United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542

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Cons. # 22420-2006-F-0045

Memorandum

To: District Ranger, Española Ranger District, Santa Fe National Forest, Espanola, New Mexico

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

Subject: U.S. Fish and Wildlife Service's Biological Opinion on the Effects of Actions Associated with the Biological Assessment for the Buckman Water Diversion Project, Santa Fe National Forest, USDA Forest Service

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion on the effects of the proposed Buckman Water Diversion Project (Buckman Project). The diversion structure for the Buckman Project would be constructed on the Rio Grande approximately 3 miles (mi) below the Otowi Gage in Santa Fe County, New Mexico. This biological opinion concerns the effects of the proposed action on the endangered Rio Grande silvery minnow (*Hybognathus amarus)* (silvery minnow) and its designated critical habitat, the endangered southwestern willow flycatcher (*Empidonax traillii extimus)* (flycatcher) and its designated critical habitat, and the threatened bald eagle (*Haliaeetus leucocephalus)*. Your request for formal consultation, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 531 *et seq.*) was received on February 5, 2007. The 90-day consultation period began on February 7, 2007.

This biological opinion is based on information submitted in the Biological Assessment (BA) for the Buckman Water Diversion Project dated January 5, 2007; informal meetings between the Forest Service, the project proponents [City of Santa Fe (City), County of Santa Fe (County), and Las Campanas Limited Partnership (LCLP)], and the Service; site visits; and other sources of information available to the Service. A complete administrative record of this consultation is on file at the Service's New Mexico Ecological Services Field Office (NMESFO).

This biological opinion 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 designated critical habitat. This consultation analyzes the effects of the action and its relationship to the function and conservation role of silvery minnow and flycatcher designated critical habitat to determine whether the current proposal destroys or adversely modifies designated critical habitat. This document represents our biological opinion for the silvery minnow and its designated critical habitat, the flycatcher and its designated critical habitat, and the bald eagle in accordance with section 7 of the Act.

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

Southwestern Willow Flycatcher
The flycatcher is a migrant through this portion of the Rio Grande and may be present between April and June, and again in August. Suitable nesting habitat does not develop near the Buckman Project diversion site. The riparian vegetation that is present is sparse and forms narrow bands along the channel margins. Construction may remove some of this vegetation; however, this will be replaced with plantings of native tree and shrub species as part of the proposed "on site" mitigation. Noise from construction activities could affect individual birds moving in the area; however, construction along the river bank will not be permitted from April 15 to June 30 to avoid noise impacts. Construction activities away from the river are not likely to affect flycatchers.

Operation of the new diversion may have an effect to native water flows that could affect the habitat quality or quantity downstream of the diversion. Suitable habitat may be present downstream of the diversion site below the downstream end of Bandelier National Monument and upstream of Cochiti Reservoir. Stands of coyote willow provide habitat for the flycatcher in this area. The extent and quality of this habitat fluctuates with changing flows and sediment deposits in the inflow to Cochiti Reservoir. The willow stands vary in width and length, with few trees over 5 ft in height. Nesting habitat is not present. The reduction in flows to Cochiti Reservoir resulting from operation of the Buckman Project is estimated at less than 5 cubic feet per second (cfs) and is not expected to substantially affect the locations of banks and sandbars where the willows germinate and grow.

Designated flycatcher critical habitat upstream on the Rio Grande above the Rio Chama confluence would not be affected by the Buckman Project. There would be no changes in Rio Grande water moving through this designated critical habitat reach. With the slight increase in flows of San Juan- Chama Project water released from storage, there may be improved opportunities for development of riparian vegetation in the lower reaches of the Rio Chama that could benefit migrating flycatchers outside of their designated critical habitat.

Operation of the Buckman Project will result in a reduction of flows released from Cochiti Dam to the San Acacia Diversion Dam. This reduction may affect flows in the designated critical habitat units on the Rio Grande in Valencia and Socorro counties. Additionally, several areas on the Middle Rio Grande within the project area were excluded from designated critical habitat designation; including the Isleta Pueblo and the Sevilleta National Wildlife Refuge (U.S. Fish and Wildlife Service 2005). This reduction in flow will, as later described, vary seasonally and the magnitude of the alteration may not be obviously apparent. However, any flow reduction through this reach has the potential to affect the width of the active channel, transport and deposition of sediments, and the amount of water available to support riparian vegetation. The likely result for the flycatcher habitat through this portion of the Rio Grande on the designated critical habitat and non-critical habitat reaches is that the active area for establishment of riparian vegetation would be reduced but not eliminated. The extent of the reduction is uncertain; however, given the small amount of change in flow, and the dynamics of riparian vegetation development, the effects to the amount of available habitat in the future are not expected to be significant. Effects to individual flycatchers are not likely to occur since no nesting occurs in the vicinity of the construction, and opportunities for nesting habitat in current and future breeding habitats are not significantly affected. The number of flycatcher territories in the Middle Rio Grande Management Unit has exceeded recovery goals (100 territories) for the past three years (Ahlers and Doster 2007). Additionally, flycatcher habitat restoration projects (see Environmental Baseline, below) are occurring throughout the basin, improving conditions for the flycatcher. Given these improvements in the environmental baseline and the relatively small reduction in flows expected from this project, the effects of this project on flycatcher are discountable.

Bald Eagle

The bald eagle commonly winters along the Rio Grande between the site of the proposed Buckman Project diversion and Cochiti Reservoir between November and March. Preferred roost sites are in snags and cliffs along the river, particularly between Bandelier National Monument and the inflow delta of the reservoir. As stated in the BA, three roosting sites were identified near the diversion site.

Noise and human activities during the construction of the diversion may disturb bald eagles using the nearby roosts. Monitoring of the roosts during drilling of five test wells near the Buckman Project site did not indicate any significant response to noise; however, bald eagles apparently avoided areas where they could see construction or human activity. No removal of suitable snags potentially used as roosts will occur. The project proponents included a conservation measure to minimize the effects to bald eagles as follows:

"If a bald eagle is present within 0.5 mi upstream or downstream of the riparian work zone in the morning before project activity starts, or following breaks in project activity, the contractor is required to suspend all activity until the bird leaves of its own volition, or a Forest Service biologist, in consultation with the Service, determines that the potential for harassment is minimal. If a bald eagle could potentially be in the project area, a presence/absence survey must be done within a 0.5-mi radius of a project site before work activity initially starts for the day and again before work resumes following a break."

With this conservation measure in place, effects to the bald eagle from the proposed action are insignificant and discountable. The remainder of this Biological Opinion will deal with the effects of implementation of the proposed action on the silvery minnow and its designated critical habitat.

Consultation History

A chronology of the Buckman Project informal consultation follows:

May 21, 2001 – Correspondence from Forest Service (J. Miera) to the Service (J. Nicolopoulos) regarding the issuance of a special use permit to withdraw water from the Rio Grande by Las Campanas for 1800 acre feet of base flow. Letter requests assistance from the Service in determining any known downstream impacts.

July 6, 2001 – Federally listed, proposed, candidate and species of concern that may be affected by the proposed Buckman Water Diversion project are identified by the Service in a letter (from J. Nicholopoulos, Service, to J. Miera, Forest Service) responding to a May 21, 2001 written request.

June 18, 2002 – Correspondence from Forest Service (John Miera) concerning proposed project changes. Specifically the addition of the City of Santa Fe and Santa Fe County as applicants and the increased water diversion to 8730 afy.

July 8, 2002 – Personal Communications Record of conversation between Service personnel (B. Ortiz) and SWCA personnel (C. Oakes) verifying the receipt of the project letter, soliciting Service concerns and comments regarding the project and to find out if they would like to become involved in the NEPA process.

July 12, 2001 – Meeting between Forest Service personnel (J. Miera, M. Garcia, S. Bruin, S. Hurlocker), Service personnel (B. Ortiz), BLM personnel (S. Churchill), SWCA personnel (C. Oakes, J. Kehmeier) and Tetra Tech personnel (C. Pergler, T. Holman) regarding the level of participation desired by the Services in the Buckman Water Diversion Project EIS.

July 30, 2002 – e-mail from the Service (Brian Ortiz) to Forest Service (Sandy Hurlocker) concerning development of a Coordination Act Report (CAR) and fish inventory methodology.

August 1, 2002 – Un-scheduled meeting with Service (Brian Ortiz/Anna Mara Munoz) and Tetra Tech (Tt) (Chuck Pergler/Catherine Coghill). Discussion of July 30, 2002 email from the Service (Brian Ortiz) to Forest Service (Sandy Hurlocker). Discussion of 1) fish inventory methodology, 2) potential impacts to Rio Grande Silvery Minnow, 3) CAR preparation guidance, and 4) schedule a meeting to present Buckman Project to Service staff.

August 26, 2002 – Presentation of Buckman Water Diversion Project to Service.

September 4, 2002 – Letter from Forest Service (John Miera) to Service (Mike Buntjer) concerning the preparation and guidance of the CAR.

September 5, 2002 – Scoping letter from the Service (J. Nicolopolous) to the Forest Service (S. Hurlocker) with comments on biological resources.

September 30, 2002 – Email communications from the Service (B. Ortiz) to Tetra Tech (C. Pergler) and the Forest Service (S. Hurlocker) providing a sample CAR written by the Service (B. Hansen) to follow.

December 10, 2002 – Personal communication between Chuck Pergler (Tt) and Mary Orr (Forest Service) relaying a conversation between Ms. Orr and Dave Krueper (Service) in regard to migratory birds.

May 12, 2003 – Personal communication between Chuck Pergler (Tt) and Brian Ortiz (Service) concerning silvery minnow analysis.

January 13, 2005 – Presentation of Buckman Water Diversion Project to Service. This was a scheduled meeting to re-establish contact with the Service concerning the Buckman Water Diversion Project Draft Environmental Impact Statement (DEIS).

April 7, 2006 – Meeting with the Service to discuss the reasoning and conclusions about the determinations.

September 22, 2006 – Meeting with the Service, Forest Service, and representatives of the three project proponents to discuss Service comments on the draft BA and supporting documents.

