United States Department of the Interior

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In Reply Refer To:
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Memorandum

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

From: Regional Director, Region 2 H Dale Hall

Subject: Biological and Conference Opinions on the Effects of Actions Associated with the Programmatic Biological Assessment of Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico

This document transmits the U.S. Fish and Wildlife Service's (Service) biological and conference opinions on the effects of actions associated with the "Programmatic Biological Assessment of Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico." The duration of this action is from the date of signature on this biological opinion through February 28, 2013. This assessment partially incorporates the 2001 biological assessment submitted to the Service on June 8, 2001, for "U.S. Bureau of Reclamation's Discretionary Actions Related to Water Management, U.S. Army Corps of Engineers Water Operations Rules, and Non-Federal Actions Related to Ordinary Operations on the Middle Rio Grande, New Mexico," for the period June 30, 2001, through December 31, 2003 (Reclamation 2001). This 10-year assessment concerns the effects of the 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), the threatened bald eagle (*Haliaeetus leucocephalus*), and the endangered interior least tern (*Sterna antillarum athalassos*). Your request for formal consultation, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C.

1531 *et seq*.), was received on February 19, 2003. The Bureau of Reclamation (Reclamation) is the lead Federal agency for this consultation, representing the Army Corps of Engineers (Corps) and the non-Federal agencies that are parties to this consultation. These non-Federal agencies include the State of New Mexico and the Middle Rio Grande Conservancy District (MRGCD). Although the City of Albuquerque (City) has been closely involved in this consultation, it is not a party to the consultation, but willing to assist in various activities that will benefit the silvery minnow and the flycatcher. For the purposes of this opinion, the non-Federal agencies will collectively be referred to as ™parties to the consultation.š Indian Pueblos and Tribes within the action area did not request to be a party to this consultation and are not ™parties to the consultationš in this biological opinion.

These biological and conference opinions are based on information submitted in the biological assessment dated February 19, 2003; meetings between the Service and Reclamation, the Corps, and other parties to the consultation; meetings with affected Indian Pueblos and Tribes; and other sources of information. A complete administrative record of this consultation is on file at the Service˜s New Mexico Ecological Services Field Office (NMESFO).

Reclamation requested concurrence with the determination of ™may affect, is not likely to adversely affectš the bald eagle and interior least tern. The Service concurs with Reclamation˜s determination of ™may affect, is not likely to adversely affectš the bald eagle and interior least tern for the following reasons:

› The bald eagle is not present on the Rio Grande or Rio Chama during the spring runoff and summer monsoon season. Therefore, no direct impacts to bald eagles from the proposed actions during and after spring runoff are anticipated. In addition, there are no foreseeable indirect effects of the proposed actions during the irrigation season on riparian habitats that are used by wintering bald eagles within the action area. Potential indirect effects on riparian vegetation are not likely to be significant for the bald eagle, because existing habitat in the action area appears to be suitable to sustain bald eagles into the future.

› The February 19, 2003, biological assessment describes environmental commitments from completed or early consultations that assist in avoiding potential adverse impacts to the bald eagle. These measures include the following:

(1) If a bald eagle is present within 0.25 mi upstream or downstream of the active project site in the morning before project activity starts, or following breaks in project activity, the contractor should be required to suspend all activity until the bird leaves of its own volition, or the Reclamation biologist, in consultation with the Service, determines that the potential for harassment is minimal. If a bald eagle arrives during

construction activities or if a bald eagle is beyond that distance, construction need not be interrupted;
(2) If bald eagles are found consistently in the immediate project area during the construction period, Reclamation should contact the Service to determine whether formal consultation is necessary; and
(3) Reclamation will continue to conduct winter bald eagle surveys from Elephant Butte Dam to the southern boundary of the Bosque del Apache National Wildlife Refuge (Refuge).

If these environmental commitments for the bald eagle are not carried out, Reclamation must contact the Service to determine if further consultation is necessary.

› The interior least tern occurs as a vagrant along the Middle Rio Grande, and no nesting has been recently documented. Therefore, effects from the proposed action are likely to be insignificant or discountable.

The remainder of these biological and conference opinions will deal with the effects of implementation of the proposed action on the silvery minnow and its critical habitat and on the flycatcher. Reclamation has determined that the proposed action ™may affect, and is likely to adversely affectš the silvery minnow and flycatcher and ™may adversely modifyš designated critical habitat of the silvery minnow. The designation of critical habitat for the silvery minnow was published on February 19, 2003 (68 FR 8088). The final designation of critical habitat will become effective on March 21, 2003. The biological and conference opinions will be finalized before this date. Reclamation has requested a formal conference opinion on the proposed designation; however, the Service has elected to provide a formal conference opinion on the final designation, because the designation will become effective less than a week after the biological and conference opinions are finalized and the final designation is slightly different than the proposed designation. At that time, Reclamation can request in writing that the Service confirm this conference opinion as a biological opinion issued through formal consultation. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the action and no further section 7 consultation will be necessary.

This biological opinion seeks to represent current knowledge about population dynamics and habitats for the flycatcher and silvery minnow. We expect that the action agencies and parties to the consultation will continue to aggressively seek more information, which will assist in the survival and recovery of these species and the ecosystems upon which they depend. This biological opinion is intended to be adaptive, and may changed as our knowledge of the species increases. The Middle Rio Grande Endangered Species Act Collaborative Program Interim Steering Committee is working in consultation with the Service to develop a long-term management plan, which will reflect the most recent information regarding the listed species in the Middle Rio Grande. Current prescriptions for rescue and captive breeding and rearing of silvery minnows are considered necessary in response to drought emergencies. However, it should be clearly understood that the primary objective of the ESA is to maintain and recover wild populations of threatened and endangered species.

Consultation History

On June 8, 2001, Reclamation and the Corps submitted to the Service a biological assessment for proposed ™U.S. Bureau of Reclamation˜s Discretionary Actions Related to Water Management, U.S. Army Corps of Engineers Water Operations Rules, and Non-Federal Actions Related to Ordinary Operations on the Middle Rio Grande, New Mexico,š for the period June 30, 2001, through December 31, 2003 (Reclamation 2001). The Service issued a final biological opinion on June 29, 2001, concluding that the proposed actions were likely to jeopardize the continued existence of the silvery minnow and the flycatcher, and it contained a reasonable and prudent alternative (RPA) and incidental take statement, which the Federal agencies are implementing.

Although the consultation was to be effective through December 31, 2003, in June 2002, Reclamation predicted it would not be possible to meet the biological opinion˜s flow requirements for the remainder of the water year because of extreme drought. On August 2, 2002, Reclamation submitted a request for reinitiation of section 7 consultation. This request was subsequently amended by a letter on August 30, 2002. On September 12, 2002, the Service issued a new biological opinion addressing proposed water management through December 31, 2002. The new biological opinion found that Reclamation˜s proposed action was likely to jeopardize the continued existence of the silvery minnow, and that there was no RPA to the proposed action. Late season rains enabled Reclamation to use its remaining supplemental water consistent with the June 2001, biological opinion and its incidental take statement. Therefore, the June 2001, biological opinion remained in effect throughout the 2002 water year, and the September 12, 2002, biological opinion was not implemented. On September 23, 2002, Federal District Court Judge Parker entered an order that found the September 12, 2002, biological opinion to be arbitrary and capricious, and he ordered: (1) Reclamation to release San Juan-Chama Project water to maintain river flows ordered by the Court and, (2) Reclamation and the Service to reinitiate consultation. On October 17, 2002, the Tenth Circuit Court of Appeals issued a stay of Judge Parker˜s order. The Tenth Circuit Court of Appeals heard arguments for this case on January 14, 2003.

In accordance with Judge Parker˜s ruling, Reclamation, the Corps, and the Service have reinitiated consultation on water management activities on the Middle Rio Grande. Numerous meetings among involved Federal and State agencies, Pueblos and parties to the consultation have been conducted regarding reinitiation of this consultation. On January 28, 2003, Reclamation released the draft biological assessment for this consultation and issued a final assessment on February 19, 2003. The Service issued draft biological and conference opinions on February 21, 2003. Prior to finalization of the opinions, the Service conducted numerous meetings with Reclamation, the Corps, other parties to the consultation, and Pueblos and Tribes to discuss their comments on the draft opinions.

Because the Department of the Interior must begin the consultation process prior to the resolution of the legal issues presented in the appeals to Tenth Circuit Court, we have analyzed the full spectrum of water management options described in the February 19, 2003, final biological assessment, including Appendices A and B. In this biological opinion, we have analyzed the threats to the species and have developed alternatives based on biological needs of the species, independent of sources of water and discretionary authority.

BIOLOGICAL AND CONFERENCE OPINIONS

I. Description of the Proposed Action

Background

In 1999, several environmental groups, represented by the Land and Water Fund of the Rockies, sued Reclamation and the Corps for alleged violations of the ESA and the National Environmental Policy Act. As this litigation has progressed, Reclamation˜s authorities have been further defined by the Federal District Court of New Mexico in two rulings. The District Court held that (1) Reclamation has authority to restrict diversions by the Middle Rio Grande Conservancy District (MRGCD) through the Middle Rio Grande Project, and (2) Reclamation can use water from the San Juan-Chama and/or Middle Rio Grande Projects directly for endangered species purposes, even in cases where shortages to project contractors would result.

Aspects of the District Court˜s ruling have been appealed by the United States and other parties, and oral arguments were heard by the Tenth Circuit Court on January 14, 2003. Reclamation anticipates that the Tenth Circuit Court˜s ruling will further address the scope of its authority. In order to prepare for a Court decision in time to proceed for the 2003 irrigation season, the Department of Interior agreed that the Federal agencies would consult on two proposals for 2003. The first proposal would assume that the Court agreed with appellants that Reclamation˜s discretion is limited, and the second would assume that the Tenth Circuit Court upholds the District Court˜s ruling that Reclamation has discretion over Project water and operations.

As a result, Reclamation has proposed one standard action that includes contractual water deliveries and other Project operations. They have also submitted Appendix A and B that describe Reclamation˜s available discretion, based on the Court˜s future ruling, to undertake measures to avoid jeopardy or protect and conserve listed species. Appendix A lists some actions that would be available if the Court finds limited discretion, and Appendix B details additional actions that would be available for conservation measures if the Court rules that Reclamation has discretion over Project water.

Action Area

For purposes of this document, the ™Middle Rio Grandeš is defined as the area of the Rio Chama watershed and the Rio Grande, including all tributaries, from the Colorado/New Mexico State-line downstream to the headwaters of Elephant Butte Reservoir (Appendix D, Figure 1). For discussion of proposed Federal actions related to water operations, the Middle Rio Grande below Cochiti Dam is further designated by four divisions/reaches defined by locations of mainstream irrigation diversion dams. The Cochiti Division/Reach extends from Cochiti Dam to Angostura Diversion Dam. The reach from Angostura Diversion Dam to Isleta Diversion Dam is called the Albuquerque Division/Reach. The Isleta Division/Reach is bounded upstream by Isleta Diversion Dam and downstream by San Acacia Diversion Dam. Finally, the reach below San Acacia Diversion Dam to the headwaters of Elephant Butte Reservoir is the San Acacia Reach.

Standard Proposed Action

The following section describes proposed actions to be covered in this consultation. The description includes both Federal actions and non-Federal actions on the basis of total river depletions. The intent of the proposed action is that consultation coverage be extended to ordinary operations on the river as they have existed historically, as long as those operations are valid under State and Federal law, consistent with historic operations, do not create additional net depletions on the river or depletions at a new time or place, or do not affect threatened or endangered species or their habitat beyond what is considered in the biological assessment, without further consultation with the Service.

The Rio Grande Compact of 1938 (Compact) sets depletion limits on the Rio Grande and administration by the State of New Mexico enforces those limits, resulting in a reliable general description of flows. The Middle Rio Grande Basin is a Declared Ground Water Basin, which means that the New Mexico State Engineer has determined that ground water usage impacts surface flows of the Rio Grande and must be offset, creating further assurance that flow descriptions will be reliable, even if particular actions and actors maintaining those flows change. Therefore, particular actions that do not affect net depletions of water are not specifically described.

Accordingly, the following gives general narrative descriptions of the types of actions taking place within the administration of the Compact, together with the depletion limits under the Compact. Generally, the actions under consultation are depletions and diversions of water as described in the sections below, although some specific actions under consultation are identified and described, e.g., river maintenance. With respect to types of actions that might affect threatened or endangered species or their habitat other than flows in the river, such actions are generally described for non-Federal entities, and more specifically described for Federal entities.

Depletions that result from the exercise of Federal Indian water rights are not subject to State law restrictions or administered by the State. In addition, pursuant to Article XVI of the Compact, no

Indian water rights may be impaired by the State˜s compact management activities. Indian Pueblos and Tribes within the action area did not request to have the effects of their actions analyzed in this biological opinion.

However, depletions related to existing Indian uses are included within the depletion figures compiled and provided by the State. Using the information from Reclamation, the Corps and the State of New Mexico provided for this consultation, the Service is unable to identify the depletions attributable to individual water users, Indian or non-Indian. Thus, this biological opinion analyzes the effects on the listed species from existing depletions that result from both Indian and non-Indian water uses within the action area, and extends incidental take coverage for all those uses. The Service is aware that the Indian Pueblos and Tribes do not concede that the ESA applies to their actions.

The Service and the Federal agencies recognize that who depletes and the amount they deplete may vary from year to year. Consequently, the action agencies and non-Federal water users assume the risk that the future development of senior water rights, including Indian Pueblo and Tribal water rights, may result in shortages of water to junior users. Nothing in this biological opinion precludes any new depletions that result from the exercise of senior Indian water rights within the action area. Based on this understanding, the Service believes that nothing in this biological opinion directly affects or impairs Indian Pueblo and Tribal trust resources within the Middle Rio Grande Basin. However, implementation of this biological opinion by the action agencies could affect Indian Pueblo and Tribal trust resources within the Middle Rio Grande Basin.

Included within these descriptions of depletions and withdrawals were the depletions and withdrawals from the exercise of valid and existing water rights of 18 Pueblos (Acoma, Cochiti, Isleta, Jemez, Laguna, Nambò, Picuris, Pojoaque, San Felipe, San Ildefonso, San Juan, Sandia, Santa Ana, Santa Clara, Santo Domingo, Tesuque, Taos, Zia), the Navajo Nation and certain Navajo allotees, and the Jicarilla Apache Nation. Federal Indian water rights are not: (1) impaired by the Compact, (2) subject to State law restrictions, and/or (3) administered by the State of New Mexico. Nonetheless, depletions resulting from the exercise of Indian water rights are included within the general descriptions in this section, for the reasons discussed above.

Given the pending Tenth Circuit Court of Appeals decision, there is uncertainty regarding what the Court will determine to be the scope of Federal discretionary authority by the time consultation is complete. Therefore, the Federal action agencies and other parties to the consultation are consulting on the effects of total river depletions on listed species, without identifying particular aspects of the overall action as ™discretionary or non-discretionary.š Under the depletion-based approach, the scope of Federal discretion becomes most relevant at the stage of consultation where the action agency and the Service design RPAs, reasonable and prudent measures (RPMs), or conservation measures. Reclamation and the Corps have voluntarily included non-Federal actions within the scope of the consultation and any resulting incidental take statement and not out of legal obligation.

Non-Federal Actions

Middle Rio Grande water operations must be conducted in conformance with the Compact (including Article XVI) administered by the Rio Grande Compact Commission. The Commission is composed of a Commissioner from Colorado, New Mexico, and Texas, as well as a Federal Commissioner who chairs Commission meetings. Colorado is prohibited from accruing a debit, or under-delivery to the downstream States, of more than 100,000 acre feet (af), while New Mexico˜s accrued debit to Texas is limited to 200,000 af. These limits may be exceeded if caused by holdover storage in certain reservoirs, but water must be retained in the reservoirs to the extent of the accrued debit. Any deviation from the terms of the Compact requires unanimous approval from the three State Commissioners.

In order to meet delivery obligations under the Compact, depletions within New Mexico are carefully controlled. Allowable depletions above the Otowi Gage located outside of Santa Fe are confined to levels defined in the Compact. Allowable depletions below Otowi Gage and above the headwaters of Elephant Butte Reservoir are calculated based on the flows passing through Otowi Gage. The maximum allowable depletions below Otowi Gage are limited to 405,000 af, in addition to tributary inflows. In an average year, when 1,100,000 af of water passes the gage, approximately 393,000 af of water is allowed to be depleted below Otowi Gage, in addition to tributary inflows. In the dry year of 1977, for example, allowable depletions were 264,600 af in addition to tributary inflows. Analysis of effects throughout the biological assessment assumed that all covered actions occur within the Compact framework, except as specifically described below and considering that no Indian water rights may be impaired by the State˜s Compact management activities.

