 1998), this number of eggs entrained is not expected to have a measurable effect on the population. Information indicating the degree of entrainment and the survivorship of eggs that are entrained is limited. Few eggs have been found in diversions during recent monitoring. It remains unknown whether eggs are not found because they fail to become entrained or because they are eaten or otherwise lost once they enter the diversion system. As our knowledge of egg entrainment improves this value may be updated. Take of eggs will occur in the form of harm, wound, and kill.

This is the total level of take of silvery minnows anticipated for the proposed actions of all Federal agencies and non-Federal water users as described in the Description of Proposed Action section of this biological opinion.

Because the river maintenance portion of the proposed action will require project-specific consultations, including those activities proposed on pages 34 – 36 and 38 – 42 of the June 29, 2001, biological opinion, any incidental take resulting from those activities will be analyzed and accounted for, as appropriate, in future biological opinions.

Effect of the Take

In the accompanying biological opinion and when this ITS was amended on August 15, 2005, the Service determined that this level of anticipated take is not likely to result in jeopardy to the silvery minnow when the RPA is implemented.

Literature Cited

Dudley, R. K., S. P. Platania, and S. J. Gottlieb. 2005. Rio Grande silvery minnow population monitoring program results from 2004. Report to the Middle Rio Grande

Endangered Species Act Collaborative Program and the Bureau of Reclamation, Albuquerque, New Mexico. 184 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.

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Platania, S. P., M.A. Farrington, W. H. Brandenburg, S.J. Gottlieb, and R.K. Dudley. 2003. Movement patterns of Rio Grande Silvery Minnow, *Hybognathus amarus*, in the San Acacia Reach of the Rio Grande during 2002. Report to the Bureau of Reclamation, Albuquerque. 31 pp.

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.

Amendment to Term and Condition 1.1

Pursuant to your June 14, 2006 request, the Service is amending Term and Condition 1.1 (associated with Reasonable and Prudent Measure #1) of the 2003 BO, to read as follows:

> 1.1) Ramp down river flows as slowly as possible during the time periods set forth in the RPA to minimize intermittency. Even under the worst of circumstances, every effort shall be made to ensure that no more than eight miles of river dry per day. This can be accomplished by drying two, four-mile sections per day, or by other combinations totaling eight miles per day with concurrence of the Service. The location and distribution of these sections shall be determined through coordination with the Service. Ramping down the flows will allow about a month for the silvery minnow larvae to grow. It will also make salvage operations more manageable and allow time for monitoring the effects of drying.

The purpose of Term and Condition 1.1 is to minimize the level of incidental take associated with the effects of the action. Ramping down flows allows silvery minnow eggs and larvae time to develop into larger, heartier fish that may better withstand the stress of river drying and salvage operations. It also provides time for salvage crews to rescue silvery minnows as the river recedes. Limiting the total amount of river drying that occurs facilitates salvage operations by constraining the number of miles that require rescue efforts in a given day.