November 17, 2006 – The Forest Service provided a revised BA to the Service for review. Comments were provided on this version on December 1, 2006

January 5, 2007 – The Forest Service provided the Service with another revised BA for review.

January 25, 2007 – The Service advised the Forest Service that while there were some minor points of improvement, the BA met our needs.

February 5, 2007 – The Forest Service requested formal consultation with the Service for the Buckman Project.

March 2, 2007 – The Service provided the Forest Service with a 30-day letter documenting the initiation of formal consultation as of February 7, 2007.

May 10, 2007 – The Service provided the Forest Service and applicants a Draft Biological Opinion

June 14, 2007 – The Service, Forest Service, Bureau of Land Management, and Department of Interior meet to discuss finalization of the Biological Opinion and Fish and Wildlife Coordination Act Report

June 17, 2007 – The Forest Service transmitted final comments on the Draft Biological Opinion to the Service

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The January 5, 2007, BA contains the comprehensive description of the purpose and need for the proposed action, details on construction of the facilities needed, existing and future water sources relevant to this consultation, and the proposed operation of the Buckman Project. In addition, information on the project area and effects of the operation on the flycatcher, bald eagle and silvery minnow are priorities. The material contained in the January 5, 2007, BA is herein incorporated by reference (USDA-FS 2007). The following description of the proposed action is a summary of the material in the BA and should not be considered as the complete description.

Purpose and Objective

The Buckman Project is proposed by the project proponents, with the Santa Fe National Forest as the lead Federal agency for compliance with the National Environmental Policy Act and ESA. The construction of the diversion facilities and associated operational facilities would be located on Federal lands managed by the Forest Service and Bureau of Land Management, on County lands, and some State of New Mexico and private lands.

The Buckman Project is designed to address the immediate need for a sustainable means of accessing water supplies from the Rio Grande (native water) and San Juan-Chama Project (SJC) (imported water) by the project proponents. The project proponents have a suite of existing and proposed future water rights to native and imported water that would be diverted by the Buckman Project for municipal and industrial uses. Existing water sources and water rights would be continued as historically used, or modifications for those uses are included in the operational water management component of the proposed action. The water sources identified as part of the proposed action meet the City and County's near-term need for water through 2010 and for LCLP's needs through build-out estimated to occur by 2017. The proposed action does not include consideration of additional water supplies that may be acquired to meet long-term needs of the project proponents that may in the future be diverted by the Buckman Project.

Project

The Buckman Project consists of a diversion structure on the east bank of the Rio Grande approximately 3.3 mi downstream from Otowi Gage, west of the City (see Figures 1 and 2) that will use low-head pumps to divert up to a maximum 32 cfs of water from the Rio Grande, water transmission pipelines and booster stations to convey water away from the diversion structure, a water treatment plant for the City and County, water transmission lines to connect with existing service lines, a sediment disposal system, and road improvements needed for access to all facilities. A complete description of the project facilities is available in the DEIS (USDA-FS and USDI-BLM 2004) and BA (USDA-FS 2007) which has been incorporated by reference.

The construction of the facilities will not have a significant affect on listed species in the vicinity or downstream of the new diversion as described for the flycatcher and bald eagle. The silvery minnow is not found in this reach of the Rio Grande. The important component of the Buckman Project is the proposed operation of the facility to divert native and imported water from the Rio Grande for municipal and industrial use by the project proponents. This new operation will rely on the existing use of other water sources, changes in use for some of the water currently available to the project proponents, and addition of new sources. Information on current use of water supplies by the project proponents is included in the Environmental Baseline.

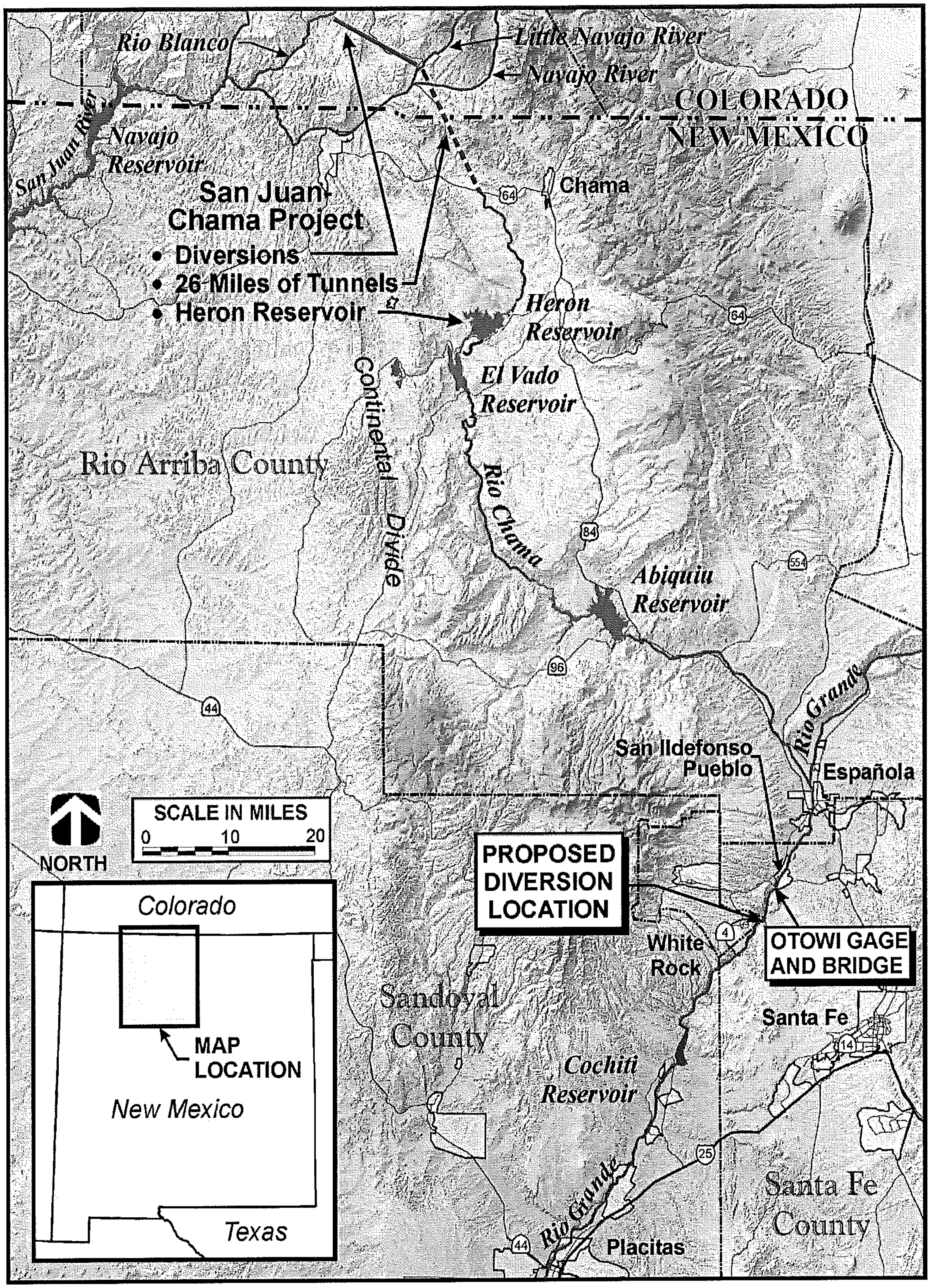

Figure 1. Buckman Water Diversion Project Vicinity Map (BA).