The following is a non-exhaustive list of non-Federal entities and proposed non-Federal actions:

State of New Mexico

- The New Mexico State Engineer has general supervision of the waters of the State and of its measurement, appropriation and distribution. The Office of the State Engineer grants State water rights permits and is responsible for ensuring that applicants meet State permit requirements and otherwise enforcing the water laws of the State.
- The Interstate Stream Commission is authorized to develop, conserve, and protect the waters and stream systems of the State and is responsible for representing New Mexico˜s interests in making interstate stream deliveries, and for investigating, planning, and developing the State˜s water supplies. The State cooperates with Reclamation to perform annual construction and maintenance

work under the State of New Mexico Cooperative Program. In the past, this work has included some river maintenance on the Rio Chama, maintenance of Drain Unit 7, drain and canal maintenance within the Refuge, similar work at the State refuges, and temporary pilot channels into Elephant Butte Reservoir.

› The New Mexico Department of Game and Fish administers programs concerned with conservation of endangered species and game and fish resources. It also manages the La Jolla State Game Refuge and Bernardo Waterfowl Area.

› The New Mexico Environment Department administers the State˜s water quality program.

Counties

Counties that border the Rio Grande and Rio Chama and their respective tributaries conduct actions that can affect these rivers. County actions can influence water management by providing for general development and infrastructure of the Counties, such as pumping of wells or land-use regulations within the Middle Rio Grande watershed.

Villages, Towns, and Cities

Middle Rio Grande villages, towns, and cities are served by municipal and industrial water systems. While most use groundwater exclusively, Santa Fe also uses surface water supplies. Both Albuquerque and Santa Fe plan to use surface water directly from the San Juan-Chama Project, in addition to ground water. If future groundwater pumping or use of surface water depletes the river, the New Mexico State Engineer requires that these depletions be offset, either by acquiring other water rights, or with San Juan-Chama Project water. Many of these contractors have voluntarily entered into annual lease programs with Reclamation to enhance Middle Rio Grande valley water management. Municipalities also manage wastewater treatment systems that discharge into the Rio Grande.

Irrigation Interests

Irrigation interests include acequias, individual irrigators, ditches, and the MRGCD. The MRGCD was established under State law in 1928 to address issues such as valley drainage and flooding, and currently operates the diversion dams of the Middle Rio Grande Project to deliver irrigation water to lands in the Middle valley, including lands of the six Middle Rio Grande Pueblos (Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia, and Isleta).

<u>Federal actions</u>

Corps of Engineers

Corps reservoir operations and authorities were described in detail in the June 2001 biological assessment (Reclamation 2001) and are incorporated here by reference. No new or additional actions are being proposed. A brief description of the major project features follows:

The Corps is responsible for operation and maintenance of five flood control dams on the Rio Grande and its tributaries: Abiquiu, Cochiti, Galisteo, Jemez Canyon, and Platoro dams. The purposes of these projects can be broadly defined as providing flood control, sediment control, water supply, recreation, and fish and wildlife conservation. Platoro Dam is on the Conejos River about 80 miles above the confluence with the Rio Grande. Congressional Authority for the construction of Platoro Dam is contained in the Interior Appropriation Act of 1941. The dam was completed in 1951 by Reclamation as a multi-purpose facility for irrigation storage and flood control. The operation and maintenance responsibility has been transferred to the Conejos Water Conservancy District by Reclamation. The Corps is responsible for administering the flood control regulation.

Abiquiu Dam and Reservoir are on the Rio Chama about 32 river-miles upstream from its confluence with the Rio Grande. Abiquiu Dam was authorized for construction by the Flood Control Act of 1948, (PL 80-858) and the Flood Control Act of 1950 (PL 81-516). Abiquiu Reservoir operates for flood control, sediment retention and water supply. The reservoir˜s storage allocations include 77,000 af for sediment control and 502,000 af for flood control. Construction of Abiquiu Dam was initiated in 1956, and the project was completed and placed into operation in 1963 by the Corps.

Cochiti Dam and Lake are located on the mainstem of the Rio Grande, about 50 miles north of Albuquerque and 25 miles southwest of Santa Fe. The lands for the dam and recreation pool are within Cochiti Pueblo˜s territorial jurisdiction, with parts of the reservoir in Sandoval, Santa Fe and Los Alamos Counties, New Mexico. Cochiti Dam also extends across the Canada de Cochiti and the Santa Fe River, tributaries of the Rio Grande draining from the east. The Flood Control Act of 1960 (PL 86-645) authorized the construction of Cochiti Dam for flood and sediment control on the mainstem Rio Grande. The reservoir˜s storage allocations include 105,000 af for sediment control and approximately 500,000 af for flood control. In 1964, PL 88-293 authorized the establishment of a permanent pool for the conservation and development of fish and wildlife resources and recreation purposes. Subparagraph (e) specifically exempted storage for a permanent pool unless the water to fill and maintain the pool came from outside the Rio Grande Basin. Construction of Cochiti Dam began in 1965 by the Corps and the project was put in operation in 1975.

Galisteo Dam is on Galisteo Creek, about 12 miles upstream of its confluence with the Rio Grande. Galisteo Creek enters the Rio Grande about eight miles downstream of Cochiti Dam. Galisteo Dam was authorized by the Flood Control Act of 1960 for flood control and sediment control for the Middle Rio Grande Valley. The Corps completed Galisteo Dam in 1970. It is an earth-fill embankment 2,820 feet long with a maximum height of 158 feet above the streambed. The reservoir˜s storage allocations include 10,200 af for sediment control and 79,600 af for flood control. Because the dam was constructed with uncontrolled outlet works, the reservoir passes all flood inflow up to approximately 5,000 cfs. Galisteo Reservoir is normally dry, with most inflows occurring in the summer months because of summer thunderstorm activity. The drainage area above Galisteo Dam includes 596 square miles.

Jemez Canyon Dam and Reservoir is on the Jemez River, 2.8 miles upstream of its confluence with the Rio Grande. It is located in Sandoval County, about 5 miles northwest of Bernalillo and about 22 miles north of Albuquerque. All lands associated with the project are held in trust by the United States for the benefit and use of the Pueblo of Santa Ana. Congressional authority for the construction of Jemez Canyon Dam is contained in the Flood Control Acts of 1948 and 1950. The Corps completed the dam in 1953. Jemez Canyon Dam regulates the Jemez River for flood and sediment control in conformity with PL 86-645. The reservoir˜s storage allocations include 40,100 af for sediment control and 73,000 af for flood control.

Bureau of Reclamation

The Albuquerque Area Office of Reclamation is responsible for operation, maintenance, and/or oversight of Federal projects on the mainstem Rio Grande and its upper basin tributaries. These projects include the San Luis Valley Project-Closed Basin Division, the San Juan-Chama Project, and the Middle Rio Grande Project. Reclamation proposes to meet its contractual obligations by delivering water as requested by contractors and other water users of the San Juan-Chama Project and Middle Rio Grande Project. The following section describes the projects and facilities involving Reclamation˜s proposed actions on the Middle Rio Grande and Rio Chama.

<u>Closed Basin Division, San Luis Valley Project</u>

Reclamation determined that the Closed Basin Division, San Luis Valley Project is extremely limited in its ability to provide water for downstream purposes during the 10-year duration of this proposed action and does not affect any listed species. The biological assessment did not address this project further.

<u>San Juan-Chama Project</u>

The San Juan-Chama Project was authorized by Congress in 1962 through PL 87-483, which amended the Colorado River Storage Act of 1956 (PL 84-485) to allow diversion of Colorado River Basin water into the Rio Grande Basin of New Mexico. The original planning projections for the San Juan-Chama Project contemplated an ultimate diversion of up to 235,000 af per year, with an initial phase development to accommodate an average annual diversion of up to 110,000 af. Only the initial phase was authorized (by PL 87-483) and subsequently constructed by Reclamation. The Project takes water from the Navajo, Little Navajo, and Blanco Rivers, which are upper tributaries of the San Juan River (of the Colorado River Basin) for use in the Rio Grande Basin of New Mexico.

Reclamation proposes to deliver water to the following users at the contractor˜s request. None of the existing contracts expires within the next ten years.

Municipal, domestic, and industrial purposes:	
City of Albuquerque	48,200 af
Jicarilla Apache Nation	6,500 af
City and County of Santa Fe	5,605 af
County of Los Alamos	1,200 af
City of Espaúola	1,000 af
Town of Belen	500 af
Village of Los Lunas	400 af
Town of Taos	400 af
Town of Bernalillo	400 af
Town of Red River	60 af
Village of Taos Ski Valley	15 af
San Juan Pueblo	2,000 af
Allocated, but uncontracted, water currently identified for future Indian water rights settlements and or use:	
Taos Area	2,990 af
Irrigation:	
Middle Rio Grande Conservancy District	20,900 af
Pojoaque Valley Irrigation District	1,030 af
Recreation:	
Corps œ Cochiti Recreation Pool	Up to 5,000 af
Total Allocation	**96,200 af**

On July 2, 2002, Article VII of the Rio Grande Compact became effective because the amount of Usable Water in storage in Elephant Butte and Caballo Reservoirs (Rio Grande Project storage) fell below 400,000 af. Article VII of the Compact prohibits increasing storage of native Rio Grande water in reservoirs built after 1929 in New Mexico until the Usable Water in Rio Grande Project storage is 400,000 af or greater. This includes El Vado, Abiquiu, Cochiti, Nichols, McClure, and Jemez Canyon Reservoirs. However, Article XVI of the Compact states that, ™Nothing in this Compact shall be construed as affecting the obligations of the United States of America to Mexico under existing treaties, or to the Indian Tribes, or as impairing the rights of the Indian Tribes.š

With Article VII Rio Grande Compact restrictions in place, only water for the six Middle Rio Grande Pueblos and San Juan-Chama will be stored at El Vado Reservoir. In order to ensure adequate storage for the needs of the six Middle Rio Grande Pueblos, releases from Heron

Reservoir (i.e., contract deliveries) will be adjusted to ensure native flows are stored at El Vado for those needs. At times, such operations will lead to flows on the Rio Chama well outside the recommendations of the Rio Chama Instream Flow Assessment, and it is likely that releases below El Vado Dam could cease completely on occasion to ensure such storage.

Proposed Action

Reclamation proposes to operate Heron Reservoir within the following constraints:

- Meet contract obligations within the San Juan-Chama Project firm yield to contractors listed above, to the extent water is available.
- Maximize storage to the extent water is available.
- Do not exceed safe storage amount of approximately 401,000 af
- Request temporary waivers from contractors to modify the date of their water delivery into the following calendar year, if such waivers will benefit the United States (i.e., to provide improved overall management of upstream water supplies).
- Reclamation may dispose of contractor water if not called for by the contracted delivery date and where consistent with the terms of the contracts or if uncontracted water within the firm yield is available.

Pojoaque Tributary Unit

The Pojoaque Tributary Unit is a component of the San Juan-Chama Project, PL 87-483, and provides supplemental water (1,030 af) for approximately 2,768 acres of irrigated land, of which Indian lands comprise approximately 34 percent of the total. The storage feature of the Pojoaque Tributary Unit is Nambò Falls Dam and Reservoir located on the Rio Nambò. It is a concrete and earth embankment structure which forms a reservoir of 2,020 af capacity. The operation and maintenance of Nambò Falls Dam and Reservoir is performed by the Pojoaque Valley Irrigation District (PVID). Reclamation maintains oversight responsibilities for this work. Water that is physically stored in the reservoir is native to the Rio Grande Basin. San Juan-Chama water is released from Heron Reservoir to the river to offset depletions of native water as a result of reservoir operations at Nambò Falls Dam as described in the corresponding contract between the United States and the PVID (Contract #: 14-06-500-1986; 1972) which references PL 87-483 and in compliance with the Rio Grande Compact. Generally, three or four releases are made per year from Heron Reservoir to benefit the Rio Grande. Thus, the annual flow readings at the Otowi Gage on the mainstem of the Rio Grande effectively include the natural tributary input from the Rio Nambò. Reclamation does have some discretion over the timing of the releases.

Proposed Action

Reclamation releases water from Heron Reservoir to offset storage effects at Nambò Falls Reservoir. Reclamation has some discretion over the timing of the releases within the following hydrological constraints:

› Water is released in compliance with the Rio Grande Compact and in conjunction with other San Juan-Chama Project water management.

<u>Middle Rio Grande Project</u>

Built originally by the MRGCD in the 1930s, Middle Rio Grande irrigation structures are used to divert water and deliver it to MRGCD customers˜ lands, including 21,664 acres of Indian water right lands within MRGCD˜s service area. The Department of the Interior determined that the United States obtained title to all of the Middle Rio Grande Project works, as anticipated by a 1947 Project Plan approved by Federal legislation and a subsequent 1951 contract between Reclamation and MRGCD. The MRGCD operates the Cochiti heading and Angostura, Isleta, and San Acacia diversion dams as ™transferred worksš under the 1951 contract. According to the 1951 contract between Reclamation and the MRGCD, the MRGCD acts as the United States˜ agent when it operates those works. Reclamation currently operates El Vado Dam and Reservoir as ™reserved works.š

Also under the 1951 contract, Reclamation retained discretion to take back operation and maintenance of transferred works upon notice to the MRGCD. Reclamation did not, however, retain discretion over the day-to-day operations decisions at the facilities. Reclamation proposes to allow the MRGCD to continue to operate and maintain the transferred works and to continue to operate the reserved works consistent with current agreements. Because the MRGCD acts as the United States˜ agent at transferred works (Cochiti heading, Angostura, Isleta, San Acacia), and because Reclamation retains discretion to operate and maintain the facilities itself or to allow the MRGCD to operate and maintain the facilities, Reclamation is consulting over the broad parameters of use of those facilities and on the effects of that use on listed species, to ensure that its agent acts within the bounds of Federal law and within the scope of its conferred authority.

The release from storage, delivery of, and diversion of water for the six Middle Rio Grande Pueblos is also part of this proposed action. This water will be delivered primarily through Middle Rio Grande Project facilities. Reclamation will continue its operations, consistent with current agreements, to store water in El Vado Reservoir to ensure delivery of water to the six Middle Rio Grande Pueblos as allowed by the Rio Grande Compact. With Article VII Rio Grande Compact restrictions in place, only water for the six Middle Rio Grande Pueblos and San Juan-Chama water will be stored at El Vado Reservoir. At times, such operations will lead to flows on the Rio Chama well outside the recommendations of the Rio Chama Instream Flow Assessment, and it is likely that releases below El Vado Dam could cease completely on occasion to ensure such storage.

Storage of native Rio Grande flows described herein will be done consistent with the prior appropriation doctrine in New Mexico, therefore, any flows necessary to meet downstream senior flow rights will be bypassed for those needs. Reclamation will work with the State of New Mexico in determination of any such downstream senior flow rights and will adjust El Vado operations appropriately.

El Vado Dam and Reservoir

Reclamation operates El Vado Dam and Reservoir to meet the purposes of the 1951 contract and to insure the Pueblos˜ water rights. According to the 1951 contract and the State permits, the water in El Vado Reservoir is ™for beneficial use in the project and for Indian lands in the project area, and which shall be held primarily for domestic, irrigation, and municipal use in the project and for Indian land in the project . . .š

Proposed Action: Operate and maintain El Vado Dam and Reservoir within the following hydrological constraints:

- Meet water user delivery requirements and MRGCD calls for water when available.
- Maintain safe storage elevation no higher than 6896.20' by June 1, except under specific exceptions that consider flood routing criteria, water surface elevation, and river flow in the middle valley.
- Exercise United States˜ right to store natural flows as needed for the six Middle Rio Grande Pueblos to the extent water is available, and for the MRGCD when Article VII of the Rio Grande Compact is not in effect and to the extent water is available.
- Exercise United States˜ storage right to store San Juan-Chama water, if requested by the MRGCD if allowed under the Compact.
- Store when available and release water for the six Middle Rio Grande Pueblos.

Diversion Dams

MRGCD built Cochiti, Isleta, San Acacia, and Angostura diversion dams in the 1930s. (Note: The MRGCD constructed the Isleta Diversion Dam on Pueblo of Isleta lands). Pursuant to the Middle Rio Grande Project authorization, Reclamation rehabilitated Isleta Diversion Dam in 1955, San Acacia Diversion Dam in 1957, and Angostura in 1958. Cochiti Diversion Dam was inundated by Cochiti Dam and its outlet works in 1975. The Sile and Cochiti Eastside Canal collectively make up the Cochiti Heading, which takes water directly out of the upper stilling basin of the Cochiti Dam outlet works.

Proposed Action: Allow the MRGCD to continue to operate and maintain diversion dams as agent of United States.

- Water for the six Middle Rio Grande Pueblos will be delivered primarily through Middle Rio Grande Project facilities.

Low Flow Conveyance Channel

Reclamation may perform some operations associated with the Low Flow Conveyance Channel (LFCC) in conjunction with its supplemental water management program. In response to drought conditions in 1996, Reclamation began operating an outfall from the LFCC to the river near Escondida, New Mexico to return about 10 cfs to the Rio Grande. This outfall will continue to be used, as needed, to augment Rio Grande flow.

The only other water operation action that Reclamation currently performs on the LFCC is in response to requests by the MRGCD or the Refuge to check up flows in the channel at existing check structures, thus increasing the head on the water so that diversions by the MRGCD and the Refuge from the LFCC are more easily made. Requests for check structure gate adjustments by the MRGCD, for example, occur infrequently, about one to three times during an irrigation season.

Proposed Actions: In response to requests by the MRGCD and the Refuge, adjust gates in existing check structures to increase the head on the water in the LFCC. Maintain the LFCC temporary outfall and other potential returns to the river.