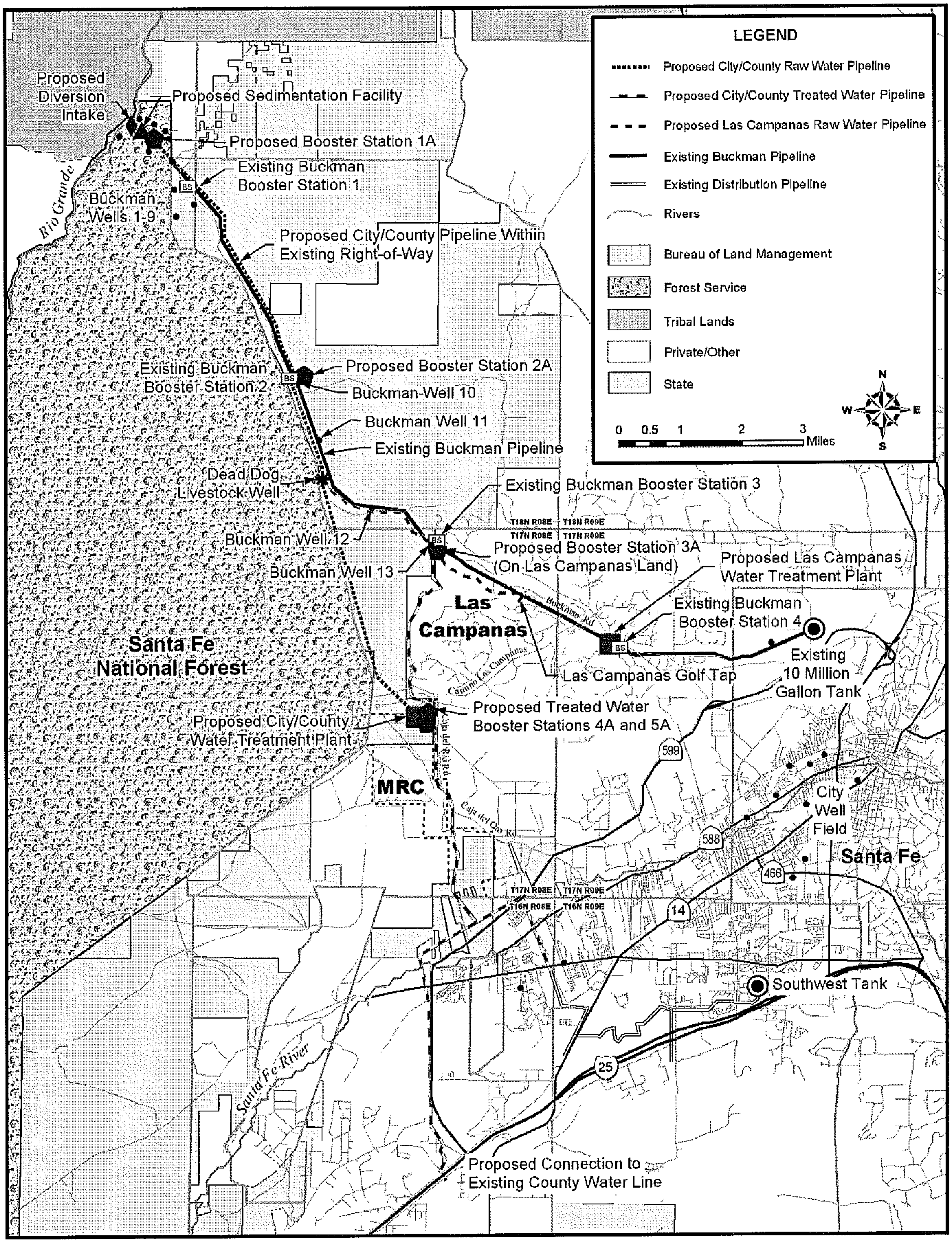

Figure 2. Buckman Water Diversion Project Context and Key Components

Water Sources

The Buckman Project will rely on native Rio Grande water and imported water that is delivered via the Rio Grande from the SJC Project. Table 1 describes the amounts and origin of water proposed to be diverted by the project.

Table 1: Buckman Project Diversion Water Sources (in acre-feet per year [afy])

Category and Type of Water	City of Santa Fe	County of Santa Fe	Las Campanas	Total
San Juan-Chama	5,230	375	0	5,605
Rio Grande type 2	0	417	655	1,072
Rio Grande type 3	0	98	0	98
Rio Grande type 4	0	424	54	478
Rio Grande type 5	0	385	1,091	1,476
Total	5,230	1,700	1,800	8,730

As shown in Table 1, there are four types of Rio Grande native waters that would be diverted by the Buckman Project. These types differ in their current status as secured water rights by the County and LCLP. Type 2 waters are owned by the County and LCLP and have been permanently transferred to Buckman. These water rights will have their official diversion point "transferred" to the new diversion. Type 3 waters are owned by the County subject to pending New Mexico State Engineer transfer permits. Type 4 are waters in the process of being acquired by the County and LCLP and will have their diversion points "transferred" to the new diversion. Type 5 water is Rio Grande water in current use downstream that the County and LCLP are seeking to purchase from the current users and transfer the consumptive use component of the water right up to the new diversion. The specific owners or existing diversion points for this Type 5 water cannot at this time be identified, nor can the date such transfers would occur.

Water Operations

The project proponents have, in addition to the Buckman Project waters, other sources of water currently in use for municipal and industrial supplies. These sources include both groundwater (Rio Grande connected and non-Rio Grande connected) and surface water from the Santa Fe River. The current use is described in the Environmental Baseline of this biological opinion. The discussion here is the proposed diversion of Buckman Project water (Table 1) in addition to other water sources already in use for the City and County.

SJC Project water is water imported into the Rio Chama/Rio Grande basin from the San Juan River (a tributary of the Colorado River). The City and County have non-expiring contracts with the Bureau of Reclamation (Reclamation) totaling 5,605 acre-feet per year (afy) of SJC project water. Water users must request release of their contracted water from Reclamation as the imported water is held in reservoirs on the Rio Chama above its confluence with the Rio Grande. Scheduling use of SJC water is flexible in that a contract holder can order release of its stored water in amounts needed to meet its daily needs. A condition of the City and County's State of New Mexico diversion permit for this SJC water limits each daily diversion volume to the amount of SJC water previously released upstream and calculated to be available at the project diversion on that day. Other SJC water, which might be obtained by the project proponents in the future and is not included in Table 1, could be diverted instead of native water or used to offset pumping of groundwater connected to the Rio Grande. If additional SJC water is diverted, the total diversion at the Buckman Project would not exceed 8,730 afy.

Rio Grande native water for the Buckman Project is either: (1) already owned by the County and LCLP and used by them or leased back to another entity; (2) in the process of purchase or transfer to the County and LCLP; or, (3) will be acquired in the future from willing sellers from downstream users (most likely near San Acacia or Socorro). As part of the operations plan, the amount of native water diverted each month will vary based on the needs of the County and LCLP. As indicated in Table 1, LCLP will rely exclusively on Rio Grande water as it currently has no SJC contract water available for municipal and industrial uses. Thus, a combination of both SJC and Rio Grande water will be diverted every month.

The Buckman Project diversion can divert up to 32 cfs, with up to 4 cfs returned to the river as part of sediment control operations and a maximum 28.2 cfs conveyed away from the river for municipal and industrial use (Table 2). The diversion is inoperable at Rio Grande flows of less than 150 cfs and can only operate at partial capacity between 150 and 200 cfs river flow. The amount diverted will vary over the course of a year based on demand, availability and scheduling of other supplies, and the amount of both native and imported water available in any given year. The Buckman Project may divert up to 8,730 afy from the river. The capacity of the diversion is considerably higher than 8,730 afy, an estimated 20,268 afy if the diversion operated at full capacity over the entire year. The proposed action does not include that level of diversion, with the need for a 28.2 cfs maximum capacity related to the highest demand periods foreseen by the project proponents, including unavailability of the project proponents existing water supply sources. Actual diversions by the project will vary between zero and 28.2 cfs. The percentage of imported and native water within any daily diversion will also vary.

Table 2: Project Proponents Maximum Annual Demands in 2010

Water User	Annual Demand	Peak Day Demand	Source
City/County	6,930 afy	23.2 cfs	SJC and RG
LCLP	1,800 afy	5.0 cfs	RG
Total	8,730 afy	28.2 cfs	SJC and RG

Table 3 shows the project proponents total and native water peak day demand for each month. Information in Table 3 was obtained from Table 4 and Table 10 in the BA. The portion of the total peak day demand not met by Rio Grande water is met with SJC water.

Table 3: Maximum Peak Day Demand per Month in 2010

Month	**Total Peak Day Demand (cfs)**	**Rio Grande (Native) Peak One Day Demand (cfs)**	**Rio Grande (Native) 5-Day Peak Demand (cfs)**
January	11.3	4.32	3.18
February	12.7	4.86	3.52
March	14.1	5.40	3.82
April	18.2	7.02	4.60
May	23.8	9.18	6.87
June	28.2	10.80	8.55
July	26.1	10.04	7.95
August	23.8	9.18	7.56
September	22.6	8.64	6.57
October	19.6	7.56	5.09
November	14.1	5.40	3.94
December	11.3	4.32	3.18

As Table 3 shows, the highest demand period for Buckman Project water will occur between May and September. This period generally is the warmest time of the year, and water needs are correspondingly higher. It should be noted that these figures represent peak daily demand. Continuous diversions at this level will not occur as they would result in a greater amount of water being diverted than the 8,730 afy annual diversion limit. The availability of other water sources to meet the peak day demand will factor into the amount of water actually diverted each day. However, for the purposes of this consultation, the peak day demands in Table 3 will be used in the analysis of effects to the Rio Grande below Cochiti Reservoir as discussed later in this document.

As a conservation measure to protect native Rio Grande flows downstream of the Buckman Project, the County and LCLP have proposed a staged curtailment plan as part of the proposed action. The plan is based on the measured flows of the Rio Grande at the Otowi Gage upstream of the Buckman Project diversion. The project proponents commissioned a technical memorandum (CH2MHill 2005) to evaluate the effects of native water diversion at the Buckman Project diversion on flows downstream to Albuquerque. That analysis determined that when flows at the Otowi Gage were over 325 cfs, flows at the Central Gage in Albuquerque were sufficient to meet the 100 cfs requirement of the 2003 Middle Rio Grande Water Operations Biological Opinion covering Reclamation's, the U.S. Army Corps of Engineers' and related non-Federal actions on the Middle Rio Grande (2003 BO) (U.S. Fish and Wildlife Service 2003).

The staged curtailment plan for reduction in diversions of Rio Grande water at Buckman would operate during the irrigation season (March through October), which is the period of highest water use for irrigation, evaporation, and riparian demands that can result in a drying of portion of the river. The decision to curtail would be based on a 5-day running average measurement of native flows (those flows except SJC water released for municipal and industrial consumptive use) at Otowi Gage where the measurements showed a decline at or below 325 cfs. When this occurs, diversions of native Rio Grande water are curtailed according to the schedule in Table 4. These figures are derived from a formula where allowable diversion is reduced based on the actual Otowi flow below 325 cfs, as follows:

(Actual Otowi flow in cfs minus 200 cfs / 325 cfs minus 200 cfs) times the non-reduced 5-day peak diversion for that month (see column three in Table 3).

An example of how this method works uses an actual Otowi Gage flow of 300 cfs, for the month of September where the 5-day peak diversion is 6.57 cfs.

(300-200/325-200) x 6.57 = 5.26 cfs maximum diversion with reduction

The amount of reduction at each lower increment of Otowi flow increases as flows decline toward 200 cfs. The curtailment schedule between 325 and 200 cfs provides a measure of relief when flows are low and the potential for river drying is high.

Table 4: Curtailment Schedule for Buckman Project Diversion of Rio Grande Flows when Otowi Gage Native Flows are below 325 cfs. Maximum native water diversion rates per month are in cfs generated by the stated formula

Month:	March	April	May	June	July	Aug	Sept	Oct
Native Flow in cfs								
325 and above (no reduction)	3.82	4.6	6.87	8.55	7.95	7.56	6.57	5.09
300	3.05	3.68	5.50	6.84	6.36	6.05	5.26	4.07
280	2.44	2.95	4.40	5.47	5.09	4.84	4.21	3.26
260	1.83	2.21	3.30	4.10	3.82	3.63	3.16	2.44
240	1.22	1.47	2.20	2.73	2.54	3.42	2.10	1.63
220	0.61	0.74	1.10	1.37	1.27	1.21	1.05	0.81
200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Action Area

The action area is defined as the Rio Grande from Otowi Gage to San Acacia Diversion Dam and the entire width of the 100 year floodplain within that reach. Silvery minnow are found in the portion of the action area between Cochiti Dam and San Acacia Diversion Dam and are likely to be affected by changes in the amount of native flows moving through the river due to the diversions for the Buckman Project.

STATUS OF THE SPECIES

Rio Grande Silvery Minnow

Description

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

In the past, the silvery minnow was included with other species 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 (Bestgen and Platania 1991).

<u>Legal Status</u>

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 are described below in the Reasons for Listing section.

Designated critical habitat for the silvery minnow was designated on February 19, 2003, (68 FR 8088). The designated critical habitat designation extends approximately 157 miles 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 designated critical habitat designation defines the lateral extent (width) as those areas bounded by existing levees or, in areas without levees, 300 feet (ft) or riparian zone adjacent to each side of the bank full stage of the Middle Rio Grande. Some developed lands within the 300 ft lateral extent are not considered designated critical habitat because they do not contain the primary constituent elements of designated critical habitat and are not essential to the conservation of the silvery minnow. Lands located within the lateral boundaries of the designated 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) areas over silt or sand substrate that are associated with shallow [< 15.8 inch (in)] 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 silvery minnow 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 in. Over 85 percent were collected from low-velocity habitats (<0.33 ft/sec) (Dudley and Platania 1997, Watts *et al.* 2002).

<u>Designated Critical Habitat</u>

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

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

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

3. Substrates of predominantly sand or silt; and

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

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

Life History

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event (Platania 1995, Platania and Altenbach 1998). The majority of adults spawn in about a one-month period in late spring to early summer (May to June) in association with spring runoff. Platania and Dudley (2000, 2001) found that the highest collections of silvery minnow eggs occurred in mid- to late May. In 1997, Smith (1999) collected the highest number of eggs in mid-May, with lower frequency of eggs being collected in late May and June. These data suggest multiple silvery minnow spawning events during the spring and summer, perhaps concurrent with flow spikes. Artificial spikes have apparently induced silvery minnow to spawn (Platania and Hoagstrom 1996). It is unknown if individual silvery minnow spawn more than once a year or if some spawn earlier and some later in the year.

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 in in size upon fertilization, but quickly swelled to 0.12 in. Recently hatched larval fish are about 0.15 in in standard length and grow about 0.005 in 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 mi 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. YOY attain lengths of 1.5 to 1.6 in by late autumn (U.S. Fish and Wildlife Service 1999). Age-1 fish are 1.8 to 1.9 in by the start of the spawning season. Most growth occurs between June (post spawning) and October, but there is some growth in the winter months. In the wild, maximum longevity is about 25 months, but very few survive more than 13 months (U.S. Fish and Wildlife Service 1999). Captive fish have lived up to four years (C. Altenbach, City of Albuquerque, *pers. comm.* 2003).

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 minnow consists of only two age classes: YOY and Age-1 (U.S. Fish and Wildlife Service 1999). The majority of spawning silvery minnow 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 (greater than 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 minnow have been induced to spawn as many as four times in a year (C. Altenbach, City of Albuquerque, *pers. comm.* 2000). It is not known if they spawn multiple times in the wild. The high reproductive potential of this fish appears to be one of the primary reasons that it has not been extirpated from the Middle Rio Grande. However, the short life span of the silvery minnow increases the population instability. When two below-average flow years occur consecutively, a short-lived species such as the silvery minnow can be impacted, if not completely eliminated from dry reaches of the river (U.S. Fish and Wildlife Service 1999).

Distribution and Abundance

Historically, the silvery minnow occurred in 2,465 mi 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 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 3 to 12 in in diameter). Further downstream the riverbed is gravel with some sand material. Ephemeral tributaries including Galisteo Creek and Tonque Arroyo introduce sediment to the lower sections of this reach, and some of this is transported downstream with higher flows (U.S. Fish and Wildlife Service 2001, 1999). The Rio Grande below Angostura Dam becomes a predominately sand bed river with low, sandy banks in the downstream portion of the reach. The construction of Cochiti Dam also created a barrier between silvery minnow populations (U.S. Fish and Wildlife Service 1999). As recently as 1978, the silvery minnow was collected upstream of Cochiti Lake; however surveys since 1983 suggest that the fish is now extirpated from this area (U.S. Fish and Wildlife Service 1999).

Silvery minnow catch rates declined two to three orders of magnitude between 1993 and 2004. Additionally, relative abundance of silvery minnow 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 minnow 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).

Augmentation, throughout this period, likely sustained the silvery minnow population. Nearly 900,000 silvery minnow have been released (primarily in the Angostura Reach) since 2000 (see Environmental Baseline). Captively propagated and released fish supplemented the native adult population and most likely also took advantage of the good spawning conditions of 2004 and 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. October monitoring indicated a significant increase in silvery minnow in the Middle Rio Grande, increasing to 3,899 total silvery minnow captured from 2 and 78 in 2003 and 2004, respectively.

In 2006, however, spring runoff was extremely low and although there were several peaks in the natural hydrograph in June, July, August, and September, only a small number of silvery minnow eggs were documented in June and July. October samples yielded only 166 silvery minnow. None of the silvery minnow collected were YOY, indicating poor recruitment, likely due to channel drying in June and July, after the late and minimal spawn (Dudley et al. 2006).

Middle Rio Grande Distribution

Since the early 1990s, the density of silvery minnow generally increased from upstream (Angostura Reach) to downstream (San Acacia Reach). During surveys in 1999, over 98 percent of the silvery minnow captured were downstream of San Acacia Diversion Dam (Dudley and Platania 2002). This distributional pattern 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.

However, in 2004 and 2005, 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). Routine augmentation of silvery minnow in the Angostura Reach (nearly 900,000 since 2000), and the transplanting of silvery minnow rescued from drying reaches (approximately 770,000 since 2003) explains this change in pattern. Additionally, 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 exacerbated the skew. High spring runoff and perennial flow in the Angostura Reach appeared to result in relatively high survival and recruitment of larval and juvenile silvery minnow 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 silvery minnow 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 minnow caught in March 2006, 33 were found in the Angostura Reach, 2,445 were found in the Isleta Reach, and 3,665 were caught in the San Acacia Reach.

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

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

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

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

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

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

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

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

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

Recovery Efforts
The final recovery plan for the silvery minnow was released in July 1999 (U.S. Fish and Wildlife Service 1999). The Recovery Plan has been updated and revised and a draft revised Recovery Plan (U.S. Fish and Wildlife Service 2007) was released for public comment on January 18, 2007 (72 FR 2301).

The draft revised Recovery Plan describes recovery goals for the Rio Grande silvery minnow and actions to complete these (U.S. Fish and Wildlife Service 2007). The three goals identified for the recovery and delisting of the Rio Grande silvery minnow are:

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

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

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

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

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

ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the ESA, when considering the effects of the action on federally listed species, we are required to take into consideration the environmental baseline. Regulations implementing the ESA (50 FR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area; the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early 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. However, stream conditions in 2004 and 2005 improved over previous years. The United States Geological Survey (USGS) in Albuquerque, New Mexico reported that stream flow conditions 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 2 months. These flows improved conditions for both spawning and recruitment.

The 2006 spring runoff was well below average because of lower than normal snowpack. In May 2006, year to date precipitation was well below average with the snow pack at 20 percent of average in the Rio Grande Basin. Fortunately, a strong monsoon season led to the wettest period of record in July and August. Consequently, only 26.5 mi of river dried in the summer of 2006, the lowest amount since 2001. Despite this monsoonal precipitation, reservoir levels continue to be below average across the state. It will take a least another year or two of well above average precipitation to reach pre-drought reservoir conditions.

Since 1996, Reclamation has relied heavily on leases of SJC water to provide supplemental water by the Middle Rio Grande Endangered Species Act Collaborative Program to implement the 2003 BO. Supplemental water has been used to create spawning pulses and recruitment flows for the silvery minnow and to meet minimum flow requirements for silvery minnow and flycatchers. From 1996-2003, Reclamation leased an average of 46,318 afy of SJC water from willing leasers to provide the average (1996-2001) of 63,109 afy of supplemental water needed for these purposes. The City and County have, in the past, leased back the unused share of SJC water to Reclamation or other entities. The 6,500 afy owned by the Jicarilla Apache was leased to Reclamation between 1999 and 2003 (MRGESCP 2004). The Jicarilla Apache leased 6,000 acre-feet (af) of their water to Reclamation in 2006 (U.S. Bureau of Reclamation 2006). The City of Albuquerque has also leased SJC water to Reclamation, however, with the implementation of their Drinking Water Project, Albuquerque's 48,200 afy of SJC water will not be available for Reclamation to use as supplemental water.

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 minnow; 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.

<u>Changes in Hydrology</u>

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 associated with the Rio Grande that supported fish until the river became connected again.

Water management and use has resulted in a large reduction of suitable habitat for the silvery minnow. Agriculture accounts for 90 percent of surface water consumption in the Middle Rio

Grande (Bullard and Wells 1992). The average annual diversion of water in the Middle Rio Grande by the Middle Rio Grande Conservation District (MRGCD) was 535,280 af for the period from 1975 to 1989 (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). 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-mi reach near Tome (river miles 150-155), a 5-mi reach near the U.S. Highway 60 Bridge (river miles 127-132), and an extended 36-mi reach from near Brown's Arroyo (downstream of Socorro) to Elephant Butte Reservoir. Extensive fish kills, including tens of thousands of silvery minnow, have occurred in these lower reaches when the river has dried (C. Shroeder, Service, *pers. comm.* 2002). Since 1996, an average of 32 mi of the Rio Grande has dried, mostly in the San Acacia Reach. The most extensive drying occurred in 2003 and 2004 when 60 and 68.7 mi, respectively, were dewatered. Most documented drying events lasted an average of two weeks, before flows returned.