River Maintenance Program

River maintenance analyses include the Rio Grande from Velarde, New Mexico to Caballo Reservoir, with the exception of the reach from Otowi to Cochiti Dam. At the Otowi gage, the Rio Grande enters White Rock Canyon. This reach includes not only the deep narrow canyon, but also Cochiti Lake, a flood control facility operated by the Corps. No future river maintenance activities are expected to occur within this reach.

Reclamation has authority for maintenance of the river channel for the Middle Rio Grande Project from Velarde to Caballo Dam authorized under the Flood Control Acts of 1948 and 1950. The goals of Reclamation˜s river maintenance program for the Project are to:

› Conserve surface water in the Rio Grande Basin;
› Provide for the effective transport of water and sediment to Elephant Butte Reservoir;
› Protect certain riverside structures and facilities;
› Reduce the rate of aggradation (i.e., bed raising through sediment accumulation) in the Rio Grande in the San Marcial area and headwaters of Elephant Butte Reservoir; and

› Reduce the rate of channel degradation (i.e., channel bed lowering due to reduced sediment load) from Cochiti Dam south to Escondida, New Mexico.

Through the river maintenance planning process, Reclamation evaluates a wide range of alternatives to determine the best combination of activities that provide for the effective transport of water and sediment and the protection of riverside facilities. The activities must also be compatible with Rio Grande geomorphology to the maximum extent possible. Reclamation is also currently in the process of evaluating both in the laboratory and through field scale testing, various river bioengineering technologies (as described in Reclamation˜s biological assessment) to meet the previously mentioned objectives.

Appendix C contains a detailed description of the river maintenance program, updated from the June 2001 biological assessment, including related activities such as river maintenance techniques, bioengineering, sediment removal, vegetation management, levee maintenance, and reach-specific activities. It is also anticipated that this consultation will significantly reduce consultation efforts for future river maintenance projects. The Coordination Process subsection in the 2001 assessment is incorporated by reference and outlines infomation and reports that will be developed as a part of the aforementioned coordination process and an environmental compliance document that will summarize activities associated with a project and document that the project falls within the sideboards established in this consultation. This streamlined process for specific projects should reduce the workload and time needed for future ESA compliance on river maintenance activities. Some activities that are defined and analyzed in the assessment with sufficient detail may not require future consultation. Projects that include significant actions not considered in this assessment or potential adverse impacts to federally listed species will be consulted on separately. However, it is anticipated that the majority of river maintenance projects would fall within the sideboards established by the programmatic assessment.

Proposed Action: Maintenance of the river channel for the Middle Rio Grande Project from Velarde to Caballo Dam.

Annual Operating Plan

Each year, Reclamation, in cooperation with the Corps, prepares and distributes to interested parties an Annual Operating Plan (AOP) to address water operations in the Rio Grande Basin, including operations related to the San Juan-Chama and Middle Rio Grande Projects, and compliance with the Rio Grande Compact. The AOP addresses water operations in the Rio Grande Basin including operations related to San Juan-Chama, Middle Rio Grande Project, and compliance with the Rio Grande Compact. This document contains stream flow forecasts, including snowmelt runoff forecasts, anticipated operations outlooks for the various Reclamation and Corps-operated facilities along the river, and hydrographs reflecting reservoir operations, including actual (to the date of the plan˜s publication) and anticipated inflow, outflow, and storage. Much of the planning information in the report is developed through the coordination, cooperation, and agreement of various parties. The agencies provide monthly updates, informing interested parties of operations throughout the course of the water year.

The AOP process was described in detail on pages 46-47 in the 2001 biological assessment (Reclamation, 2001). This assessment incorporates the AOP process described therein by reference.

Proposed Action: The AOP process is an integral component of all of the aforementioned Federal and non-Federal water operations and should be considered as part of the collective action described in this assessment.

Adaptive Management and Monitoring

Reclamation is committed to applying the concepts of adaptive management to all of the proposed Federal actions described in this programmatic biological assessment. The general framework for adaptive management applications follows the scientific perspective of managing in the face of uncertainty. These underlying premises of adaptive resource management are:

› There is uncertainty in the systems we manage,
› Management is necessary despite existing uncertainty,
› Monitoring is required to evaluate decision making, and
› Learning is important to the extent that it helps managers achieve their objectives.

This approach is especially relevant to the issues facing water managers on the Middle Rio Grande. Reclamation will continue to attempt to develop meaningful management goals with involvement of all stakeholders in the Middle Rio Grande and attempt to implement and monitor actions related to those goals. Finally, based partly on the results of monitoring and research, Reclamation will use adaptive management principles to adjust future actions within the sideboards set forth in this document to benefit all resources.

Program monitoring is necessary to determine whether management actions have placed natural resources on a trajectory towards agreed-upon desired future conditions. Assessments of management programs also help to reveal information deficits and technical problems that directed research may be able to rectify. Likewise, program monitoring and evaluation, when focused on problem identification, can reveal limiting factors that underlie animal communities that fail to achieve their full potential. Finally, monitoring and evaluation of contemporaneous dynamic variables is required to adapt management practices to new circumstances. Without monitoring, innovation is discouraged, new knowledge is applied too slowly, and inefficiencies persist to the detriment of natural resources and the public.

For over a decade, Reclamation has been involved in biological, hydrological and geomorphic monitoring in the Middle Rio Grande to support project activities. A general monitoring plan was developed in 1997, and later updated that encompasses activities for biological studies and geomorphic and hydrological assessment to support both water operations and river maintenance activities and ensure water management goals are being achieved. Biological studies include regular fish population monitoring at about 16 sites below Cochiti Dam and flycatcher presence/absence surveys and nest monitoring. Winter bald eagle surveys will continue near the headwaters of Elephant Butte Reservoir. Reclamation and the Service will cooperatively monitor discharge at critical river locations to ensure that management goals are being achieved. Based in part on the results of these and other monitoring efforts, Reclamation will use adaptive management principles to adjust future actions within the sideboards set forth in this document to maximize benefits to all resources.

Environmental Commitments

The following are species-specific, general environmental commitments from completed or early consultations:

Southwestern Willow Flycatcher

› Construction disturbance will be avoided near occupied and known flycatcher territories from April 15 through August 15. A predetermined, standard-setting buffer distance around flycatcher territories has not been established; instead, such buffer zones will be defined on a case-by-case basis (Reclamation 2001).

› Future project sites with occupied or suitable habitat shall be surveyed for at least one breeding season prior to the start of any project activities. If flycatchers are detected within the boundaries of proposed projects, consultations will be initiated with the Service. It is Reclamation˜s intent to use the principles of adaptive management and monitor project sites sufficiently to accumulate the necessary data and information for future decision-making (Reclamation 2001).

› Reclamation will minimize the number of new transects that are cleared in conjunction with river surveying activities. As referenced in the 2001 biological assessment, the collection and use of hydrographic data from transects provides for better management of the Middle Rio Grande floodplain and river channel. Transect clearing or maintenance will not occur in occupied habitat. Out-of-use transects will be allowed to revegetate. Brushing will occur only when necessary for project purposes. In the event that transect brushing is necessary, brushing or surveys during the breeding period (April 15 through August 15) shall be avoided to minimize disturbance. Suitable or potential flycatcher habitat can also be avoided in certain cases by limiting brushing to the river˜s edge and not clearing beyond that point. All sites proposed for transect clearing will be reviewed by Reclamation biologists. If the site is determined not to have suitable or potential flycatcher habitat, transect clearing will proceed under the above conditions (Reclamation 2001).

› By restoring the active river channel through sediment plug management in the San Marcial Reach, Reclamation˜s river maintenance program helps to prevent prolonged, detrimental inundation of riparian and flycatcher habitat.

Rio Grande Silvery Minnow

› Reclamation will continue to conduct fish population monitoring at established locations in the Middle Rio Grande between Angostura Diversion Dam and the headwaters of Elephant Butte Reservoir. Pre- and post-construction fish monitoring will continue at constructed and proposed river maintenance sites through the Middle Rio Grande (Reclamation 2001).

› If it is necessary to redirect flows away from a construction site, steps will be taken to allow flows to recede from the area gradually so silvery minnows can avoid entrapment. Any disconnected aquatic habitat, e.g., isolated pools, associated with a river maintenance site will be sampled for silvery minnows, which, if found, will be relocated into adjacent areas of flowing water (Reclamation 2001).

› Construction activities requiring the movement of equipment within the river channel will avoid potential silvery minnow habitat to the extent possible. Work will be done in xeric conditions when feasible to minimize direct impacts of construction activities to silvery minnows. While many of the proposed habitat enhancement activities involve extensive construction activity in or near the river channel (to avoid disturbance to native riparian vegetation, for example), disturbance to the aquatic environment will be minimized (Reclamation 2001).

II. Status of the Species

Rio Grande Silvery Minnow

Species Description

The silvery minnow was federally listed as endangered under the ESA on July 20, 1994 (Service 1994). The species is listed by the State of New Mexico as an endangered species. Primary reasons for listing the silvery minnow involved a number of factors, described in the Status and

Distribution section, that contributed to a collapse of population numbers throughout its historic range. The final recovery plan for the silvery minnow was released in July 1999 (Service 1999c). The primary objectives are to increase numbers of the silvery minnow, enhance its habitat in the Middle Rio Grande valley, and expand its range by reestablishing the species in at least three other areas in its historic range.

The silvery minnow is a stout minnow, with moderately small eyes, a small, subterminal mouth, and a pointed snout that projects beyond the upper lip (Sublette *et al.* 1990). The back and upper sides of the silvery minnow are silvery to olive, the broad mid-dorsal stripe is greenish, and the lower sides and abdomen are silver. Maximum length attained is about 3.5 inches (90 mm). The only readily apparent sexual dimorphism is the expanded body cavity of ripe females during spawning (Bestgen and Propst 1994).

The silvery minnow has had an unstable taxonomic history, and in the past was included with other species of the genus *Hybognathus* due to morphological similarities. Phenetic and phylogenetic analyses corroborate the hypothesis that it is a valid taxon, distinctive from other species of *Hybognathus* (Cook *et. al.* 1992, Bestgen and Propst 1994). It is now recognized as one of seven species in the genus *Hybognathus* in the United States and was formerly one of the most widespread and abundant minnow species in the Rio Grande basin of New Mexico, Texas, and Mexico (Pflieger 1980, Bestgen and Platania 1991). Currently, *Hybognathus amarus* is the only remaining endemic pelagic spawning minnow in the Middle Rio Grande. The speckled chub (*Extrarius aestivalus*), Rio Grande shiner (*Notropis jemezanus*), phantom shiner (*Notropis orca*), and bluntnose shiner (*Notropis simus simus*) have gone extinct or have been extirpated from the Middle Rio Grande (New Mexico Department of Game and Fish 1998b, Bestgen and Platania 1991). The other four pelagic spawning endemic minnow species have been extirpated from the Middle Rio Grande (Dudley and Platania 1997).

Critical Habitat

Critical habitat was proposed for the silvery minnow on June 6, 2002 (67 FR 39205) and was finalized on February 19, 2003 (68 FR 8088). The critical habitat designation extends 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, a total of approximately 157 mi (252 km). Although the final rule designates the Jemez River from Jemez Canyon Dam in New Mexico to the upstream boundary of Santa Ana Pueblo as part of the critical habitat designation, a correction notice has been drafted for publication in the Federal Register to remove this reach from the designation. As discussed in the final rule the Pueblo of Santa Ana was excluded from the critical habitat designation and it has been determined that the Jemez river below Jemez Canyon Dam is owned by the Pueblo of Santa Ana. The critical habitat designation defines the lateral extent (width) as those areas bounded by existing levees or, in areas without levees, 300 feet (ft) (91.4 meters (m)) of riparian zone adjacent to each side of the bankfull stage of the Middle Rio Grande. 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 areas, the final 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).

Some developed lands within the 300-ft (91.4-m) lateral extent are not considered critical habitat because they do not contain the primary constituent elements and they are not essential to the conservation of the silvery minnow. Lands located within the exterior boundaries of the critical habitat designation, but not considered critical habitat, include: developed flood control facilities; existing paved roads; bridges; parking lots; dikes; levees; diversion structures; railroad tracks; railroad trestles; water diversion and irrigation canals outside of natural stream channels; the LFCC; active gravel pits; cultivated agricultural land; and residential, commercial, and industrial developments. These developed areas do not contain any of the primary constituent elements and do not provide habitat or biological features essential to the conservation of the silvery minnow.

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

1. A hydrologic regime that provides sufficient flowing water with low to moderate currents capable of forming and maintaining a diversity of aquatic habitats, such as, but not limited to the following: backwaters (a body of water connected to the main channel, but with no appreciable flow), shallow side channels, pools (that portion of the river that is deep with relatively little velocity compared to the rest of the channel), eddies (a pool with water moving opposite to that in the river channel), and runs (flowing water in the river channel without obstructions) of varying depth and velocity œ 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 a 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 ^{o}C (35 ^{o}F) and less than 30 ^{o}C (85 ^{o}F) and reduce degraded conditions (e.g., decreased dissolved oxygen, increased pH).

The primary constituent elements identified above provide for the physiological, behavioral, and ecological requirements of the silvery minnow. The first primary constituent element provides water of sufficient flows to reduce the formation of isolated pools. We conclude this element is essential to the conservation of the silvery minnow because the species cannot withstand permanent drying (loss of surface flow) of long stretches of river. Water is a necessary component for all silvery minnow life-history stages and provides for hydrologic connectivity to facilitate fish movement. The second primary constituent element provides habitat necessary for development and hatching of eggs and the survival of the silvery minnow from larvae to adult. Low-velocity habitat provides food, shelter, and sites for nursery habitat, which are essential for the survival and recruitment of silvery minnows (68 FR 8008). The third primary constituent element provides appropriate silt and sand substrates (Dudley and Platania 1997; Remshardt *et al.* 2001), which we believe are important in creating and maintaining appropriate habitat and life requisites such as food and cover. The final primary constituent element provides protection from degraded water quality conditions. We conclude that when water quality conditions degrade (e.g., water temperatures are too high, pH levels are too high, and dissolved oxygen concentrations are too low), silvery minnows will likely be injured or die.

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

Life History

The silvery minnow travels in schools and tolerates a wide range of habitats (Sublette *et al.* 1990), but generally prefers low velocity (< 0.33 feet per second, 10 centimeters/second [cm/sec]) areas over silt or sand substrate that are associated with shallow (< 15.8 inches [40 cm]) braided runs, backwaters or pools (Dudley and Platania 1997). Adults 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 (Dudley and Platania 1997). Dudley and Platania (1997) reported that this fish species was most commonly found in habitats with depths less than 19.7 inches (50 cm). Over 85 percent were collected from low velocity habitats (< 0.33 feet/sec [10 cm/sec]) (Dudley and Platania 1997, Watts *et al.* 2002). Habitat for the silvery minnow includes stream margins, side channels, and off-channel pools where water velocities are low or reduced from main-channel velocities. Stream reaches dominated by straight, narrow, incised channels with rapid flows are not typically occupied by the silvery minnow (Sublette *et. al.* 1990, Bestgen and Platania 1991).

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event (Platania 1995, Platania and Altenbach 1996). Adults spawn in about a one-month period in late spring to early summer (May to June) in response to 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. It is unknown if individual silvery minnows spawn more than once a year or if some minnows spawn earlier and some minnows spawn later in the year. An artificial flow spike of 1,800 cfs (51 cubic meters/second) for 24 hours was released from Cochiti Dam on May 19, 1996. This flow spike apparently stimulated a spawning event and resulted in the collection of 49 silvery minnow eggs by researchers at Albuquerque on May 22, the day after the spike passed (Platania and Hoagstrom 1996). A late spawn was documented in the Isleta and San Acacia Reaches on July 24, 25, and 26, 2002, following a high flow event produced by a thunderstorm. This spawn was smaller than the typical spawning event in May, but a significant number of eggs were collected (N = 496) in two hours of effort (J. Smith, Service, *pers. comm.* 2002). In 2002, small spawning events of a few eggs have been documented in all reaches except the Cochiti Reach as late as August 7 (J. Smith, Service, *pers. comm.* 2002).

Platania (2000) found that development and hatching of eggs are correlated with water temperature. Eggs of the silvery minnow raised in 30^{1} C water hatched in about 24 hours while eggs reared in 20 œ 24^{1}C water hatched within 50 hours. Eggs were 0.06 inches (1.6 millimeters [mm]) in size upon fertilization, but quickly swelled to 0.12 inches (3 mm). Recently hatched larval fish are about 0.15 inches (3.7 mm) in standard length and grow about 0.005 inches (0.15 mm) in size per day during the larval stages. Eggs and larvae have been estimated to remain in the drift for 3 œ5 days, and could be transported from 134 to 223 miles (216 to 359 km) downstream depending on river flows. About three days after hatching the larvae move to low velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce. Young-of-year attain lengths of 1.5 to 1.6 inches (39 to 41 mm) by late autumn (Service 1999). Age 1 fish are 1.8 to 1.9 inches (45 to 49 mm) by the start of the spawning season. Most growth occurs between June (post spawning) and October, but there is some growth in the winter months. In the wild, maximum longevity is about 25 months, but very few survive more than 13 months (Service 1999). Captive fish have lived until Age 4 (C. Altenbach, City, *pers. comm.* 2003).