Predatory birds have been observed 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 minnow. Thus, while some dead silvery minnow 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 altered timing of flows may inhibit reproduction. Since completion of Elephant Butte Dam in 1916, four additional dams have been constructed on the Middle Rio Grande, and two have been constructed on one of its major tributaries, the Rio Chama (Scurlock 1998). Construction and operation of these dams, which are either irrigation diversion dams (Angostura, Isleta, San Acacia) or flood control and water storage dams (Elephant Butte, Cochiti, Abiquiu, El Vado), have modified the natural flow of the river. Mainstem dams store spring runoff and summer inflow, which would normally cause flooding, and release this water back into the river channel over a prolonged period of time. These releases are often made during the winter months, when low-flows would normally occur. The releases depart significantly from natural conditions, and can substantially alter the habitat. In spring and summer, artificially low-flows may limit the amount of habitat available to the species and may also limit dispersal of the species (U.S. Fish and Wildlife Service 1999).

In the spring of 2002 and 2003, there was concern that silvery minnow 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 silvery minnow spawning. In response to the releases, significant silvery minnow spawning occurred and was documented in all reaches except the Cochiti Reach (S. Gottlieb, UNM, *in litt.* 2002; Dudley *et al.* 2005). Fall populations in 2003 and 2004 continued to decrease despite large spawning events, indicating a lack of recruitment.

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

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

<u>Changes in Channel Morphology</u>

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

The active river channel within occupied habitat 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 (Reclamation 2001). These non-native plants are very resistant to erosion, resulting in narrowing of the channel. When water is confined to a narrower cross-section, its velocity increases and the ability to carry sediments is enhanced. 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 minnow, and narrower channels resulted in fewer fish captured. The availability of wide, shallow habitats that are important to the silvery minnow is decreasing. Narrow channels have few backwater habitats with low velocities that are important for silvery minnow fry and YOY.

Within the current range of the silvery minnow, human development and use of the floodplain have greatly restricted the width available to the active river channel. A comparison of river area between 1935 and 1989 shows a 52 percent reduction, from 26,598 acres (10,764 ha) to 13,901 acres (5,626 ha) (Crawford *et al.* 1993). These data refer to the Rio Grande from Cochiti Dam downstream to the "Narrows" in Elephant Butte Reservoir. Within the same stretch, 234.6 mi of levees occur, including levees on both sides of the river. Analysis of aerial photography taken by Reclamation in February 1992, for the same river reach, shows that of the 180 mi of river, only 1 mi, or 0.6 percent of the floodplain has remained undeveloped.

Development in the floodplain, makes it difficult, if not impossible, to send large quantities of water downstream that would create low velocity side channels that the silvery minnow prefers. As a result, reduced releases have decreased available habitat for the silvery minnow and allowed encroachment of non-native species into the floodplain.

Water Quality

Both point (pollution discharges from a pipe) and non-point (diffuse sources of pollution) sources affect the Middle Rio Grande. Major point sources are wastewater treatment plant (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 two Rio Rancho facilities 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 averaging measurements and/or the frequency of water quality measurements is insufficient to detect water quality situations that would be toxic to silvery minnow. The Rio Rancho WWTP now uses ultraviolet disinfection (Dee Fuerst, City of Rio Rancho, *pers. comm.* 2003). However, high concentrations of ammonia could still be discharged during an upset. Spills from the Rio Rancho City sewage system are treated with chlorine, which may lead to chlorine being flushed to the Rio Grande.

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 minnow 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 minnow (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, they requested that the Environmental Protection Agency conduct toxicity tests on water in the Rio Grande collected below the Floodway. Aquatic crustaceans exposed to this water were found to have significant reproductive impairment and mortality when compared with controls. Additionally, larval fish also experienced significant mortality and/or narcosis when exposed to water and bed sediment collected from this same area on April 22, 2002 (http://oaspub.epa.gov/enviro/pcs det_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.

In a cooperative study, the New Mexico Environment Department (NMED) detected elevated polychlorinated biphenyl (PCBs) contamination of the San Jose Drain (NMED DOE Oversight Bureau Correspondence and Transmittal Letter, signed S. Yanicak, to G. Turner, DOE, Subject: 2002 – 2003 Cooperative Polychlorinated Biphenyl (PCB) Study Data, Dated June 6, 2006). The San Jose Drain empties into an area near the confluence of the Tijeras Arroyo with the Rio Grande. The PCB pollution was detected in sediment and storm water runoff and in fish tissue collected downstream. Concentrations of PCBs in fish tissues were elevated above the threshold by which fish consumption advisories would recommend that no fish be eaten by people (R. Ford-Schmid, NMED, electronic communication, June 24, 2004).

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

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

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

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

Silvery Minnow Propagation and Augmentation

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

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

Since 2000 approximately 900,000 silvery minnow have been propagated using both adult wild silvery minnow 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 minnow are released into the Angostura Reach of the river near Alameda Bridge to ensure downstream repopulation. Eggs left in the wild have a very low survivorship and this ensures that an adequate number of spawning adults are present to repopulate the river each year. While hatcheries continue to successfully spawn silvery minnow, wild eggs are collected to ensure genetic diversity within the remaining population.

<u>Ongoing Research</u>

There is ongoing research by the NMFRO and University of New Mexico (UNM) to examine the movement of silvery minnow. 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 minnow disperse a few miles downstream. One individual was captured 15.7 mi upstream from its release site (Platania *et al.* 2003). Monitoring within 48 hours after the release of the 41,500 silvery minnow resulted in the capture of 937 fish. Of these, 928 were marked and 927 were collected downstream of the release point. The farthest downstream point of recapture was 9.4 mi.

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 minnow 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 150,000 silvery minnow are currently being maintained in captivity (M. Ulibarri, Service, *pers. comm.* 2007).

<u>Permitted and/or Authorized Take</u>
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 minnow. Many of the permits issued under section 10 allow take for the purpose of collection and salvage of silvery minnow and eggs for captive propagation. Eggs, larvae, and adults are also collected for scientific studies to further our knowledge about the species and how best to conserve the silvery minnow. Because of the population decline from 2002-2004, the Service has reduced the amount of take permitted for voucher specimens in the wild.

Incidental take of silvery minnow is authorized through section 7 consultation associated with the 2003 BO, the City of Albuquerque Drinking Water Project (U.S. Fish and Wildlife Service 2004), the Isleta Island Removal Project, the Tiffany Plug Removal Project, and the Interstate Stream Commission's (ISC) Habitat Restoration Project. In 2005 the Service revised the ITS using a formula that incorporates October monitoring data, habitat conditions during the spawn (spring runoff), and augmentation. Annual estimated take now fluctuates relative to the total number of RGSM found in October across 20 population monitoring locations.

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 designated critical habitat:

1. <u>Release of Carryover Storage from Abiquiu Reservoir to Elephant Butte Reservoir</u>: The Army Corps of Engineers (Corps) consulted with the Service on the release of water during the winter of 1995. Ninety-eight thousand af of water was released from

November 1, 1995 to March 31, 1996, at a rate of 325 cfs. 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 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 Opinions 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: In 2001 and 2003, the Service issued jeopardy biological opinions on the effects of water operations and management activities in the Middle Rio Grande on the silvery minnow and flycatcher. In 2002, the Service issued a jeopardy biological opinion for the silvery minnow. The current opinion, issued on March 17, 2003, contains a Reasonable and

Prudent Alternative to jeopardy with multiple elements. These elements set forth a flow regime in the Middle Rio Grande and describe habitat improvements necessary to alleviate jeopardy to both the silvery minnow and flycatcher. For example, the elements require augmentation in the Rio Grande of an additional million silvery minnow over the life of the project and 484 acres of habitat restoration.

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. This consultation covers through 2060. During typical operations, the project will divert a total of 94,000 afy of raw water from the Rio Grande (47,000 afy of City of Albuquerque SJC water and 47,000 afy of Rio Grande native water) at a near constant rate of about 130 cfs. Diversions of native water would be reduced if flows above the new diversion site were less than 260 cfs and all diversions would cease at levels below 195 cfs. Peak diversion operations will consist of up to 103,000 afy being diverted at a rate of up to 142 cfs. Consultation on this project was completed in 2004. Construction is currently underway with operations likely to begin by 2008.

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 minnow. Since 1996, approximately 770,000 silvery minnow have been rescued and relocated to wet reaches, the majority of which were released in the Angostura Reach. Studies are being conducted to determine survival rates for salvaged fish.

10. Habitat Restoration Projects: Several habitat restoration projects have been completed in the Albuquerque reach through the MRGESCP. 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, in 2005, 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. Phase II is scheduled to begin in winter 2007. Habitat restoration projects may have a water cost in terms of increased evapotranspiration from riparian vegetation and evaporation off the increased water surface (MRGESCP 2004) that are accounted for as new depletions and a water source to provide for these depletions must be acquired as restoration is implemented.

11. Bernalillo Priority Site Project: The Bernalillo Priority Site Project proposed by Reclamation is necessary to protect the integrity of the east levee and canal system along the Albuquerque Reach of the Middle Rio Grande between the U.S. Highway 550 bridge and the northern boundary of the Pueblo of Sandia. The banks of the river are close to the east levee and pose a potentially serious threat to project facilities and public health and safety. The Project proposes to create a secondary high flow channel, realign the main river channel, and install bendway weirs to reduce bank erosion threatening the levee.

12. Middle Rio Grande Conservation District: Improvements to physical and operational components of the irrigation system since 2001 have contributed to a reduction in the total diversion of water from the Rio Grande by the MRGCD. Prior to 2001, average diversions were 630,000 afy and now average 370,000 afy. The change was possible because of the considerable efforts of MRGCD to install new gages, automated gates at diversions, and scheduling and rotation of diversions among water users. The new operations reduce the amount of water diverted; however, this also reduces return flows that previously supported flow in the river. The river below Isleta Diversion Dam may be drier than in the past, but small inflows may contribute to maintaining flows.

13. Pilot Water Leasing Project: The City of Albuquerque and Albuquerque Bernalillo County Water Utility Authority with six conservation groups established a fund in February 2007 that will provide the opportunity to lease water from Rio Grande farmers and have that water remain in the river channel to support the silvery minnow. This program supports the need for reliable sources of water to support conservation programs as identified by the MRGESCP (2004).

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 negatively affected the silvery minnow population. The population is unable to expand its distribution because poor habitat quality and Cochiti Dam prevent upstream movement and Elephant Butte Reservoir blocks downstream movement (U.S. Fish and Wildlife Service 1999). Augmentation of silvery minnow 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 minnow. 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 2003). 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 afy returning to the river from the WWTP (U.S. Bureau of Reclamation 2003). The effect of water withdrawals means 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.

Various conservation efforts have been undertaken in the past and others are currently being carried out in the middle Rio Grande. Silvery minnow abundance has increased over 2002-2003 population levels. However, the threat of extinction for the silvery minnow continues because of increased reliance on captive propagation, the fragmented and isolated nature of currently occupied habitat, and the absence of silvery minnow in other parts of the historic range. The increased abundance of silvery minnow from 2004-2006 is a positive sign. Nevertheless, the threats that endanger this species are still present.

Existing Water Management in the Rio Grande by Buckman Project Proponents

The project proponents do not divert any of their existing native Rio Grande water or SJC water. The Rio Grande water remains in the channel to contribute to the offset requirements on the project proponents due to groundwater pumping in the Buckman Well Field. This 797 afy (131 afy City, 11 afy County, and 655 afy LCLP) is part of the current flow of the Rio Grande, and may be considered to exist as a continuous component of the flow within the larger total flow of the Rio Grande. A portion of the SJC water (5,605 afy for the City and County) has been used to meet the remainder of the offset requirement. This requirement varies depending on the amount of water pumped from the Buckman Wellfield now and in the past. In the BA, the amount of offset water needed in 1997-2001 averaged 2,487 afy. For 2006, the offset for the Buckman Wellfield was calculated to be approximately 2,949 afy. To maximize the benefit of this water to the Rio Grande Compact, most of the SJC water used for offsets is released from storage during the winter and early spring and thus does not contribute to maintaining river flows over the course of the year.

As mentioned in the environmental baseline, the City and County have, in the past, leased back the unused share of SJC water to Reclamation or other entities. When leased to Reclamation, this water can be used as part of the supplemental water needed by the Middle Rio Grande Endangered Species Act Collaborative Program to implement the 2003 BO.

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or designated critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, which will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Silvery minnow are present in the project area between Cochiti Dam and San Acacia Diversion Dam. The primary adverse effects of the Buckman Project on the silvery minnow result from the decrease in Rio Grande flows below Cochiti Dam due to the diversion of native water, and changes in availability of supplemental water to Reclamation through use of the project proponent's SJC water for diversion. This reduction in flows contributes to an increased risk of river drying (either in timing of a drying event or the extent of that event). Even without a drying event, the reduction in flows affects the total wetted area, water depth, sediment transport, and structure of the aquatic habitats (pools, runs, riffles). Reduced water quality may also be a concern, particularly as there would be less water for dilution of waste water treatment plant (WWTP) inflows. Primary constituent elements of designated critical habitat are also adversely affected.

The potential and extent of adverse effects to the silvery minnow and its designated critical habitat from operation of the Buckman Project will vary depending on the amount of native and SJC water diverted in a year and the amount of the diversion during the period of the year when low flows are likely to occur below Isleta Diversion Dam and the potential for river drying is high. The amount of water available in the Rio Grande, depending on hydrologic year (i.e., dry, normal, or wet), and the amount of storage left from previous years, will also dictate the potential extent of effects. The actual extent of effects for each year of operation cannot be measured at this time because the future hydrological information needed is not available.

For the purposes of this analysis, we have developed the following operational scenario to enable us to identify changes to the Rio Grande from the implementation of the Buckman Project. The parameters of this evaluation scenario are as follows:

1. The Buckman Project will need to operate at full capacity to meet the needs of the project proponents. No other water sources will be available. This is the scenario presented for the diversion amounts discussed in the BA and included here in Table 3.
2. The staged curtailment plan for reduction in diversions of Rio Grande water would operate during the irrigation season (March through October), which is the period of highest water use for irrigation, evaporation, and riparian demands that can result in a drying of portion of the river. The decision to curtail would be based on a 5-day running

average measurement of native flows (those flows except SJC water released for municipal and industrial consumptive use) at Otowi Gage where the measurements showed a decline at or below 325 cfs. When this occurs, diversions of native Rio Grande water are curtailed according to the schedule in Table 4.

3. Flows in the Rio Grande below the Buckman Project enter and leave Cochiti Reservoir at the same rate. That is, the inflow equals the outflow in terms of cfs. It is understood that two canals take water from Cochiti Dam and that released flows represent the inflow minus these diversions.
4. The implementation of the Albuquerque Drinking Water Project in 2010 will increase flows between Otowi and the new diversion at Paseo del Norte due to continuous delivery of 65 cfs of Albuquerque's SJC water. Native flows will decrease between Paseo del Norte and the WWTP inflow point due to diversion of 65 cfs of native flows. The requirement to meet 100 cfs at the Central gage from the 2003 BO remains in effect. The analysis assumes this project is in place and that the effects of the Buckman Project are additive in this reach.
5. Because there is no streamflow gage at the Paseo Diversion site, estimates of flows there for the analysis were derived by adding 30 cfs to the readings for the Albuquerque Central Gage to approximate flows at Paseo. The use of 30 cfs to account for losses within the Rio Grande in that reach are taken from the Drinking Water Project (CH2MHill 2003).
6. The diversion of flows at the Buckman Project will be as described in Table 3 of this document for a one-day peak. In the BA, this maximum diversion was reduced by 0.92 cfs of "baseline" seepage loss under the assumption that since this amount of the native Rio Grande water currently used for offsets (666 af) is lost to seepage between Otowi and the project site, that direct diversion of this water would retain this seepage loss, thereby reducing the change in flows below the diversion site by the 0.92 cfs continuous seepage loss. This assumption is not supportable. Since the Buckman Project will divert the entire 666 af, not reduced for known seepage amounts, other native flows would be "lost" to seepage in its place. Thus, the "baseline" flow condition for seepage does not fully continue with the proposed action. For purposes of this analysis, we will use the peak day demands as cited in Table 3 of this document and Table 10 of the BA.
7. Seepage losses between Cochiti and Isleta Diversion Dam are assumed to be the same for the baseline and action under consultation. That is, the amount of native Rio Grande flow lost to seepage remains the same proportionately so that a 10 cfs reduction in flows at the head of the system is reflected by a 10 cfs reduction in flows at the bottom.

8. The flow data from the most recent dry year (2002) will be used to evaluate the effect of the Buckman Project diversions. Gage data for 2002 is available at http://waterdata.usgs.gov/nm/nsis. The daily average flows at Otowi, Cochiti, San Felipe, Central, and Isleta gages were reviewed along with the flow analysis from the Drinking Water Project EIS (CH2MHill 2003).

Direct Effects

Angostura Reach

Surface Flows

Surface flows between Cochiti Dam and the Albuquerque diversion at Paseo del Norte will be lower by the amount of native flow taken at the Buckman Diversion (Table 3). Based on 2002 data, for most months of the year, the reduction in flows would be a minor component of the total flow and effects would be difficult to assess. In September and October, the reduction in native flows may impact the total flow reaching the Paseo Diversion such that a curtailment strategy for the Drinking Water Project would be put into place. Table 5 shows the derived Paseo Diversion flows with and without the Buckman Project flows for September and October from Table 3 rounded down to whole numbers. Data from the Otowi Gage for this same period shows that based on the Buckman Project curtailment protocol; there would be one day of reduced native diversion in October, which we consider discountable for this analysis.

As part of the development of the Buckman Project curtailment strategy, the technical report (CH2MHill 2005) indicated that based on flows at Otowi and the Albuquerque Central Gage, flows over 325 cfs at Otowi enabled flows at the Central Gage to remain over 100 cfs. However, that analysis did not take into account the need to maintain or exceed 260 cfs at Paseo del Norte for the Drinking Water Project. Since the Buckman Project curtailment only happens at less than 325 cfs at Otowi, there are likely to be many more times that the Drinking Water Project is in curtailment over the number of days of curtailment for the Buckman Project.

The technical report for the Drinking Water Project (CH2MHill 2003) included an analysis of the changes in flows for normal, drought, and extended drought years at the Central Gage. For normal years, with implementation of the Drinking Water Project, flows would be generally 22 cfs lower than with the No Action alternative. With the addition of the Buckman Project, flows would likely be 4-11 cfs lower for peak-day diversions. In a dry year, river conditions under both the Drinking Water Project and the No Action alternative included flows reaching zero in May-July and September-October which would necessitate releases of supplemental water to maintain 100 cfs at the Central Gage, as required by the 2003 BO. Under this scenario, flows would generally be 26-29 cfs lower, except during curtailment in April-May and September-October when Drinking Water Project flows would be 39 cfs and 0-31 cfs higher respectively than the No Action alternative due to releases of water included in the Drinking Water Project to meet minimum flow requirements for the silvery minnow as described in the 2003 BO.

The result of the Buckman Project diversions of native Rio Grande flows is an increase in the extent of Abuquerque's Drinking Water Project curtailment of native flow diversions and an increase of four days with no project diversions (flows 195 cfs or less). When there are no Albuquerque diversions (Paseo Diversion flows at or below 195 cfs), there is no release of SJC water, and thus there is a concomitant reduction in flows between Cochiti and the Paseo Diversion of an additional 65 cfs. When flows at Paseo Diversion are between 260 and 195, Albuquerque reduces its native water diversion by 1 cfs for each cfs of flow under 260. With the Buckman Project in operation, less native flow reaches Albuquerque and subsequently, less can be taken at Paseo by Albuquerque. The Drinking Water Project curtailment (no diversion when flow is < 195 cfs) supports silvery minnow habitat in the reach from Paseo Diversion to the Albuquerque WWTP during times of low flows because all native water remains in the channel. The effect of the Buckman Diversion still occurs because of the lower flow moving through this reach despite the curtailment of Albuquerque's diversion.