Platania (1995) suggested that historically the downstream transport of eggs and larvae of the silvery minnow over long distances was likely beneficial to the survival of their populations. This behavior may have promoted recolonization of reaches impacted during periods of natural drought (Platania 1995). The spawning strategy of releasing floating eggs allows the silvery minnow to replenish populations downstream, but the current presence of diversion dams (Angostura, Isleta, and San Acacia Diversion Dams) prevents recolonization of upstream habitats

(Platania 1995). As populations are depleted upstream, and diversion structures prevent upstream movements, isolated extirpations of the species through fragmentation may occur (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 (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, (Service 1999)).

Population Dynamics

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

Platania (1995) found that a single female in captivity could broadcast 3,000 eggs in eight hours. Females produce 3 to 18 clutches of eggs in a 12-hour period. The mean number of eggs in a clutch is approximately 270 (Platania and Altenbach 1996). In captivity, silvery minnows have been induced to spawn as many as four times in a year (C. Altenbach, City, *pers. comm.* 2000). It is not known if they spawn multiple times in the wild. The high reproductive potential of this fish appears to be one of the primary reasons that it has not been extirpated from the Middle Rio Grande. However, the short life span of the silvery minnow increases the population instability. When two below-average flow years occur consecutively, a short-lived species such as the silvery minnow can be impacted, if not completely eliminated from the dry reaches of the river (Service 1999)

Density of silvery minnows increases from upstream (Angostura Reach) to downstream (San Acacia Reach). This is a result of the silvery minnow eggs and larvae being carried downstream in the current and the inability of the adults to repopulate upstream reaches because the diversion dams are barriers. This distributional pattern has been observed since 1994 (Dudley and Platania 2002) (Appendix D, Figure 3). In the Angostura Reach, catch rates indicated that silvery minnows were more widely distributed in 2001 and 2002, as compared to 1999 and 2000. These results may be due to salvage operations in which silvery minnows were moved to the Angostura Reach from areas that were drying in the Isleta and San Acacia Reaches. The silvery minnow population has been declining since 1986, and has dropped precipitously since 1999 (Dudley and Platania 2002) (Appendix D, Figure 2). There was a slight increase in the number of silvery minnows caught in 2001; however, catch rate declined again in 2002. Drying of the Rio Grande has led to extensive losses of silvery minnows, especially in the San Acacia Reach where they were once most abundant (Dudley and Platania 2002) (Appendix D, Figure 3, Figure 4). The effect of river drying is evident in the months of June and July, 2002. In June, an abnormally high catch rate occurred because fish were trapped in small, isolated pools that were easy to seine. By July these pools were dry and no fish were present at these sites. The total number of fish caught for the remainder of 2002 remained low. In October, November, and December 2002, a total of 11, 36, and 15 silvery minnows, respectively, were caught from the 20 sites that are sampled regularly. The total area seined in these months ranged from 13,248 m^2 (3.3 acres) to 14,205 m^2 (3.5 acres) (calculated from data present on website http://www.uc.usbr.gov/progact/rg/rgsm2002/).

Although only limited data are available it appears that natural recruitment and survival of YOY in 2002 was poor when compared to 2000 and 2001. From August 27 to 30, 2002, a total of 14 silvery minnow YOY were caught from 20 sites. For the same time period in August 2001, 714 silvery minnow YOY were caught from 19 sites. In 2000, 206 YOY were caught in early August from 15 sites and 31 YOY were caught from 13 sites in late August (calculated from data present on website http://www.uc.usbr.gov/progact/rg/rgsm2002/). The number of YOY caught in October of 2000, 2001, and 2002 were 74, 112, and 7, respectively (calculated from data present on website http://www.uc.usbr.gov/progact/rg/rgsm2002/). Numbers of YOY from the October sampling period represent those fish that survived through the summer and are likely to contribute to the spawning population in the spring. These numbers indicate that the number of wild (not hatchery raised) silvery minnows available for spawning in 2003, may be low.

Status and Distribution

Historically, the silvery minnow occurred in 2465 mi (3967 km) of rivers in New Mexico and Texas. They were known to have occurred from Espaúola 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 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 and flycatcher by reducing the magnitude and frequency of flooding events that help to create and maintain habitat for both of the species. In addition, the construction of Cochiti Dam has resulted in changes to the degradation of silvery minnow habitat within the Cochiti Reach. Flow in the river at Cochiti Dam is now generally clear, cool, and free of sediment. There is relatively little channel braiding, and areas with reduced velocity and sand or silt substrates are uncommon. Substrate immediately downstream of the dam is often armored cobble (rounded rock fragments generally 8 to 30 cm (3 to 12 inches) in diameter). Further downstream the riverbed is gravel with some sand material. Ephemeral tributaries including

Galisteo Creek and Tonque Arroyo introduce sediment to the lower sections of this reach, and some of this is transported downstream with higher flows (Service 2001b; 1999). Recovering from the degradation imposed by Cochiti Dam, the Rio Grande gains sediment below Angostura Dam and becomes a predominately sand bed river with low, sandy banks in the downstream portion of the reach. The construction of Cochiti Dam also created a barrier between silvery minnow populations. As recently as 1978, the silvery minnow was collected upstream of Cochiti Lake; however surveys since 1983 suggest that the fish is now extirpated from this area (Service 1999).

Surveys indicate a continued decline of silvery minnows in the entire Middle Rio Grande (Bestgen and Platania 1991, Platania 1993, Platania and Dudley 1997, Dudley and Platania 2002). In 1997, it was estimated that 70 percent of the silvery minnow population was found in the reach below San Acacia Diversion Dam (Dudley and Platania 1997). During surveys in 1999, over 98 percent of the silvery minnows captured were downstream of San Acacia Diversion Dam (Dudley and Platania 2002). This area represents 2.4 percent of the historical range. Surveys indicate a dramatic decline in the number of silvery minnows in this reach (Dudley and Platania 2002) (Appendix D, Figure 3, Figure 4). Although the San Acacia Reach still has the greatest number of fish caught in surveys, because of the marked decline in numbers caught in this lower reach in the past few years, the percent of the population found here currently is only slightly above the Isleta and Angostura Reaches. The reasons why more silvery minnows are typically caught in the San Acacia Reach are:

1. The species˜ reproductive strategy (buoyant eggs spawned during the spring and early summer high flows), resulting in downstream transport of eggs and larval fish;

2. Diversion dams that prevent the movement of mature fish into upstream reaches; and

3. Reduction in the amount of available habitat in the upstream reaches due to streambed degradation, reduction in side-channel habitat, and the narrowing and incising of the stream channel.

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 streamflow 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 (Service 1993b, 1994).

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

<u>Southwestern Willow Flycatcher</u>

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

<u>Species Description</u>

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

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

Listing and Critical Habitat

The flycatcher was listed as endangered without critical habitat designation on February 27, 1995 (Service 1995). Critical habitat was designated on July 22, 1997 (Service 1997a). A correction notice was published in the Federal Register on August 20, 1997, to clarify the lateral extent of the designation (Service 1997b). On May 11, 2001, the 10th Circuit Court of Appeals set aside designated critical habitat for the flycatcher. On May 2, 2002, the Service sent out a scoping letter to over 800 interested parties requesting information in order to develop a new critical habitat proposal.

A final recovery plan for the flycatcher was signed by the Service˜s Southwest Region Director on August 30, 2002, and is expected to be available to the public in early 2003. The Recovery Plan describes the reasons for endangerment, current status of the flycatcher, addresses important recovery actions, includes detailed papers on management issues, and provides recovery goals.

Reasons for Endangerment

Declining flycatcher numbers have been attributed to loss, modification, and fragmentation of riparian breeding habitat, loss of wintering habitat, and brood parasitism by the brown-headed cowbird (Sogge *et al.* 1997, McCarthey *et al.* 1998). Habitat loss and degradation are caused by a variety of factors, including urban, recreational, and agricultural development; water diversion and groundwater pumping; channelization; dams; and livestock grazing. Fire is an increasing threat to willow flycatcher habitat (Paxton *et al.* 1997), especially in monotypic saltcedar vegetation (DeLoach 1991) and where water diversions and/or groundwater pumping desiccates riparian vegetation (Sogge *et al.* 1997). Flycatcher nests are parasitized by brown-headed cowbirds (*Molothrus ater*), which lay their eggs in the flycatcher nests. Feeding sites for cowbirds are enhanced by the presence of livestock and range improvements such as waters and corrals, agriculture, urban areas, golf courses, bird feeders, and trash areas. When these feeding areas are in close proximity to flycatcher breeding habitat, especially coupled with habitat fragmentation, cowbird parasitism of flycatcher nests may increase (Hanna 1928; Mayfield 1977a,b; Tibbitts *et al.* 1994).

Habitat

The flycatcher breeds in dense riparian habitats from sea level in California to approximately 8,500 feet in Arizona and southwestern Colorado. Historic egg/nest collections and species' descriptions throughout its range describe the flycatcher's widespread use of willow (*Salix* spp.) for nesting (Phillips 1948, Phillips *et al.* 1964, Hubbard 1987, Unitt 1987, T. Huels *in litt.* 1993, San Diego Natural History Museum 1995). Currently, flycatchers primarily use Geyer willow, Gooddingˇs willow, boxelder (*Acer negundo*), saltcedar (*Tamarix* sp.), Russian olive (*Elaeagnus angustifolio*), and live oak (*Quercus agrifolia*) for nesting. Other plant species less commonly used for nesting include: Buttonbush (*Cephalanthus* sp.), black twinberry (*Lonicera involucrata*), cottonwood (*Populus* spp.), white alder (*Alnus rhombifolia*), blackberry (*Rubus ursinus*), and stinging nettle (*Urtica* spp.). Based on diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the flycatcher: Monotypic willow, monotypic exotic, native broadleaf dominated, and mixed native/exotic (Sogge *et al.*1997).

Saltcedar is an important component of the flycatchersˇs nesting and foraging habitat in Arizona and other parts of the birdˇs range. In 2001 in Arizona, 323 of the 404 (80 percent) known flycatcher nests (in 346 territories) were built in a saltcedar tree (Smith *et al.* 2002). Along the Rio Grande in New Mexico, between 1999œ2001, only about 12 percent of territories (n = 138) were found in vegetation dominated by saltcedar. However, almost half of all the nests found from 1999œ2002 (n = 156) were in saltcedar (Reclamation 2003). Although the quality of saltcedar as nesting habitat for flycatchers has been debated, comparisons of reproductive performance (Service 2002a) and physiological conditions (Owen and Sogge 2002) of flycatchers breeding in native and exotic vegetation has revealed no difference.

Open water, cienegas, marshy seeps, or saturated soil are typically in the vicinity of flycatcher territories and nests; flycatchers sometimes nest in areas where nesting substrates are in standing water (Maynard 1995; Sferra *et al.* 1995, 1997). However, hydrological conditions at a particular site can vary remarkably in the arid Southwest within a season and among years. At some locations, particularly during drier years, water or saturated soil is only present early in the breeding season (i.e., May and part of June). The complete absence of water or visibly saturated soil has been documented at several flycatcher sites where the river channel has been modified (e.g., creation of pilot channels), where modification of subsurface flows has occurred (e.g., agricultural runoff), or as a result of changes in river channel configuration after flood events (Spencer *et al.* 1996).

Flycatcher habitat can quickly change and vary in suitability, location, and occupancy over time (Finch and Stoleson 2000). Flycatcher nesting habitat comprised of willows can grow out of suitability; saltcedar habitat can develop from seeds to suitability in five years; heavy runoff can remove or reduce habitat suitability in a day; and river channels, floodplain width, location, and vegetation density may change over time. The development of flycatcher habitat is a dynamic process involving, maintenance, recycling, and regeneration of habitat. Due to its dynamic and cyclic nature, flycatcher ™habitatš is often defined as either suitable or potential (Service 2002a). Thus, areas other than occupied locations can be considered flycatcher ™habitatš and are essential to the survival and recovery of the flycatcher (Service 2002a).

Breeding Biology

Throughout its range the flycatcher arrives on breeding grounds in late April and May (Sogge and Tibbitts 1992; Sogge *et al.* 1993; Muiznieks *et al.* 1994; Sogge and Tibbitts 1994; Maynard 1995; Sferra *et al.* 1995, 1997). Nesting begins in late May to early June and young fledge from late June through mid-August (Willard 1912; Ligon 1961; Brown 1988a,b; Whitfield 1990; Sogge and Tibbitts 1992; Sogge *et al.* 1993; Muiznieks *et al.* 1994; Whitfield 1994; Maynard 1995). Flycatchers typically lay three to four eggs per clutch (range = 1 œ 5). Eggs are laid at one-day intervals and are incubated by the female for approximately 12 days (Bent 1960, Walkinshaw 1966, McCabe 1991). Young fledge approximately 12 to 13 days after hatching (King 1955, Harrison 1979). Typically one brood is raised per year, but birds have been documented raising two broods during one season and re-nesting after a failure (Whitfield 1990, Sogge and Tibbitts 1992, Sogge *et al.* 1993, Sogge and Tibbitts 1994, Muiznieks *et al.* 1994, Whitfield 1994, Whitfield and Strong 1995). The entire breeding cycle, from egg laying to fledging, is approximately 28 days.

Flycatcher nests are fairly small (3.2 inches tall and wide) and are commonly placed in a shrub or tree. Nests are open cup structures, and are typically placed in the fork of a branch. Nests have been found against the trunk of a shrub or tree (in monotypic saltcedar and mixed native broadleaf/saltcedar habitats) and on limbs as far away from the trunk as 10.8 feet (Spencer *et al.* 1996). Typical nest placement is in the fork of small-diameter (e.g., 0.4 in), vertical or nearly vertical branches (Service 2002a). Occasionally, nests are placed in down-curving branches. Nest height varies considerably, from 1.6 to 60 feet, and may be related to height of nest plant, overall canopy height, and/or the height of the vegetation strata that contain small twigs and live growth. Most typically, nests are relatively low, 6.5 to 23 feet above ground. Flycatcher nests in box elder dominated habitats are highest at almost 60 feet (Service 2002a).

The flycatcher is an insectivore, foraging in dense shrub and tree vegetation along rivers, streams, and other wetlands. The bird typically perches on a branch and makes short direct flights, or sallies to capture flying insects. Drost *et al.* (1998) found the major prey items of the flycatcher (in Arizona and Colorado) consisted of true flies (Diptera); ants, bees, and wasps (Hymenoptera); and true bugs (Hemiptera). Other insect prey taxa included leafhoppers (Homoptera: Cicadellidae); dragonflies and damselflies (Odonata); and caterpillars (Lepidoptera larvae). Non-insect prey included spiders (Araneae), sowbugs (Isopoda), and fragments of plant material.

Brown-headed cowbird parasitism of flycatcher broods has been documented throughout its range (Brown 1988a,b; Whitfield 1990; Muiznieks *et al.* 1994; Whitfield 1994; Hull and Parker 1995;

Maynard 1995; Sferra *et al.* 1995; Sogge 1995b). Where studied, high rates of cowbird parasitism have coincided with flycatcher population declines (Whitfield 1994; Sogge 1995a,c; Whitfield and Strong 1995) or, at a minimum, resulted in reduced or complete nesting failure at a site for a particular year (Muiznieks *et al.* 1994; Whitfield 1994; Maynard 1995; Sferra *et al.* 1995; Sogge 1995a,c; Whitfield and Strong 1995). Cowbird eggs hatch earlier than those of many passerine hosts, thus giving cowbird nestlings a competitive advantage (Bent 1960; McGeen 1972; Mayfield 1977a,b; Brittingham and Temple 1983). Flycatchers can attempt to renest, but this often results in reduced clutch sizes, delayed fledging, and reduced nest success (Whitfield 1994). Whitfield and Strong (1995) found that flycatcher nestlings fledged after July 20, had a significantly lower recruitment rate; cowbird parasitism was often the cause of delayed fledging.

Territory Size

Flycatcher territory size likely fluctuates with population density, habitat quality, and nesting stage. Territories are established within a larger patch of appropriate habitat sufficient to contain several nesting pairs of flycatchers; flycatchers appear to be semi-colonial nesters. Estimated territory sizes are 0.59 to 3.21 acres for monogamous males and 2.72 to 5.68 acres for polygynous males at the Kern River (Whitfield and Enos 1996), 0.15 to 0.49 acres for birds in a 1.48 to 2.22 acre patch of habitat on the Colorado River (Sogge 1995c), and 0.49 to 1.24 acres in a 3.71 acre patch on the Verde River (Sogge 1995a).