Table 5: Buckman Project Effects on Flows (cfs) reaching Paseo del Norte Diversion in September and October 2002. A * indicates a day where Buckman Project flows would result a flow of less than 195 cfs at the Paseo Diversion where diversions otherwise would have been possible.

Date	Central Gage Flows	Seepage Addition	Paseo del Norte Gage	Buckman Diversion	Net Effect
9/20	233	30	266	8.64	258
9/21	179	30	209	8.64	201
9/22	208	30	238	8.64	230
9/23	201	30	231	8.64	223
9/24	212	30	242	8.64	234
9/25	177	30	207	8.64	199
9/26	166	30	196	8.64	188 * no diversions
9/27	198	30	228	8.64	220
9/28	216	30	246	8.64	238
10/1	200	30	230	7.56	223
10/2	180	30	210	7.56	203
10/3	169	30	199	7.56	192* no diversions
10/4	160	30	190	7.56	183 no diversions
10/5	151	30	181	7.56	174 no diversions
10/6	201	30	231	7.56	224
10/7	234	30	264	7.56	257
10/8	225	30	255	7.56	248
10/9	181	30	211	7.56	204
10/10	173	30	203	7.56	196
10/11	169	30	199	7.56	192* no diversions
10/12	181	30	211	7.56	204
10/13	180	30	210	7.56	207
10/14	192	30	222	7.56	215
10/15	220	30	250	7.56	243
10/16	209	30	239	7.56	232
10/17	195	30	225	7.56	218
10/18	172	30	202	7.56	195* no diversions

10/19	154	30	184	7.56	177 no diversions
10/20	139	30	169	7.56	162 no diversions
10/21	115	30	145	7.56	138 no diversions
10/22	127	30	157	7.56	150 no diversions
10/23	156	30	186	7.56	179 no diversions
10/25	239	30	269	7.56	262
10/26	200	30	230	7.56	223

Channel width and habitat effects

Reduction in river flows has a correlation to the velocity, depth, and width of the wetted channel that relate to habitat conditions. During a dry year where flows are already reduced, depending on the channel configuration, the amount of shallow habitats may be reduced. It is not expected that the Angostura Reach would go dry under the existing baseline, and the additive effect of the Buckman Project is not sufficient to cause that to happen. However, particularly in the Paseo Diversion to WWTP inflow reach, the additive reduction of the Buckman Diversion to the Albuquerque diversion of up to 65 cfs does increase the effects to water depths and velocity. Since silvery minnow prefer wide, shallow, low velocity habitats, any reduction in flow that reduces the extent of these areas directly affects habitat availability and quality.

The Drinking Water Project technical report (CH2MHill 2003) discussed the changes in velocity and channel width below the Paseo Diversion from the diversion of 65 cfs of native water. A reduction in velocity of 0.1 to 0.2 ft per second within a typical range of 1.0 to 1.4 ft per second was presented. A 20-30 ft reduction in width within a typical range of 70-130 ft respectively was presented. Under normal flow conditions where the Drinking Water Project is not operating under curtailment, the effect of the Buckman Project diversions would be an incremental addition to the reductions seen from the Drinking Water Project diversions which could further narrow the wetted area reducing depths and flows. Because of changes to the river channel configuration and the normal range of flows, the exact change due to the Buckman Diversion is unknown. The greatest effects are likely to occur during the peak months of May-August, with the September-October period also significant due to the overall lower flows. Maintenance of habitat features for the silvery minnow are particularly important in the spawning season through the fall to provide for survival of eggs and larvae and recruitment of the young of the year. During periods when the Drinking Water Project is curtailing diversions of native water and allowing more water to remain in the system, the Buckman Project diversions still reduce the amount of water in the river and thus affect channel components that may adversely affect individual silvery minnow in the reach.

Effects to silvery minnow habitat from this reduction would be in terms of total wetted area, water depth, water velocity, changes in water temperature, and related water quality issues. Shallow waters that provide habitat for young of the year silvery minnow would likely be the first areas affected. Deeper pools and runs would be less affected except at very low flows. River habitat restoration efforts in the Albuquerque area are focused on providing suitable channels with shallow areas and appropriate flows to support silvery minnow. A reduction in flows may render some areas less suitable or reduce the amount or quality of restored habitat available in the future.

Dilution effects

The Buckman Project diversion would reduce the native flows in the Rio Grande that currently provide for the dilution of inflows from agricultural drains and WWTPs. This change is small, but at low flows the percentage change may be more significant. Given the change in flows relative to WWTP inflows, effects are likely to be present, but are not likely measurable. Effects to the silvery minnow from pollutants in the inflows would not change.

Importance of area for silvery minnow

The Angostura Reach is designated as critical habitat for the silvery minnow and is the only reach not to have gone dry since the species was listed in 1994. Water management in this reach is designed to maintain continuous flows at all times in all years. In the draft Silvery Minnow Recovery Plan (U.S. Fish and Wildlife Service 2007), this reach is described as having high habitat variability to support the silvery minnow, although some areas through Albuquerque are of reduced quality. Protections for flows in this reach under the 2003 BO and the 2004 Drinking Water Project Biological Opinion have provided additional certainty for suitable habitat conditions. Restoration work in this reach is also an important component for silvery minnow population enhancement. Augmentation stockings of over 900,000 hatchery-produced young and 770,000 salvaged individuals from below Isleta Diversion Dam continue to support the population in this reach as well as reaches below through downstream movement of silvery minnow when flow conditions are appropriate. Actions that reduce the amount or quality of available habitat in the reach do not contribute to the survival and recovery of the silvery minnow.

<u>Isleta, San Acacia, and San Marcial Reaches</u>

Surface flows

The Rio Grande below Isleta Diversion Dam is subject to seasonal drying due to use of native flows for municipal-industrial and agricultural purposes. It can be generally assumed that the lower the flows reaching Isleta Diversion Dam, the greater the probability of river drying below the diversion. Several areas of the river between Isleta Diversion Dam and San Marcial are particularly prone to drying during the irrigation season and the actual extent of drying varies from year to year. In 2003-2005, 60-70 mi went dry each year. Favorable rainfall patterns reduced that to 26.5 mi in 2006. Recession (managed drying) is a planned practice that maintains flows in a steadily decreasing level to maintain the drying limits contained in the 2003 BO where portions of the Rio Grande can go dry between July 30 and October 31. The annual operating plan for the Rio Grande (Reclamation 2006) included the following recession schedule (Table 6). Reductions in flows reaching Isleta Diversion Dam due to the Buckman Project will cause flows to be at these minimum targets more often, thus resulting in greater or earlier periods of recession operations to manage the rate at which the river is drying.

Table 6: Flow targets in the 2006 recession protocol for managing drying of Rio Grande below Isleta Diversion Dam. Flows in cfs.

Date	**Central**	**Isleta**	**San Acacia**	**San Marcial**
January 1	100	50	175	0
May 1	100	50	175	20
June 15	100	50	150	20
June 18	100	40	140	10
June 21	100	30	130	0
June 24	100	20	120	0
June 27	100	10	110	0
June 30	100	0	100	0
July 3	100	0	90	0
July 6	100	0	80	0
July 9	100	0	70	0
July 12	100	0	60	0
July 15	100	0	50	0
July 18	100	0	40	0
July 21	100	0	30	0
July 24	100	0	20	0
July 27	100	0	10	0
July 30	100	0	0	0
November 1	100	50	110	0

Because of inflows from the Albuquerque WWTP that replace the 65 cfs of native water plus additional flows from groundwater, the Drinking Water Project analysis did not show any significant difference in surface flows reaching Isleta Diversion Dam between implementation of the project and the No Action alternative. Clearly, flows are reduced under both circumstances, but not differentially. For a dry year, the Drinking Water Project alone reduces flows at Isleta Diversion Dam by up to 12 cfs in June-August although flows may potentially increase during curtailment periods in April-May and September-October. The additional peak day reduction from the Buckman Project diversions will reduce flows reaching the Isleta Diversion Dam in June-August by an additional 10.8 to 9.18 cfs, in September-October by 8.64 and 7.56 cfs respectively, and less at other times during the year. By the time flows travel between Cochiti and Isleta Diversion Dam there will be various transit losses; however, the amount of loss is continuous and not based on actual flow so a reduction in flows at the top of the system would still be reflected at the bottom and the flow reduction can be, to a reasonable extent, tracked through the system to this point. Below Isleta Diversion Dam, it becomes more difficult to track the reduction in flows through the system due to the variable nature of diversions lower in the system and how return or other inflows reach the main channel. There may be effects to flows below the San Acacia Diversion Dam; however, they are difficult to document.

Isleta Diversion Dam has a capacity of up to 1070 cfs capacity to feed the Peralta Main Canal and the Belen Main Canal. This diversion serves 33,000 acres of cropland, which is 51% of the total for MRGCD (CH2MHill 2003) and diversions here are large even with the new technology in place for MRGCD operations. Based on information from historic river drying and past silvery minnow salvage operations, we can estimate the impact that an additional reduction in flows reaching Isleta Diversion Dam could have on the extent of river drying.