Movements

The site and patch fidelity, dispersal, and movement behavior of adult, nestling, breeding, non-breeding, and migratory flycatchers are just beginning to be understood (Kenwood and Paxton 2001, Koronkiewicz and Sogge 2001). From 1997œ2000, 66 to 78 percent of flycatchers known to have survived from one breeding season to the next returned to the same breeding site and 22 to 34 percent of returning birds moved to different sites (Luff *et al.* 2000). In 2001, 75 percent of adults known to have survived from 2000 returned to the same breeding site (Kenwood and Paxton 2001). All but three surviving birds (n = 28) banded at Roosevelt Lake returned to the area the next year (Kenwood and Paxton 2001). Although flycatcher territory fidelity appears to be high, they can regularly move among sites within and between years (Kenwood and Paxton 2001). Within-drainage movements are more common than between-drainage movements (Kenwood and Paxton 2001). Year to year movements of birds have been detected between the San Pedro/Gila River confluence and Roosevelt Lake; the Verde River near Camp Verde and Roosevelt Lake; and the Little Colorado River near Greer and Roosevelt Lake (Kenwood and Paxton 2001). Typical distances moved range from 1.2 to 18 miles. However, long-distance movements of up to 137 miles have been observed on the lower Colorado River and Virgin River (McKernan and Braden 2001).

Rangewide Distribution and Abundance

Unitt (1987) documented the loss of more than 70 flycatcher breeding locations rangewide (peripheral and core drainages within its range), estimating the rangewide population at 500 to 1000 pairs. There are 221 known flycatcher breeding sites in California, Nevada, Arizona, Utah, New Mexico, and Colorado that were detected from 1993 œ2001. These include approximately 986 territories (Sogge *et al.* 2002, Service 2002a) (Appendix E, Table 1). It is difficult to calculate the flycatcher abundance since not all sites are surveyed annually. Also, sampling errors (e.g., incomplete survey effort, double-counting males/females, composite tabulation methodology, natural population fluctuation, and random events) may bias population estimates and it is likely that the total breeding population of flycatchers fluctuates from year to year. Numbers have increased since the bird was listed and some habitat remains unsurveyed. However, after nearly a decade of intensive surveys, the existing numbers are consistent with the upper end of Unitt˜s (1987) estimate.

Flycatchers are believed to function as a group of meta-populations and their survival and recovery are dependent on well distributed populations in close proximity (Service 2002a). Esler (2000) describes Levins˜ meta-population theory as addressing the demography of distinct populations (specifically extinction probabilities), interactions among sub-populations (dispersal and recolonization), and ultimately persistence of the aggregate of sub-populations, or the meta-population. Meta-population theory has been applied increasingly to species whose ranges have been fragmented. An incidence function analysis completed for the flycatcher incorporated a spatial component to estimate probabilities of habitat patch extinction and colonization (Lamberson *et al.* 2000). Modeling indicated that persistence of flycatcher populations is reduced when populations are small and widely distributed. Conversely, meta-populations are more stable when sub-populations are large and close together. However, where populations exceed 25 pairs, the effects of catastrophic events (e.g., fire, disease, flood, etc.) are magnified.

Rangewide, the population is comprised of extremely small, widely-separated breeding groups, including unmated individuals. About 40 to 50 percent of the 986 territories currently found throughout the subspecies range are located at three locations (Cliff/Gila Valley œNM, Roosevelt Lake œ AZ, San Pedro/Gila confluence œ AZ) (Appendix E, Table 1). In Arizona, 63 percent of the sites (n = 46) where flycatchers were found in 2001 (Smith *et al.* 2002) were comprised of 5 or fewer territories. In Arizona during the 2001 season, all but the ™Salt River Inflowš site at Roosevelt Lake had 20 pairs or less (Smith *et al.* 2002). Rangewide, 76 percent of all sites from 1993 to 2001 had 5 or less flycatcher territories present at the site (Sogge *et al.* 2002). Across the bird˜s range, there are fewer than six sites with greater than 50 territories (Sogge *et al.* 2002). The distribution of breeding groups is highly fragmented. For example, in New Mexico the flycatchers at Los Ojos on the Rio Chama are approximately 60 miles from the closest known site at San Juan Pueblo, and the Radium Springs site is approximately 70 miles south of the flycatchers at San Marcial.

The large distances between flycatcher breeding groups and small population sizes decrease stability and increase the risk of local extirpation due to stochastic events, predation, cowbird parasitism, and other factors (Service 2002a). Having 40 to 50 percent of the entire subspecies at just three locations could have dire effects on the species should catastrophic events occur that would remove or significantly reduce habitat suitability at those sites.

Additionally, flycatchers no longer occur at 65 of the 221 sites located and/or monitored rangewide since 1993 and all but two of these sites had less than 5 flycatcher territories present (Sogge *et al.* 2002). The two exceptions, PZ Ranch on San Pedro River (1996) and Colorado River Delta at Lake Mead (1996), were destroyed by fire and lake inundation, respectively.

New Mexico Distribution and Abundance

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

In New Mexico, surveys and monitoring since 1993 have documented approximately 173 to 400 flycatcher territories in 8 drainages (Appendix E, Table 2). Flycatchers have been observed at 34 sites along the Rio Grande, Chama, Canadian, Gila, San Francisco, San Juan, and Zuni drainages.

Within the Rio Grande, flycatchers were reported at Elephant Butte State Park in the 1970s; the majority nesting in saltcedar, although the exact location of the sightings was not reported (Hundertmark 1978, Hubbard 1987). In recent years, breeding pairs have been found within the Middle Rio Grande Project action area from Elephant Butte Reservoir upstream to the vicinity of Taos, on both the mainstem Rio Grande and on the Rio Grande de Rancho, a tributary to the upper Rio Grande. Breeding pairs have also been found on the Chama River in the vicinity of Los Ojos (Appendix E, Table 3).

______Arizona Distribution and Abundance

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

In 2001, 346 territories were known from 46 sites along 11 drainages in Arizona (Smith *et al.* 2002). The lowest elevation where territorial pairs were detected was 459 feet at Topock Marsh on the Lower Colorado River and the highest elevation was at the Greer River Reservoir (8202 feet).

As reported by Smith *et al.* (2002), the largest concentrations or breeding locations of willow flycatchers in Arizona in 2001 were at the Salt River and Tonto Creek inflows to Roosevelt Lake (255 flycatchers, 141 territories); near the San Pedro/Gila river confluence (219 flycatchers, 118 territories); Gila River, Safford area (46 flycatchers, 21 territories); Alamo Lake on the Bill Williams River (includes lower Santa Maria and Big Sandy river sites) (39 flycatchers, 21 territories); Topock Marsh on the Lower Colorado River (26 flycatchers, 14 territories); Lower Grand Canyon on the Colorado River (21 flycatchers, 12 territories); Big Sandy River Wikieup (14 flycatchers, 10 territories); and Alpine/Greer on the San Francisco River/Little Colorado River (5 flycatchers, 3 territories). The greatest number of flycatchers are found at two locations. Roosevelt Lake and the San Pedro/Gila confluence make up 259 (75 percent) of the 346 territories known in the state.

Only 68 (20 percent) of all known Arizona flycatcher territories in 2001 (40 on Gila River, 26 on Colorado River, 2 on Bill Williams River) were found below dams. Territories are primarily found on free-flowing streams or surrounding impoundments. At Roosevelt (n=141) and Alamo (n=21) lakes, due to the low reservoir levels, 162 territories (47 percent of statewide total) are found in the now dry lake bottom (Smith *et al.* 2002). Between 5 and 10 territories were discovered in 2002 in the conservation space of Horseshoe Reservoir on the Verde River (M. Ross, USFS, *pers. comm.* 2002).

Following the 1996 breeding season, 145 territories were known to exist in Arizona. In 2001, 346 territories were detected; a statewide increase of 201 territories. Although there was an increase in statewide numbers, some sites became unoccupied or had reductions in number of territories, other new sites were detected, some sites grew in numbers, and better surveys provided more comprehensive information on actual abundance (Sogge *et al.* 2002). Since 1995, the increase of 184 territories (75 to 259) at Roosevelt Lake and at the San Pedro/Gila River confluence represents almost 90 percent of the statewide growth. Survey effort was initially a factor in detecting more birds at the San Pedro/Gila river confluence, but the Roosevelt population grew as a result of increased habitat development and bird reproduction in the conservation pool of the reservoir.

In 2002, drying of habitat and the subsequent decline of habitat suitability at Roosevelt Lake and other locations in Arizona (possibly as result of prolonged drought and water management) resulted in reductions in productivity and possible increases in cowbird parasitism and predation (T. McCarthey, AGFD, *pers. comm.* 2002). The combined loss of habitat suitability and productivity with the potential future inundation of habitat at Roosevelt Lake could negatively impact the status of the flycatcher in Arizona and possibly throughout the subspecies range (E. Paxton, U.S. Geological Survey [USGS], *pers. comm.* 2002).

California Distribution and Abundance

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

Survey and monitoring efforts since the late 1980s have confirmed the flycatcher's presence at a minimum of 11 sites on 8 drainages in southern California (including the Colorado River). Current known flycatcher breeding sites are restricted to coastal southern California from Santa Barbara to San Diego, and California˜s Great Basin near the towns of Kernville, Bishop, Victorville, the San Bernardino Mountains and along the lower Colorado River. The largest populations exist along the San Luis Rey, Santa Margarita, Santa Ynez, and Kern and Owen˜s rivers. The total known flycatcher population in southern California is 256 territories (Sogge *et al.* 2002).

Texas Distribution and Abundance

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

Nevada Distribution and Abundance

Unitt (1987) documented three locations in Clark County from which flycatchers had been found prior to, but not after 1970. In 1998, two pairs of flycatchers were documented. Current survey efforts have documented breeding birds along the Amargosa, Pahranagat, Muddy, and Virgin Rivers (McKernan and Braden 1997, 1998) in southern Nevada.

Colorado Distribution and Abundance

In 2002, 23 flycatcher territories were located in the San Luis Valley of the Rio Grande. Preliminary data on song dialects suggest that the few birds recently documented in southwestern Colorado may be the southwestern willow flycatcher. Surveys since 1993 have documented flycatchers at six locations in Delta, Mesa, and San Miguel Counties.

______Utah Distribution and Abundance

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

Fire

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

Mortality

There are no extensive records for the actual cause of flycatcher mortality. Incidents associated with nest failures, human disturbance, and nestlings are typically the most often recorded due to the static location of nestlings, eggs, and nests. As a result, nestling predation and brood parasitism are the most commonly recorded causes of flycatcher mortality. Human destruction of nesting habitat through bulldozing, groundwater pumping, and aerial defoliants has been recorded in Arizona (T. McCarthey, AGFD, *pers. comm.* 2001) and New Mexico. Human collision with nests and spilling the eggs or young onto the ground have been documented near high use recreational areas (Service 2002a). A flycatcher from the Greer Town site along the Little Colorado River in eastern Arizona, was found dead after being hit by a vehicle along SR 373. This route is adjacent to the breeding site (T. McCarthey, AGFD, *pers. comm.* 2002).

Reproductive Success

In New Mexico, breeding success has been studied in the Gila River sites, and along the Rio Grande. In 2001, 133 nests were monitored in the Gila River near Gila-Cliff Valley, New Mexico. Data indicated that 34.4 percent of the nesting attempts were successful (Broadhead, *et al.*, 2002). Along the Rio Grande in 2002, 80 nests were monitored and success was 55 percent (Ahlers in prep.). In 2001, 45 nesting attempts were documented, and 73 percent of these were successful (Ahlers *et al.* 2002). In 2000, the nest success along the Rio Grande was 65 percent of 26 monitored nests (Ahlers *et al.* 2001). Nesting was usually initiated in May or early June, with the first eggs documented in the last week of May, and the latest egg laying in the last week of July (Reclamation 2003).

In 2001, a total of 426 nesting attempts were documented in Arizona at 40 sites (Smith *et al.* 2002). The outcome from 329 nesting attempts was determined (not every nesting attempt was monitored). Of the 329 nests monitored, 58 percent (n=191) were successful, 35 percent failed (n=114), and 7 percent (n=24) had an outcome which could not be determined. Causes of nest failure were predation (n=82), nest desertion (n=10), brood parasitism (n=6), infertile clutches (n=12), weather (n=2), and unknown causes (n=2). Cowbirds may have contributed to other abandoned nests, but no direct evidence was detected. Three parasitized nests fledged flycatchers along with cowbird young. Nine sites had cowbird trapping in 2001 (Alamo Lake, Greer/Alpine [Alpine Horse Pasture and Greer River Reservoir], Roosevelt Lake [Lake shore], and Winkelman [CB Crossing, Cook˜s Lake, Dudleyville Crossing, Indian Hills, and Kearny]).

Intensive nest monitoring efforts in California, Arizona, and New Mexico have shown that cowbird parasitism and/or predation can result in failure of the nest, reduced fecundity in subsequent nesting attempts, delayed fledging, and reduced survivorship of late-fledged young. Cowbirds have been documented at more than 90 percent of sites surveyed (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Muiznieks *et al.* 1994, Sogge and Tibbitts 1994, Whitfield 1994, Tomlinson 1997, Griffith and Griffith 1995, Holmgren and Collins 1995, Kus 1995, Maynard 1995, McDonald *et al.* 1995, Sferra *et al.* 1995, Sogge 1995a, b, San Diego Natural History Museum 1995, Stransky 1995, Whitfield and Strong 1995, Griffith and Griffith 1996, Skaggs

1996, Spencer *et al.* 1996, Whitfield and Enos 1996, Sferra *et al.* 1997, McCarthey *et al.*1998). The probability of a flycatcher successfully fledging its own young from a cowbird parasitized nest is low (< 5 percent). Also, nest loss due to predation appears consistent from year to year and across sites, generally in the range of 30 to 50 percent. Documented predators of flycatcher nests identified to date include common king snake (*Lampropeltis getulus*), gopher snake (*Pituophis melanoleucos affinis*), Cooper˜s hawk (*Accipiter cooperii*), yellow-breasted chat (*Icteria virens*), and western screech owl (*Otus kennicottii*) (Paxton *et al.* 1997, McCarthey *et al.* 1998, Paradzick *et al.* 2000, Smith *et al.* 2002). These flycatcher predators were documented by video nest surveillance. Clark˜s spiny lizard (*Sceloporus clarkii*) and a spotted skunk (*Spilogale putorius*) were documented as predators of other nesting surrogate passerines. These limited, but thorough observations of nests, demonstrate a wide variety of flycatcher nest predators. It is expected that other common predators of passerines, such as grackles and cowbirds, also eat flycatcher eggs and nestlings.

Cowbird trapping has been demonstrated to be an effective management strategy for increasing reproductive success for the flycatcher in certain areas as well as for other endangered passerines (e.g., least Bell's vireo [*Vireo bellii pusillus*], black-capped vireo [*V. atricapillus*], golden-cheeked warbler [*Dendroica chrysoparia*]). It may also benefit juvenile survivorship by increasing the probability that parents fledge birds early in the season. Expansion of cowbird management programs may have the potential to not only increase reproductive output and juvenile survivorship at source populations, but also to potentially convert small, sink populations into breeding groups that contribute to population growth and expansion.

III. Environmental Baseline

One aspect of the environmental baseline applies to both the flycatcher and the silvery minnow œ the current drought conditions. As of early March 2003, the State of New Mexico was experiencing drought conditions statewide affecting future spring runoff, soil moisture conditions, and streamflow outlooks. In early fall 2002, it was believed that precipitation events associated with a moderate El Niúo would help relieve the drought pressures; however, these precipitation events never occurred (National Weather Service 2003a). The Rio Grande basin has received below normal precipitation, only adding to the long-term moisture deficits. The wet fall and early winter of 2002 provided some drought relief; however, long term moisture deficits averaging 9 inches over the past three years and deficits as high as 15 inches over the past 5 years contribute to current drought conditions in northern New Mexico, an area that supplies water to the Rio Grande basin (National Weather Service 2003a). Albuquerque experienced the warmest January in recorded history this year with only a small amount of measurable precipitation (National Weather Service 2003b); however, February precipitation in the Rio Grande basin was 147 percent of average (Natural Resources Conservation Service 2003c).

The long-term moisture deficits have led to extremely low soil moisture conditions that will significantly decrease spring runoff (Natural Resources Conservation Service 2003a). Forecasts predict that streamflow in the Rio Grande will be 61 percent of normal into Cochiti Lake and 53 percent of normal into Elephant Butte Reservoir (National Weather Service and Natural Resources Conservation Service 2003, Natural Resources Conservation Service 2003c). ™At an expected 65 percent runoff prediction, it will take more than several years to restore the normal lake level of nearly one million af or better in the [Elephant] Butte [Reservoir] (Natural Resources Conservation Service 2003a).š In Attachment C of the March 2002 Amendment to the Biological Assessment for the Rio Grande and LFCC Modification, Reclamation states that it would take 25 years of 100 percent normal runoff to bring Elephant Butte Reservoir up to full capacity. On the other hand, it would take 3 years of 200 percent of normal runoff to achieve the same goal (Reclamation 2002a).

Another aspect of the environmental baseline that also applies both to the silvery minnow and the flycatcher are the water rights of the Indian Pueblos. There are 18 federally-recognized Indian Pueblos in the action area: Taos, Picurös, San Juan, Santa Clara, San Ildefonso, Pojoaque, Nambò, Tesuque, Jemez, Zia, Acoma, Laguna, Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia, and Isleta. The Pueblos hold aboriginal, time immemorial, reserved, and in some instances contract water rights that are recognized and protected under Federal law. With respect to the six Middle Rio Grande Pueblos (Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia, and Isleta), a certain portion of their water rights is statutorily recognized under the Act of March 13, 1928, 42 Stat. 312, and the Act of August 27, 1935, 49 Stat. 887. These Acts of Congress do not establish the full extent of the water to which these Pueblos are entitled. In addition, the Navajo Nation and certain Navajo allottees hold aboriginal, time immemorial, or reserved water rights within the action area.

The Jicarilla Apache Nation (Nation) has existing uses of water rights in the Rio Grande Basin, including rights under a Federal settlement contract and legislation, and a partial final decree in the Rio Chama adjudication. The Nation received a Congressionally authorized and approved perpetual contract for the diversion and depletion of 6,500 af per year of SJC Project water as part of the settlement of its water rights claims in 1992. The Nation became entitled to those rights in April 1999 when the conditions of the settlement contract were fulfilled. The settlement contract and the Jicarilla Apache Tribe Water Rights Settlement Act of 1992 allow the Nation to lease its SJC Project water to third parties. Since the year 2000, the Nation has leased its SJC Project water to Reclamation under the Supplemental Water Program, in which this water is consumptively used through exchanges with the MRGCD by Reclamation. According to the Nation, prior to that, beginning in 1997, the Nation˜s SJC Project water was used in the Program with the Nation˜s consent.

In the Rio Chama Basin, the Nation also has adjudicated water rights for historic and existing uses on Reservation lands. The Nation˜s reserved water rights for historic and existing uses total an annual diversion of 65.14 af or the quantity of water necessary to supply an annual depletion of 40.32 af, whichever is less, and a net evaporation of 1,786.85 af. The Nation˜s water rights for historic and existing uses perfected under state law and located within the lands proclaimed as part of the Reservation on September 13, 1988, total an annual diversion of 1,492.93 af or a quantity of water necessary to supply an annual depletion of 1,095.01 af, whichever is less, and a net evaporation of 765.74 af.

Rio Grande Silvery Minnow

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 propagation of silvery minnows, on-going research efforts, and past projects in the Middle Rio Grande. Also of importance is the current drought, the expected weather pattern for the near future, and how it may affect flow in the Rio Grande. Each of these topics is discussed below.

Changes in Hydrology

There have been two primary changes in hydrology since 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, of lesser magnitude than they are today, there were no diversion dams to block repopulation of upstream areas, the fish had a much greater geographical distribution, and there were oxbow lakes, cienegas, and sloughs that supported fish until the river became connected again.

Lack of water is the single most important limiting factor for the survival of the species. Water management and use has resulted in a large reduction of suitable habitat for the silvery minnow. Agriculture accounts for 90 percent of surface water consumption in the Middle Rio Grande (Bullard and Wells 1992). The average annual diversion of water in the Middle Rio Grande by the MRGCD was 535,280 af (65,839 hectare-meters) for the period from 1975 to 1989 (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 œ 37 percent (S.S. Papadopulos & Associates, Inc. 2000; USGS 2002c). In addition, a portion of the water diverted by the MRGCD is returned to the river in the form of return flows and may be rediverted (in some cases more than once) (Bullard and Wells 1992; MRGCD, *in litt.* 2003).

River reaches particularly susceptible to drying, as documented by the Service during the spring and summer of 1996, are immediately downstream of the Isleta Diversion Dam (river mile 169), a 5-mile (8-km) reach near Tome (river miles 150 œ155), a 5-mile (8-km) reach near the U.S. Highway 60 Bridge (river miles 127 œ 132), and an extended 36-mile (58-km) reach from near Brown Arroyo (downstream of Socorro) to Elephant Butte Reservoir. Extensive fish kills, including tens of thousands of silvery minnows, have occurred in these lower reaches when the river has dried (C. Shroeder, Service, *pers. comm.* 2002). In 1996, at least 36 river miles in the San Acacia Reach were dry for 128 days and the San Marcial Gage, located at the lower end of this reach had 0 cfs reading for 180 days. In 1997, at least 16 river miles were dry for approximately five to seven days. Approximately 16 river miles were dry for 28 days in 1998 (Smith 1999). The river was dry in 1999 for four to five days for at least 28 river miles (Platania and Dudley 1999). Drying occurred in 2000 for less than a week in late July (Dudley and Platania 2001). Approximately 8 to 10 miles of river dried in 2001, with the period of intermittency usually lasting less than two days (Service 2002b). Predatory birds have been seen hunting and consuming fish from isolated pools during river intermittence (J. Smith, NMESFO, *pers. comm.* 2003). Though the number of fish present in any pool is unknown, it must be assumed that many of the fish preyed upon in these pools are silvery minnows. Thus, while some dead silvery minnows were collected during the shorter drying events, it is assumed that many more mortalities occurred than were documented.

River drying occurred during the 2002 irrigation season in the Isleta and San Acacia Reaches. Between June and August, 2002, approximately 15.75 miles of river in the San Acacia Reach and 11 miles in the Isleta Reach dried. These reaches of river dried and re-wetted several times due to rainstorm events. During these drying events, the Service˜s silvery minnow salvage crews captured and relocated 3,639 adult silvery minnows to the Angostura and Isleta Reaches, and documented 249 dead silvery minnows that counted toward the Incidental Take Statement in the June 29, 2001, programmatic biological opinion, as clarified in an August 1, 2002, memorandum to Reclamation (NMESFO, *in litt.* 2002). Approximately 98 percent of the salvaged silvery minnows were released at Central Bridge in Albuquerque, with the remainder released in the upper portions of the Isleta Reach. Re-wetting from storm runoff and the subsequent drying of the river in areas that were previously dry led to the death of additional silvery minnows (< 100) that did not count toward the incidental take statement of the June 29, 2001, programmatic biological opinion. These silvery minnows were not considered as take under the June 29, 2001, programmatic biological opinion because an ™act of natureš caused the river to re-wet and subsequently dry, rather than the actions of Federal agencies (J. Smith, Service, *pers. comm.* 2003).

In 1996, the Service conducted an emergency salvage of silvery minnows trapped in drying pools downstream of Isleta Diversion. Approximately 10,000 silvery minnows were salvaged, transported, and released in a perennial reach of the Rio Grande near Albuquerque (Arritt 1996). Additional salvages of silvery minnows occurred between 1997 and 2002. Mortality of silvery minnows was documented in 1996, 1997, and 1999 in isolated pools during river intermittency (Smith and Hoagstrom 1997, Smith 1999b, Dudley and Platania 1999). Smith and Hoagstrom (1997) and Smith (1999) focused on the relative size of the isolated pools (i.e., estimated surface meters and maximum depth) in relation to pool longevity (i.e., number of days pool existed) and fish community. Smith (1999) found that the typical isolated pools found during intermittent conditions usually only lasted 48 hours. Those that persisted longer lost greater than 81 percent of their estimated surface area and more than 26 percent maximum depth in 48 hours. Because of poor water quality (high water temperatures, low dissolved oxygen) and exposure to predators, mortality of silvery minnows is expected when drying exceeds 48 hours. These small isolated pools are very different in character from the large, deep oxbow lakes and sloughs that once occurred along the river and sustained fish populations through times of drought.

During the past few years, the City and other San Juan-Chama (SJC) project contractors allowed the use of their SJC water for the purpose of providing flows in the river that were crucial for the silvery minnow population in the San Acacia Reach (Service 2001b). Albuquerque intends to fully utilize its SJC water in the future for municipal uses; therefore, this water may not be available for future activities involving conservation of silvery minnow populations (Reclamation 2002b).

Water in the active river channel has been reduced with the construction of drains along both banks of the Rio Grande. The majority of the Middle Rio Grande valley has drains paralleling the river. The west side of the Rio Grande has 160 miles (258 km) of drains, including the LFCC, in a 180-mile (290 km) stretch between Cochiti Dam and the Narrows at Elephant Butte Reservoir. This represents 89 percent of the total length between Cochiti Dam and Elephant Butte Reservoir. The east-side drains also parallel the river to San Acacia Diversion Dam for a distance of 100.5 miles (162 km).

The LFCC that parallels the river for 75 miles (121 km) was designed to expedite delivery of compact water to Elephant Butte Reservoir during low flow conditions. Water was diverted to the LFCC from the Rio Grande from 1959 to 1985. The LFCC has a capacity of approximately 2,000 cfs. Because the LFCC is at a lower elevation than the river bed, there is seepage from the river to the LFCC. This causes a significant loss of surface flows in the river channel. If the flow in the Rio Grande is 2,000 cfs or less, diverting water into the LFCC can dewater the river from the San Acacia Diversion Dam south to Elephant Butte Reservoir. The LFCC has not been fully operational since 1985, because of outfall problems at Elephant Butte Reservoir. In 1997, 1998, and 2001, experimental operations occurred in the upper 10 miles of the LFCC for sedimentation studies; however, the diverted flows were returned to the Rio Grande through a temporary outfall near Escondida. It is estimated that 67 percent of the flow in the Rio Grande is lost to seepage in the project area, with much of this water seeping into the LFCC (Jim Wilber, Reclamation, *pers. comm.* 1999).

In 2000, a program was initiated to pump water from the LFCC back into the river. The initial pumping program had a total of three stations in the San Acacia Reach. These pumps augmented flows throughout the reach within and below the Refuge. This program reduced the amount of intermittency in the river in 2000 and 2001. In 2002, the pumping was expanded to five stations located in the San Acacia Reach from about 3 miles upstream of US 380 to near Old Fort Craig. The pumping stations at the southern boundary of the Refuge and Fort Craig have created approximately 16 miles of flowing water. A new pumping station located approximately 4 miles north of the southern boundary of the Refuge will provide approximately 4 miles of additional flowing water when sufficient water is in the LFCC. With these pumping stations, flow can be maintained for approximately 20 continuous miles of river, from near the middle of the Refuge, to Elephant Butte. However, if the pumps fail, the river may become intermittent. Reclamation has contractors that check the pumps, but mechanical failures can go undiscovered for several hours. Unexpected disasters such as engine fires (one occurred in mid-July of 2002) can severely affect the ability of the pumps to deliver water (G. Pargas, Tetra Tech, *pers. comm.* 2002).

Changes to Size and Duration of Peak Flows

Water management has also resulted in a loss of peak flows that historically initiated spawning. The reproductive cycle of the silvery minnow is tied to the natural river hydrograph. A reduction in peak flows and/or improper timing of flows may inhibit reproduction. Lack of a peak flow was especially severe in the spring and summer of 1996 because of drought. The Service was concerned that silvery minnow reproduction might not occur or would be seriously reduced. A moderate flow spike was coordinated with the cooperation of the City. River and habitat conditions prior, during, and following the spike were monitored. This spike was successful in triggering a spawn and temporarily improved habitat conditions (Platania and Hoagstrom 1996).

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

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

<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 channel migration (i.e., jetty jacks) adversely affect the silvery minnow. These effects result directly from constraints placed on channel capacity by structures built in the floodplain. These environmental changes have and continue to degrade and eliminate spawning, nursery, feeding, resting, and refugia areas required for species survival and recovery (Service 1993a).

The active river channel through the reaches where the minnow persists in the Angostura and San Acacia Reaches is being narrowed by the encroachment of vegetation, resulting from continued low flows and the lack of overbank flooding. The lack of flood flows has allowed non-native riparian vegetation such as saltcedar and Russian olive to encroach on the river channel (Reclamation 2001). These non-native plants are very resistant to erosion, resulting in it narrowing (Reclamation 2001). When water is confined in a more narrow cross-section, its velocity increases, which gives it more power. Fine sediments such as silt and sand are carried away leaving coarser bed materials such as gravel and cobble. Habitat studies during the winter of 1995 and 1996 (Dudley and Platania 1996), demonstrated that a wide, braided river channel with low velocities resulted in higher catch rates of silvery minnows, and narrower channels resulted in fewer fish captured. The availability of wide, shallow habitats that are important to the silvery minnow are decreasing. Narrow channels have few backwater habitats with low velocities that are important for silvery minnow fry and juveniles.

Where the silvery minnow now persists, 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 ™Narrowsš in Elephant Butte Reservoir. Within the same stretch, 234.6 miles (378 km) of levees occur, including levees on both sides of the river. Analysis of aerial photography taken by Reclamation in February 1992, for the same river reach, shows that of the 180 miles (290 km) of river, only 1 mile (1.6 km), or 0.6 percent of the flood plain has remained undeveloped.

Development in the flood plain, makes it difficult, if not impossible, to send large quantities of water downstream that would create low velocity side channels that the silvery minnow prefers. For example, the railroad bridge at San Marcial is so low, flow releases from Cochiti Dam have been reduced to avoid damage to the bridge. The construction of houses in the flood plain on the east side of the river at Socorro requires that releases from Cochiti Dam are reduced to prevent damage to these homes. These reduced releases decrease the available habitat for the silvery minnow.

Water Quality

The term ™water qualityš is used to refer only to the chemical characteristics of the watecolumn. However, the water quality of a river is reflected in the quality or condition of its associated natural resources (e.g., the water column, sediment, biota). The disadvantage of looking only at the physicochemical characteristics of the water is that they only provide a snapshot in time. Because of dilution and the constant downstream flow of water, significant changes in important water quality characteristics may not be detected because samples were taken too soon or too late or at an inappropriate site. This explains why the results of water quality tests are often highly variable over space and time. However, by examining the results of several studies and reviewing monitoring data from wastewater treatment plants (WWTPs) bordering the Rio Grande, we can gain some understanding of important factors that influence water quality and the health of aquatic organisms in the river.

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

Effluents from WWTPs (under both permitted levels and exceedences of the permit) contain contaminants that may affect the water quality of the river. It is anticipated that WWTP effluent may be the primary source of perennial flow in the lower portion of the Angostura Reach during extended periods of intermittency. For that reason the water quality of the effluent is extremely important. In the project area, the largest WWTP discharges are from Albuquerque, followed by Rio Rancho, Los Lunas, and Bernalillo, (mean annual discharge flows are 80.4, 2.5, 0.9, and 0.7 cfs, respectively; Bartolino and Cole 2002). Records of effluent discharge are available for the Albuquerque WWTP for the time period since 1998 (http://oaspub.epa.gov/enviro/pcs_det_reports.detail_report?npdesid=NM0022250). Since that time, total residual chlorine (chlorine) and ammonia, as nitrogen (ammonia), have been discharged unintentionally at concentrations that exceed protective levels for the silvery minnow (Appendix D, Tables 5 and 6). Albuquerque WWTP effluent discharge records show that during November 1999, the monthly maximum chlorine concentration in the outfall was 0.49 milligrams per liter (mg/L). Additionally, on February 23, 2003, the concentration of chlorine in the outfall was reported to be 0.70 mg/L (C. Abeyta, Service, *in litt.* 2003; D.S. Dailey, City, *in litt.* 2003). Concentrations of chlorine as low as 0.013 mg/L are harmful to the silvery minnow. Records also show that the monthly maximum concentration of ammonia during July 2001 was 14 mg/L. At pH 8 and a water temperature of 25 ¹C, concentrations of ammonia as low as 3.1 mg/L are harmful to larval fathead minnow (USEPA 1999). The fathead minnow has been suggested as a surrogate to evaluate the effects of various chemicals on the silvery minnow (Buhl 2002).

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

In addition to chlorine and ammonia, WWTP effluents may also include cyanide, chloroform, organophosphate pesticides, semi-volatile compounds, volatile compounds, heavy metals, and pharmaceuticals and their derivatives, which can pose a health risk to silvery minnows when discharged in concentrations that exceed the protective water quality criteria (J. Lusk, Service, *in litt*. 2003). Even if the concentration of a single element or compound is not harmful by itself, chemical mixtures may be more than additive in their toxicity to silvery minnows (Buhl 2002). In the wild, silvery minnows are exposed to many different chemical and physical agents simultaneously, and these cannot be accounted for during traditional water quality sampling regimes. The long-term effects and overall impacts of chemicals on the silvery minnow are not known.

As precipitation falls and exceeds the ability of soils and plants to absorb it, the remainder of the water runs off, usually in a short-lived flood. Large precipitation events wash sediments and pollutants into the river from surrounding lands through storm drains and intermittent tributaries. Although there are contaminant monitoring programs required for stormwater outfalls, there are no criteria established to regulate the quality of stormwater discharges. Contaminants of concern to the silvery minnow that are frequently found in stormwater 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 (USGS 2001).

Harwood (1995) studied the North Floodway Channel (Floodway) of Albuquerque, which drains an urban area of about 90 square miles and crosses Pueblo of Sandia lands. He found that storm water contributions of dissolved lead, zinc, and aluminum were significant and posed a threat to the water quality of the Rio Grande. Because the Floodway crosses lands of the Pueblo of Sandia and enters their portion of the Rio Grande, the Pueblo requested that the Environmental Protection Agency conduct toxicity tests on water in the Rio Grande collected below the Floodway. Aquatic crustaceans exposed to this water were found to have significant reproductive impairment and mortality when compared with controls. Additionally, larval fish also experienced significant mortality and/or narcosis when exposed to water and bed sediment collected from this same area on April 22, 2002 (http://oaspub.epa.gov/enviro/pcs_det_reports.detail_report?npdesid=NM0022250). This study indicates that stormwater runoff can impact the water quality of the Rio Grande and the aquatic organisms that live in the river.