Isleta Diversion Dam is at River Mile (RM) 169.3. In 2005, drying events requiring salvage of silvery minnow began at RM 166 on June 28 and at RM 167 on July 1. Salvage operations due to river drying between RM 166 and 167 continued through July 13. Over 82,000 silvery minnow were salvaged during this period. The Buckman Project could divert an additional 10.8 cfs in June and 10.04 cfs in July, potentially increasing the initiation of drying and lengthening the period in which salvage is needed in the reach below Isleta Diversion Dam. Once a level of flow was restored by mid-July, this reach did not go dry again. A 2005 paper on maintaining in-channel refuges for the silvery minnow (MRGESCP 2005) presented the concept of maintaining flows at low levels to keep at least a portion of the channel wet at all times, particularly in the upper portions of the Isleta and San Acacia reaches. The paper suggested that providing a 10 cfs release past Isleta Diversion Dam during the critical periods for river drying could keep at least a portion of the channel wet and reduce the need to salvage minnow because of drying. This 10 cfs flow could be enhanced at RM 166.5 with two cfs from the Alejandro Drain and three cfs from the 240 Wasteway to keep the river wet and provide for refuge habitats through perennial pools at least through RM 164.5. Additional inflows from drains and wasteways would provide refuge areas down to Bernardo (RM130.6). A flow of 15 cfs could provide the same benefits below San Acacia Diversion Dam. These analyses indicate the importance that even a small amount of flow can have in supporting the silvery minnow, and that the loss of that amount of flow can have adverse effects. The Buckman Project diversions in the summer months would reduce the amount of water available for maintaining the 10 cfs from Isleta Diversion Dam envisioned under the 2005 concept paper. Acquisition of other water or differential management to provide this flow may thus be needed to achieve this opportunity.

Channel width and habitat effects

As discussed for the Angostura Reach, reductions in flows affect the amount and quality of the habitat available. At low flows where river drying is likely, reduced flows exacerbate the loss of habitat and may significantly reduce the amount or quality of available refuge sites (deep pools) that must maintain adequate water quality until a re-wetting event occurs. Additionally, the potential for habitat restoration projects in this area is high, and a reduction in flows may affect the extent and quality of the future restoration.

Dilution effects

With lower flows, contaminants associated with inflows from waste water treatment plants and agricultural areas are less diluted upon their entry to the river. In addition, lower flows contribute to earlier or more severe river drying. With river drying, concentrations of potentially harmful chemicals in residual pools may increase stress and subsequent mortality of silvery minnow. The longer or more severe the drying event, the more evaporation occurs, decreasing the number of pools available and increasing the concentration of harmful pollutants that stress individual silvery minnow in refuge pools.

Importance of area for silvery minnow

These reaches often have higher numbers of silvery minnow, in part from local recruitment and in part from movements of fish downstream from the Angostura Reach. The habitat quality varies, particularly because of channel incisement and narrowing and periodic drying of shallow water areas. Further reductions in flows may contribute to changes in sediment transport, establishment of vegetative banks that constrain channel movement, and increase periods or areas of drying that adversely affect the silvery minnow and its habitat.

Indirect Effects

Availability of Supplemental Water

Effects of reduced native flow and availability of SJC imported water to use as supplemental water to protect the silvery minnow relate to the ability of Reclamation and other affected partners to meet the requirements of the 2003 BO. With both the Albuquerque and Jicarilla Apache SJC water now being used for diversion, the availability of SJC water for supplemental flows has been significantly reduced. To offset this loss, Reclamation and the MRGEASCP are exploring alternative sources. The initiation of the Pilot Water Leasing Program in 2007 may provide sufficient water to make up all or part of the loss. The supplemental water has been used in the past to support flows throughout the system, particularly below Isleta Diversion Dam to manage recessions if those are needed. It is difficult to assess the effects to river drying below the Isleta Diversion Dam if there is a significant reduction in supplemental water available. Recession may occur more often or for longer periods without this water available to support flows. The amount of this change due to the Buckman Project is approximately 6,000 af or more of the 63,109 af average amount needed from1996 to 2002. It should also be noted that as stated in the environmental baseline, the Drinking Water Project operation uses Albuquerque's SJC water so it is also not available for supplemental purposes.

Designated Critical Habitat

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of designated critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to designated critical habitat for the silvery minnow.

The proposed Buckman Project encompasses designated critical habitat for the silvery minnow from the Cochiti Dam to the terminus in the San Marcial Reach. The majority of the effects are in the Angostura Reach where there is interaction between the Drinking Water Project and the Buckman Project. Effects that can be described also occur in the Isleta Reach, with effects below that point being more problematic to describe. Reduction in flows due to the Buckman Project may affect components of the primary constituent elements, particularly for water depth, wetted area, velocity, temperature, and water quality. Reductions also exacerbate the potential for river drying in the Isleta Reach. The quantitative measurements of these effects are difficult to establish due to the changes in recent management of the Rio Grande and the uncertainty of future annual flows.

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 Act. Cumulative effects include:

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

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

- Contamination of the water (i.e., sewage treatment plants, runoff from small feed lots and dairies, and residential, industrial, and commercial development). A decrease in water quality and gradual changes in floodplain vegetation from native riparian species to non-native species (i.e., saltcedar) could adversely affect the silvery minnow and its habitat. Silvery minnow larvae require shallow, low velocity habitats for development. Therefore, encroachment of non-native species results in less habitat available for the silvery minnow.

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

- Wildfires and wildfire suppression in the riparian areas along the Rio Grande may have an adverse affect on silvery minnow. Wildfires are a fairly common occurrence in the bosque (riparian area) along the Rio Grande. Although fire retardant, which is toxic to aquatic species, is generally not used in close proximity to the Rio Grande, other fire suppression techniques, such as scooping water from the Rio Grande in large buckets, may harm silvery minnow. Silvery minnow could potentially be scooped up along with the water and dropped onto burning areas.

The Service anticipates that these types of activities will continue to threaten the survival and recovery of the silvery minnow by reducing the quantity and quality of habitat through continuation and expansion of habitat degrading actions.

CONCLUSION

After reviewing the current status of the silvery minnow and its designated critical habitat, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the Buckman Diversion Dam Project, as proposed in the January 5, 2007, BA is not likely to jeopardize the continued existence of the silvery minnow or result in adverse modification of designated critical habitat. The Buckman Project will have effects to silvery minnow and their designated critical habitat through reductions in flow in the Angostura Reach, the Isleta Reach, and reductions in availability of supplemental water to support flows as required in the 2003 BO. Improvements to habitat in these reaches through projects described in the environmental baseline may be slightly less effective in light of the reduced flows. Although the proposed action has the potential to cause minimal adverse effects to designated critical habitat for the silvery minnow, it is anticipated that these impacts will not affect the function or intended conservation role of designated critical habitat relative to the conservation of the silvery minnow and to the overall critical habitat designation. The implementation of the proposed action is not expected to impede the survival or recovery of the silvery minnow within Middle Rio Grande or range-wide.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act 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 Forest Service so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The action agency has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest Service (1) fails to assume and implement the terms and conditions or (2) fails to require adherence to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Forest Service must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

Amount or Extent of Take Anticipated

The Service has developed the following incidental take statement based on the premise that the Buckman Project will be implemented as proposed. Take is expected in the form of harm and harass as: (1) reduction in habitat area available to the silvery minnow resulting from reduction in flows in the Angostura Reach and Isleta Reach; and (2) increased mortality of silvery minnow below the Isleta Diversion Dam due to reduced flows and the reduction in availability of supplemental water to maintain wetted habitats.

Up to 13 miles of river between the Paseo Diversion and the WWTP outfall, and up to 3 miles of river below the Isleta Diversion dam, will experience peak flow reductions of up to 11 cfs due to the Buckman Project. The Service has determined that these reduced flows will result in a permanent loss of 6.21 acres of critical habitat in the Middle Rio Grande (see Service 2007 for methodology).

Actual mortality associated from these reductions in habitat cannot be segregated out of the larger incidental take resulting from water operations associated with the 2003 BO as amended. The amount of estimated take from river drying changes each year as a result of changes in the environmental baseline including the number of adults reproducing each spring, summer survivorship, and augmentation. Given the high degree of variability exhibited by each of these values depending on river condition, the number of minnows that will be taken as a result of the Buckman Diversion Project cannot be quantified.

Effect of the Take

The Service has determined that this level of anticipated take is not likely to result in jeopardy to the silvery minnow or destruction or adverse modification of designated critical habitat.

Reasonable and Prudent Measures

The combined effects of the implementation of baseline conservation actions through existing biological opinions and the MRGESCP are comprehensive and of themselves provide the needed minimization of incidental take for the entirety of Rio Grande operations. The additional habitat and species loss from the Buckman Project will likely be minimized through additional habitat restoration and efforts to salvage silvery minnow during river drying. However, as water users on the Rio Grande, the project proponents do have a significant stake in the continued effectiveness of these programs. The Service believes the following RPMs are necessary and appropriate to minimize impacts of incidental take of the silvery minnow from the Buckman Project.

1. The Project Proponents will seek to minimize the amount of native Rio Grande flows diverted at times when the likelihood of river drying is high.

Terms and Conditions
In order to be exempt from the prohibitions of section 9 of the ESA, the action agency must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

To implement RPM 1, the Project Proponents shall:

Prior to implementation of the project, work with each other, the Service, and to the extent practicable the City of Albuquerque and the Bureau of Reclamation, to establish a coordination strategy that will minimize diversions of native Rio Grande water during periods of low flow and associated river drying in the Middle Rio Grande. Elements of this strategy may include identifying opportunities to modify diversion schedules at the Buckman Diversion and/or divert SJC water instead of native water to minimize reduction of silvery minnow habitat from March through October. Written documentation of this strategy must be submitted to the Service prior to operation of the BDD.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

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

1. Encourage conservation of water to benefit the silvery minnow.

2. Support the efforts of the Middle Rio Grande Endangered Species Act Collaborative Program.

RE-INITIATION NOTICE

This concludes formal consultation on the action(s) described in the January 7, 2007 biological assessment. As provided in 50 CFR § 402.16, re-initiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or designated critical habitat in a manner or to an extent not considered in this biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or designated critical habitat not considered in this draft biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

In future correspondence on this project, please refer to consultation number 22420-2006-F-0045. If you have any questions or would like to discuss any part of this draft biological opinion, please contact Jennifer Parody of my staff at (505) 761-4710.

Wally Murphy

cc:
Assistant Regional Director, Region 2 (ES), U.S. Fish and Wildlife Service, Albuquerque, NM
Regional Section 7 Coordinator, Region 2 (ES), U.S. Fish and Wildlife Service, Albuquerque, NM

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