Sediment is the sand, silt, organic matter, and clay portion of the river bed, or the same material suspended in the water column. Ong *et al.* (1991) recorded the concentrations of trace elements and organochlorine pesticides in suspended sediment and bed sediment samples collected from the Middle Rio Grande between 1978 and 1988. These data were compared to numerical sediment quality criteria (Probable Effects Criteria [PEC]) proposed by MacDonald *et al.* (2000). According to MacDonald *et al.* (2000) most of the PECs provide an accurate basis for predicting sediment toxicity to aquatic life and a reliable basis for assessing sediment quality in freshwater ecosystems. Although PECs were developed to assess bed (bottom) sediments, they also provide some indication of the potential adverse effects to organisms consuming these same sediments when suspended in the water column. Some concentrations of trace elements and organochlorine pesticides in suspended sediment collected from the Rio Grande floodway at San Acacia and San Marcial exceeded the PECs for copper, chromium, and zinc. The concentrations of trace elements and organochlorine pesticides in bed sediments were much lower than the PECs, suggesting a differential adherence pattern to suspended sediments and bed sediments and dilution by clean sediments. Additional trace elements were elevated in suspended sediments collected from the Rio Grande at San Felipe. The concentrations of contaminants adhered to suspended sediments may pose a health risk to silvery minnows depending on ingestion rates, bioavailability, and the relative sensitivity of this species (Rand and Petrocelli 1985, pp.496-502).

Volatile organic compounds that have been detectable in the Middle Rio Grande at Isleta include chlorpyrifos, and trichlorofluoromethane (Ellis *et al.* 1993). Anderholm *et al.* (1995) described the relationship between the quality of shallow ground water and land use in an urban area in and adjacent to Albuquerque. Important sources of recharge that affect shallow ground-water quality in the area include infiltration of surface water, which is used in agricultural land-use areas to irrigate crops, and infiltration of septic-system effluent in residential areas. The presence of synthetic organic compounds (volatile organic compounds and pesticides) in shallow ground water in the study area indicated that human activities have affected shallow ground-water quality. Past spills of TCE and other toxic substances have polluted some of the groundwater in the Albuquerque area. The connection of the surface water quality to the shallow ground water and the exchange of volatile organic compounds is currently being investigated by USGS.

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

Pesticide contamination occurs from agricultural activities, as well as from the cumulative impact of residential and commercial landscaping activities. The presence of pesticides in surface water depends on the amount applied, timing, location, and method of application. Water quality standards have not been set for many pesticides, and existing standards do not consider cumulative effects of several pesticides in the water at the same time. Roy *et al.* (1992) reported that DDE, a degradation product of DDT, was detected most frequently in whole body fish collected throughout the Rio Grande. He suggested that fish in the lower Rio Grande may be accumulating DDE in concentrations that may be harmful to fish and their predators. In a study at the Refuge, Ong *et al.* (1991) found detectable levels of DDE in American coot (*Fulica americana*) and carp (*Cyprinius carpio*). Carter (1997) reported that sediment collected and analyzed in the Rio Grande had detectable concentrations of DDE, but that no other organochlorine insecticides or polychlorinated biphenyls were detected. Whole-body fish samples were also collected at the site of sediment collection and analyzed for organic compounds. Organic compounds were reported more frequently in samples of fish, and more types of organic compounds were found in whole-body fish samples than in bed-sediment samples. Concentrations of DDE, polychlorinated biphenyls, cis-chlordane, trans-chlordane, trans-nonachlor, and hexachlorobenzene were also detected in whole-body samples of fish. The presence of DDT and its metabolites, DDD and DDE, in bed sediment and whole-body fish confirms the persistence of this pesticide in the Rio Grande. Although DDT applications have stopped and concentrations in fish tissue have declined dramatically, DDT compounds may still pose adverse health risks to fish species when bioaccumulated from contaminated environments (Rand and Petrocelli 1985, p. 336).

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, nitrites, and phosphorus, total dissolved solids (salinity), and radionuclides. Each of these also has the potential to affect the aquatic ecosystem and health of the silvery minnow. As the river dries, pollutants will be concentrated in the isolated pools. Even though these pollutants do not cause the immediate death of silvery minnows, the evidence suggests that the amount and variety of pollutants present in the Rio Grande, could compromise their health and fitness (Rand and Petrocelli 1985).

Silvery Minnow Propagation

Fish species have been propagated and cultured for more than one hundred years in the United States and other countries. The United States began species propagation in 1871, when a bill was passed in Congress that acknowledged the Federal government˜s role in natural resource management (Springer 2002). The resolution stated ™The most valuable food fishes of the coast and the lakes are rapidly diminishing in number, to the public injury and so as materially to affect the interests of trade and commerceš (Springer 2002). One year later, the first national fish hatchery was established in California. At that time, and for more than 100 years since, fish hatcheries existed to rear game fishes, restore stocks, and introduce sport fishes to new areas (Springer 2002).

The ESA requires Federal agencies to use their authorities to conserve endangered species (ESA, section 7(a)(1)). The current role of the Service in this stewardship is that of lead authority and protector of threatened and endangered fish in the United States. This includes protection of the habitats upon which these species depend, as well as recovery of populations that have been diminished due to habitat degradation, excessive harvesting, water quality issues, or other factors (Edwards 1993). With the passage of the ESA, the National Fish Hatchery System not only had to change its methods of operation, but its philosophy as well. The first step in this new direction was taken at Dexter National Fish Hatchery (Hatchery). The Hatchery, a 40-year-old warm water facility originally designed to breed largemouth bass (*Micropterus salmonoides*) and channel catfish (*Ictalurus punctatus*) for New Mexico, was transformed into an endangered fish-rearing facility and technology center.

The Hatchery has been a leader in the development of captive propagation techniques and has reared some of the rarest fish in the country. These include the Colorado pike minnow *(Ptychocheilus lucius*) as well as the Gila topminnow (*Poeciliopsis occidentalis*). There are at least 15 species of threatened or endangered fish being cultured at the Hatchery. These species include the silvery minnow and many other cyprinids such as the bandtail chub (*Gila elegans*), Pahranagat roundtail chub (*Gila robusta jordani*), chihuahua chub (*Gila nigrescens*), Virgin River chub (*Gila robusta seminuda*), woundfin (*Plagopterus argentissimus*), and the Guzman beautiful shiner (*Cyprinella formosa formosa*).

Propagation of minnows in the United States began in the early 1930s with the culture of bait fish to support sport fisheries. Golden shiners (*Notemigonus crysoleucas*), bluntnose minnows (*Pimephales notatus*), fathead minnow (*Pimephales promelas*), and eastern silvery minnow (*Hybognathus regius*) were propagated to provide bait for game fish (Markus 1934, Raney 1941). Many aspects of culturing bait fish in ponds were described as early as 1938. The silvery minnow has been difficult to raise in captivity. The greatest success has occurred at the Hatchery, while other facilities have experienced high levels of mortality (J. Brooks, Service, *in litt.* 2001).

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

In 2000, adult wild silvery minnows from the San Acacia Reach and eggs from San Marcial were collected for a pilot propagation and augmentation program. Wild gravid adults were successfully spawned in captivity at the City of Albuquerque˜s propagation facilities. Approximately 500 silvery minnows were induced to spawn producing approximately 203,600 eggs (Platania and Dudley 2001b). These eggs were raised for 2 to 3 days and released as larval fish at Bernalillo (91,600) and Los Lunas (112,000)(Platania and Dudley 2001b).

In 2000, an estimated 41,498 silvery minnow eggs were collected in three days just below the San Marcial Railroad Bridge (J. Smith, Service, *in litt.* 2000). The eggs were transported to the City of Albuquerque˜s propagation facilities where they were raised to adults. It was estimated that the eggs would have an estimated five to 10 percent survivorship which would result in approximately 2,075 to 4,150 adult silvery minnows (C. Altenbach, City, *pers. comm.* 2002). However, because the project was only designed to rear 1,000 adult silvery minnows from 10,000 eggs, approximately 2,500 juvenile silvery minnows were released in the Angostura Reach of the Rio Grande in July of 2000 to provide space in the facilities to grow out remaining juveniles to a larger size.

Silvery minnow eggs were salvaged from the Rio Grande in 2001 to supplement the captive population. During spring runoff in mid-May, approximately 89,500 wild eggs were collected near the headwaters of Elephant Butte Reservoir (Platania and Dudley 2002). From May 17 to 19, 2002, the catch of silvery minnow eggs collected for captive propagation is conservatively estimated to be 922,000 (Platania and Dudley 2003). These eggs were transported to captive propagation units where they were raised to sub-adults and adults for release back into the wild. Silvery minnow adults were spawned artificially using hormones throughout 2001 and into early 2002. In April of 2002, the City of Albuquerque˜s propagation facilities spawned silvery minnows in captivity for the first time without the use of hormones (C. Altenbach, City, *pers. comm.* 2002).

Silvery minnows are currently housed at five facilities in New Mexico. The New Mexico facilities are: the Hatchery; New Mexico State University Coop Unit (Las Cruces); Rock Lake State Fish Hatchery; the Service˜s Fishery Resources Office, and the City of Albuquerque˜s propagation facilities. These facilities are actively propagating and rearing silvery minnows or are available for propagation. In 2000, the total combined capacity of these facilities was approximately 175,000 silvery minnow juveniles and adults (J. Brooks and J. Landye, Service, *in litt*. 2000). New facilities are being constructed at the City, the Hatchery, and at NMFRO that will increase the total capacity of all facilities to approximately 500,000 juveniles and adults. Silvery minnows are also held in South Dakota at the U.S. Geological Survey, Biological Resources Division (USGS-BRD) Lab, but there is no active spawning program at this facility.

Ongoing Research

There is on-going research by the NMFRO and University of New Mexico (UNM) to examine the movement of silvery minnows. The fish are marked with a visible flourescent elastomer tag and released in large numbers in a few locations. Crews then sample intensively upstream and downstream from the release site in an attempt to capture the marked fish. In January 2002, approximately 13,000 silvery minnows were released by UNM into the San Acacia Reach. In June 2002, 2,082 silvery minnows were released by NMFRO 1,640 ft (500 m) above the Alameda Bridge in Albuquerque; in December 2002, 41,500 silvery minnows were released in Rio Rancho; and in January 2003, approximately 61,000 silvery minnows were released in Bernalillo. The last three releases were made by NMFRO. In addition to providing information on movement, these releases will augment the wild population.

Preliminary results indicate that the majority of silvery minnows dispersed. However, one individual was captured 15.7 miles (25.3 km) upstream from its release site (S. Platania, UNM, *pers. comm.* 2003). Monitoring within 48 hours after the release of the 41,500 silvery minnows resulted in the capture of 937 fish. Of these, 928 were marked and 927 were collected downstream of the release point. However, the results of this study are too preliminary to draw and solid conclusions at this time.

In 2002, a hybridization study involving the plains minnow and silvery minnow was conducted to determine the genetic viability of hybrids. 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). It is important to know if hybridization (or competition) with the plains minnow occurs.

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

Permitted and/or Authorized Take

Table 4 (Appendix E, Table 4) outlines silvery minnow take authorized by section 10 and incidental take permitted under section 7. These permits and/or authorizations are issued by the Service. Applicants for section 10 permits must also acquire a permit from the State to ™takeš or collect silvery minnows. Many of the permits issued under section 10 allow take for the purpose of collection and salvage of silvery minnows and eggs for captive propagation. Eggs, larvae, and adults are also collected for scientific studies to further our knowledge about the species and how best to conserve the silvery minnow. Since 2000, the Service has reduced the amount of take permitted for voucher specimens as a result of the increasingly precarious status of the species in the wild. The only incidental take authorized under section 7 consultation for silvery minnows was associated with the June 29, 2001, programmatic biological opinion.

Other Projects

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

1. Release of Carryover Storage from Abiquiu Reservoir to Elephant Butte Reservoir: The Corps consulted with the Service on the release of water during the winter of 1995. Ninety-eight thousand af (12,054 hectare-meters) of water was released from November 1, 1995, to March 31, 1996, at a rate of 325 cfs (9.8 cm). This discharge is above the historic winter flow rate. Substantial changes in the flow regime that do not mimic the historic hydrograph can be detrimental to the silvery minnow. For example, during the winter release habitat study, Dudley and Platania (1996) observed an apparent increase in flow between two winter sampling trips, January 19 œ 26, 1996, and February 3 œ 5, 1996, resulting in a decrease in low-velocity and side-channel habitats favored by silvery minnows.

2. Corrales, Albuquerque, and Belen Levees: These levees contribute to floodplain constriction and habitat degradation for the silvery minnow. Levees at these sites contribute to the degradation of the environmental baseline by reducing the amount and quality of suitable habitat for the silvery minnow.

3. Low Flow Conveyance Channel Experimental Operations: In December 1994, Reclamation submitted a biological assessment addressing the diversion of water from the Rio Grande into the LFCC to study the effects of channel gradient and sedimentation on

water delivery. The Federal action evaluated the alternative of installing a temporary outfall to the river and diverting water during spring runoff for three consecutive years. Experimental diversions into the LFCC began in May 1997 and continued through June 1997. Experimental diversions began again in early March 1998, and continued until the end of spring runoff. This resulted in the entrainment of silvery minnow eggs and subsequent recruitment of silvery minnow adults into the LFCC. Experimental operations began again on May 20, 2001. Since then, no entrainment of silvery minnows has been documented. This lack of entrainment has led to speculation that there was little or no spawning occurring in the upstream reaches.

In March, 2002, the Service received a biological assessment from Reclamation for additional LFCC experimental operations and for parrot feather removal. The Service completed a draft biological opinion for this project and transmitted it to Reclamation on January 14, 2003.

4. Tiffany Plug Removal: This Reclamation project cut a pilot channel in the Rio Grande upstream of the bridge at San Marcial. The purpose of this project was to direct water flow through the excavation, rather than allow the water to flow into the adjacent floodplain, resulting in a straighter, narrower, and deeper channel. This caused the narrowing of the river channel which reduced the hydrologic diversity needed by the silvery minnow.

5. 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.

   Measures were implemented to minimize impacts on the silvery minnow and flycatcher and their associated habitats and to enhance local riparian conditions. These environmental actions included: Adding sinuosity to the temporary channel; constructing the channel with variable width; constructing low water crossings along the temporary channel to allow overbank flows to inundate existing native riparian vegetation and encourage native revegetation; a channel widening project in the southern reach of the Refuge to improve aquatic and riparian habitat; and creation of an inflow channel to a portion of the eastern floodplain north of Black Mesa to encourage sediment deposition and new habitat creation.

6. Santa Ana River Restoration Project: In August 1999, Reclamation submitted a biological assessment to the Service to proceed with 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 is currently under construction and involves components such as, a Gradient

Restoration Facility (GRF), channel re-alignment, bioengineering, riverside terrace lowering, and erodible banklines. The primary component of the Santa Ana Restoration Project is a GRF which will provide control of the 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 involves 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 banklines are also involved to assist in establishing the new channel bank and re-generating native species vegetation in the floodplain.

7. Cochiti Fish Screens: This Corps project involved the reparation of fish screens located on the headworks of the Sile and Cochiti Eastside Main Canals in the stilling basin of Cochiti Dam in November 1999. The repair work took approximately six hours per work day for four days and involved reducing outflow from Cochiti Dam to approximately 100 cfs during the six hours of work each day. Conditions that had to be met for the work to progress included: (1) A minimum 700 cfs release prior to and following the release reduction to 100 cfs for repairs; (2) the release reduction could not occur before 9:00 AM and could last for a maximum duration of six hours; (3) drawdown to 100 cfs for six hours could be undertaken only for two consecutive days, and additional repair and release reduction would be deferred to no more than two consecutive days the following week if needed; and (4) all repairs had to be completed prior to December 1, 1999, to minimize disturbance of bald eagles.

8. Silvery Minnow Augmentation: The Service completed an intra-Service section 7 consultation on the salvage and controlled propagation of silvery minnows in 2000. This consultation covered the collection of free floating silvery minnow eggs below the San Marcial Railroad Bridge and the collection of wild adult silvery minnows for spawning. This consultation set forth measures to limit silvery minnow mortality during collection and rearing.

9. Salvage of Silvery Minnows: The Service completed an intra-Service section 7 consultation of the salvage of silvery minnows from isolated pools in 2000. This consultation set forth measures to limit silvery minnow mortality during collection.

10. 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.

11. Bosque del Apache National Wildlife Refuge Water Management Plan: The Refuge completed an intra-Service section 7 consultation in May 2001, for the use of 869 af of the consumptive appropriation water right of 8,691 af from the Rio Grande for the years 2001 through 2004 to aid in maintenance of habitat for the silvery minnow if: (1) Refuge is presented with data indicating that the addition of limited Refuge water will foster survival of the species; (2) an equal or greater percentage of water by other water users in the Middle Rio Grande Valley is also contributed; and (3) legal permitting from the Office of the State Engineer is obtained prior to the emergency transfer request. However, the Refuge maintains that its consumptive water right is actually 12,417 af (referred to in the Permit No. 2 and Rg-1937 *et al.* ENGLD with a priority date of January 4, 1906, approved by the New Mexico Office of the State Engineer).

12. Programmatic Biological Opinion on the Effects of Actions Associated with the U. S. Bureau of Reclamation˜s, U.S. Army Corps of Engineers˜, and non-Federal Entities˜ Discretionary Actions Related to Water Management on the Middle Rio Grande: The Service completed this biological opinion on June 29, 2001, determining the effects of water management by the applicants on the silvery minnow and flycatcher. This biological opinion had one RPA with several elements. These elements set forth a flow regime in the Middle Rio Grande and described habitat improvements necessary to alleviate jeopardy to both the silvery minnow and flycatcher.

13. 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 are being 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.

Summary

In summary, the remaining population of the silvery minnow is restricted to about 5 percent of its historic range. Every year since 1996, there has been at least one drying event in the river that has further reduced the silvery minnow population. During 1996, approximately 27 percent of the occupied range of the silvery minnow was dry for several days. In the San Acacia Reach, where the majority of the silvery minnow population occurred, approximately 60 œ 64 percent of the reach dried. (Reclamation 2001). Although the consequences of the 1996 mortality event are unknown in terms of the total number of silvery minnows or percentage of the population that perished, the species˜ status and long-term recovery potential were adversely affected (Platania and Dudley 1999). Dead silvery minnows were documented in during channel drying events in 1999, 2000, 2001, and 2002 (Platania and Dudley 1999; J. Smith, NMESFO, *pers. comm.* 2002; Service 2002b).

Data collected during the summers of 2000, 2001, and 2002 indicate a near-absence of Age 0 silvery minnows in the Middle Rio Grande, suggesting that the population has dramatically decreased since 1999 (Smith and Jackson 2000, Hoagstrom and Brooks 2000, Dudley and Platania 2002). There was a slight increase in silvery minnow abundance in the Angostura and Isleta Reaches in 2001; however, it appears these slight gains were lost in 2002 (Dudley and Platania 2002). The population is unable to expand its distribution, because three diversion dams currently block upstream movement and Elephant Butte Reservoir blocks downstream movement (Service 1999). Augmentation of silvery minnows with captive-reared fish will continue, however continued monitoring and evaluation of these fish is necessary to obtain information regarding the survival and movement of individuals.

Water withdrawals from the river and water releases from dams severely limit the survival of silvery minnows. The consumption of shallow groundwater and surface water for municipal, industrial, and irrigation uses continues to reduce the amount of flow in the Rio Grande and eliminate habitat for the silvery minnow (Reclamation 2002b). However, under state law, the municipal and industrial users are required to offset the effects of groundwater pumping on the surface water system. The City, for example, has been offsetting their surface water depletions with 60,000 af per year (Reclamation 2002b). The combined effect of water withdrawals and the drought mean that discharge from WWTPs and irrigation return flows will have greater importance to the silvery minnow and a greater impact of 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 the river and contribute to the overall degradation of water quality.

Southwestern Willow Flycatcher

Status of the Species within the Action Area

Presence/absence and nest monitoring surveys along the Rio Grande have been conducted since 1993. Table 5 (Appendix E, Table 5) presents the results of surveys for flycatchers at these sites from 1994 through 2002.

Chama River

Surveys for presence/absence and habitat suitability along the Rio Chama below Abiquiu Dam in 1994 identified no flycatchers, but found small areas of suitable habitat (Eagle Ecological Services 1994). A Service biologist recorded an unidentified willow flycatcher about a quarter-mile from the Rio Chama near Chili, New Mexico (Eagle Ecological Services 1994). More recent data also indicate that the Rio Chama may be used by flycatchers. Several flycatcher territories were identified each breeding season from 1993 œ1998 in the Rio Chama drainage until surveys were discontinued, including areas near Parkview, above Heron Reservoir (USGS 1998), and in the vicinity of Los Ojos. Non-protocol surveys have indicated that at least a few birds have persisted.

Velarde Area

In 1995, several individual flycatchers were observed along the river near Velarde, New Mexico. In 1996, flycatchers were again detected during the breeding season in the Espaúola valley (Ahlers and White 1996). Nesting attempts were documented at three sites in the Espaúola valley (Johnson *et al.* 1999). The three sites in the Velarde section of the Rio Grande had one territory in 2001.

San Juan Pueblo

In 1995 nesting flycatchers were located on the San Juan Pueblo. In 2000, protocol surveys found 16 territories on San Juan Pueblo lands. This site has not been surveyed since 2000.

Isleta Pueblo

In 2000, 14 territories were located on Isleta Pueblo lands. These sites have not been consistently surveyed. Habitat quantity and quality has not changed since 2000.

La Joya State Wildlife Refuge

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

Sevilleta National Wildlife Refuge

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

Bosque Del Apache National Wildlife Refuge

In 2001, one territory was located during surveys of suitable habitat within actively managed wetland and riparian units of the Refuge and/or along water conveyance facilities. In the past, one territory was located in 2000, and two to three territories in 1999. There are two sites on the Refuge that have been used fairly consistently since 1994. Nest searches are not conducted on the Refuge, therefore nest status and productivity cannot be confirmed. In 2002, the river corridor was surveyed in addition to selected areas within the inactive floodplain of the Refuge. Three territories were located along the river however no pairs or nests were found. One territory was located within the Refuge˜s seasonally flooded marsh units (Taylor 2001, 2002).

San Marcial

In 1994, 11 flycatcher territories were detected in the San Marcial area, all above the San Marcial Railroad Bridge (Mehlhop and Tonne 1994) (Appendix E, Table 6). In 1995, flycatchers were observed on the west bank of the Rio Grande south of Isleta Marsh within the Belen Division, and in the lower portion of the Socorro Division, both above and below the San Marcial Railroad Bridge (Ahlers and White 1995). Also in 1995, several individuals were observed along the river near Velarde, New Mexico, and nesting flycatchers were located on the San Juan Pueblo. In 1996, flycatchers were again detected during the breeding season below the San Marcial Railroad Bridge and in the Espaúola valley (Ahlers and White 1996). Nesting attempts were documented at three sites in the Espaúola valley and at one site in the San Marcial area (Johnson *et al.* 1999).

In 1997, flycatchers were observed during Reclamation surveys at three sites between the San Marcial Railroad Bridge and Elephant Butte Reservoir (Ahlers and White 1997). Sites containing flycatchers in the San Marcial Reach were dominated by dense stands of willow with cottonwood interspersed, and were in or near flooded areas at some point during the breeding season. Two nests were found in the headwater area of Elephant Butte Reservoir west of the LFCC in a patch of Goodding willows. Both of these nests may have been successful. The nests were located within the same territory about 5 meters apart. Because the second nest was being incubated following the estimated fledging date of the first nest, this could have been a renesting by the same pair (Ahlers and White 1997).

In 1998, a total of twenty flycatchers were observed from the San Marcial Railroad Bridge to Elephant Butte Reservoir including four confirmed pairs and two nests. A new nest was located on the east side of the river just below the San Marcial Railroad Bridge. The other nest was located near the 1997 nest site, west of the LFCC breach.

In 1999, 28 flycatchers established 10 pairs with 9 nests. At the San Marcial Reach, 12 territories were confirmed by 5 nests. Four of the nests were successful and one failed due to cowbird parasitism. It is estimated that ten young fledged the nesting sites (Ahlers and White 2000).

Presence/absence surveys in the San Marcial Reach in 2000 produced the following data: LF-27 (east of the Rio Grande below the San Marcial Railroad Bridge) had two pairs with nests, LF-11 (between the LFCC and the Rio Grande, below the Ft. Craig berm) had one pair with nest, and LF-17 (west of the LFCC outfall and Rio Grande above the Reservoir delta) had 14 pairs with nests. Successful nests in this area could have been as high as 12 (D. Ahlers, Reclamation, *pers. comm.* 2000)

In 2001, this area had the highest concentrations of nesting flycatchers within the reach with 22 territories. These 22 pairs produced 35 nests including 4 re-nesting attempts and 10 second broods. Twenty-six nest attempts were successful and nine failed (seven were predated and two were abandoned).

In 2002, 51 territories were established within the delta. Sixty-five nests that were located included six second broods and fourteen re-nests. Thirty-five nests were successful and 30 failed. The higher than normal nest failure in 2002 was attributed to predation (D. Alhers, Reclamation, *pers. comm.* 2002).

Habitat Characteristics

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

Habitat Availability by Reach

Table 7 (Appendix E, Table 7) outlines flycatcher habitat availability by river reach.

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

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

The bosque in the Cochiti and Angostura Reaches contains mainly single-aged stands of older cottonwoods and lacks the diversity of a healthy, multi-aged riparian forest. Non-native vegetation such as Russian olives and Siberian elms are also becoming established. Significant channel narrowing and downcutting has limited overbank flooding and reduced the potential for recruitment of native riparian vegetation, especially cottonwoods and willows. Known flycatcher habitat in some areas of the Isleta Reach consists of dense willow and cottonwood stands associated with floodplain marshes (i.e. below Isleta Diversion Dam). Flycatcher habitat adjacent to the river within the Sevilleta National Wildlife Refuge contains saltcedar and Russian olive. Channel narrowing and degradation in this reach reduces the amount of overbank flooding and the potential sites for existing and new native vegetation. Known flycatcher habitat in the Rio Puerco Reach is dominated by saltcedar.

Development of a flycatcher habitat suitability model by Reclamation˜s Denver Technical Service Center was initiated in 1998, and further refined in 1999. Vegetation within the reach was mapped using the Hink and Ohmart classification system through a cooperative effort with the U.S. Forest Service. Breeding habitat suitability was refined by identifying all areas that are within 100 meters of existing watercourses, ponded water, or in the zone of peak inundation. The 5 categories of flycatcher habitat that lie within 100 meters of water were defined as:

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

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

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

› Potential with Future Riparian Vegetation Growth and Development - Includes stands of very young sparse riparian plants on river bars that could develop into stands of adequate structure with growth and/or additional recruitment. Reclamation believes this category requires regular monitoring to ascertain which areas contain all the parameters to become flycatcher habitat.

› Low Suitability - Includes areas where native and/or non-native vegetation lacks the structure and density to support breeding flycatchers, or exceeds the hydrologic parameter of greater than 100 meters from water. The presence of low suitability habitats may be important for migration and dispersal in areas where riparian habitats have been lost (i.e. agricultural and urban areas).

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

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

Factors Affecting Species Environment within the Action Area

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

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

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

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

The Middle Rio Grande channel width has narrowed over the last century. The trend can be attributed to reduced peak flows, channelization, and reduced sediment below Cochiti Dam. Channelization is primarily responsible for the elimination of thousands of acres of the shallow, low velocity habitats required by the flycatcher. Flow regulation below Abiquiu Reservoir and Cochiti Dam has further decreased channel capacity and reduced peak flows. A channel-forming discharge has never been released from Cochiti Dam. The lack of large peak flows combined with the effects of channelization contributes significantly to channel narrowing and the elimination of overbank flooding. These factors severely limit the development of backwater habitats essential to the survival of the flycatcher.

Water Operations

The operation of El Vado and Abiquiu Dams on the Rio Chama, Cochiti Dam on the Rio Grande, and the three mainstem diversion dams below Cochiti (Angostura, Isleta, and San Acacia) have modified river flows and downstream channel morphology. Downstream effects of Cochiti Dam include the narrowing of the river channel and associated loss of flycatcher habitats, the degradation of the river bed and concurrent reduction in overbank flooding. In addition, the diversion dams have the capability to dry up the river channel completely by diverting all the flow into the irrigation system. The following discussion summarizes the dewatering events in the Middle Rio Grande from 1996 to 2002.

In 1996, at least 36 river miles in the Middle Rio Grande were dry for 128 days. This event may have contributed to complete failure of adjacent flycatcher nests (Johnson *et al.* 1999). In 1997, at least 16 river miles were dry for approximately 5 to 7 days and in 1998, approximately 16 river miles were dry for 28 days. In 1999, the river was dewatered for 4 to 5 days for at least 28 river miles. Drying occurred in 2000 for less than a week in late July. In 2001, very little river dried, and in 2002 approximately 40 miles of river dried. The years since 1996 have shown reduced amounts and durations of river dewatering.

In 1996, the known flycatcher population numbered four nesting pairs and all nests failed. In 1997, there were three known pairs of flycatchers. In 1998, there were four known pairs with two nests. In 1999, there were 28 known flycatchers, including 12 territories, 10 pairs and 9 nests. In 2000, there were approximately 72 known flycatcher territories, with at least 17 nests.
In 2001, there were approximately 70 known flycatcher territories, with 45 nests attempted, and 33 believed successful. In 2002, there were approximately 96 known territories and at least 74 nesting attempts, with 80 nests attempted, and 44 believed successful.

The large increases seen in the flycatcher numbers along the Middle Rio Grande are in part due to increased survey coverage. However, in the past few years the survey effort has become more standardized and increases in the number of territories has been documented in the Sevilleta/La Joya area and in the San Marcial area (Appendix E, Table 6). This increase can be attributed to a number of conditions. In the Sevilleta/La Joya area, the nesting sites are wetted by the Rio Puerco confluence with the Rio Grande and the presence of the San Juan Irrigation Drain, which provides water though the irrigation season. In the San Marcial area, the majority of the nesting sites are wetted by a break in the LFCC, which provides water throughout the irrigation season. In addition to irrigation returns, the increased quantity of continuous river flow since 1996 has provided water adjacent to nesting areas along the Rio Grande which has increased production of their insect prey and dense riparian vegetation.

Past Consultations

Since listing in 1995, at least 81 Federal agency actions have undergone (or are currently under) formal section 7 consultation throughout the flycatcher˜s range (Appendix E, Table 8). Six actions have resulted in jeopardy decisions. Many activities continue to adversely affect the distribution and extent of all stages of flycatcher habitat throughout its range (development, urbanization, grazing, recreation, native and non-native habitat removal, dam operations, river crossings, ground and surface water extraction, etc.). Stochastic events also continue to adversely affect the distribution and extent of flycatcher habitat.

Anticipated or actual loss of occupied flycatcher habitat due to Federal or federally permitted projects has resulted in biological opinions that led to acquisition of otherwise unprotected property specifically for the flycatcher. A small portion of the lower San Pedro River was acquired by Reclamation as a result of raising Roosevelt Dam and is now currently under the management of The Nature Conservancy. In 2002, about 20 flycatchers territories were detected on this property (S. Sferra, Reclamation, *pers. comm.* 2002). Commitments to acquire and manage unprotected habitat specifically for breeding flycatchers have been made for loss of flycatcher habitat along the Lower Colorado River (Operations of Colorado River dams and 4.4 Plan/Change in Points of Diversion), Big Sandy River (Hwy 93 Bridge), Verde River (Mingus Ave. Bridge), Tonto Creek and Salt River (raising of Roosevelt Dam) in Arizona and Lake Isabella, California (operation of dams).

Much of the increase in the flycatcher˜s numbers in central Arizona and the subspecies range can be attributed to the rapid growth at Roosevelt Lake; however, much of that occupied habitat is expected to be lost in the future due to inundation. Reclamation consulted on the new area of inundation around the perimeter of Roosevelt Lake as a result of raising the dam (Service 1996). The Service˜s biological opinion provided to Reclamation authorized the incidental take of 45 pairs (or 90 flycatchers) around the perimeter of Roosevelt Lake. However, an additional 96 territories were found at Roosevelt Lake by 2001. This totals 141 territories, representing 14 percent of all territories in the subspecies range and 40 percent of all known territories in Arizona. Nearly all are located in the center of the conservation pool surrounded by the area consulted on by Reclamation, but not addressed by that consultation. Thus, the first large storm runoff that enters Roosevelt Lake is expected to inundate large areas of habitat used by breeding flycatchers. The Service˜s Arizona Ecological Service Field Office is currently working on a biological opinion for the Salt River Project Habitat Conservation Plan (HCP) (the HCP can be found at http://arizonaes.fws.gov/).

The complete inundation of the occupied breeding habitat at Roosevelt Lake and future uncertainty of re-colonization rate or frequency, could limit the remaining abundance and distribution of flycatcher territories in central Arizona (Gila, Maricopa, and Yavapai counties) to 5 along the Verde River (from 2000 surveys) and 1 along the Hassayampa River.

On the Middle Rio Grande, the following past and present Federal, State, private, and other human activities, in addition to those discussed above, have affected the flycatcher:

1. Corrales, Albuquerque, and Belen levees: These levees contribute to floodplain constriction and habitat degradation for the flycatcher. Levees at these sites contribute to the degradation of the environmental baseline by reducing the amount of suitable or potentially suitable habitat for the flycatcher.

2. Tiffany Plug Removal: This Reclamation project cut a pilot channel in the Rio Grande upstream of the bridge at San Marcial. The purpose of this project was to direct water flow through the excavation, rather than allow the water to flow into the adjacent floodplain, resulting in a straighter, narrower, deeper channel. This caused the narrowing of the river channel which reduced overbank flooded habitat needed by the flycatcher.

3. Santa Ana River Restoration Project: In August 1999, Reclamation submitted a biological assessment to the Service to proceed with 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 is currently under construction and involves components such as, a Gradient

Restoration Facility (GRF), channel re-alignment, bioengineering, riverside terrace lowering, and erodible banklines. The primary component of the Santa Ana Restoration Project is a GRF which will provide control of the 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 involves moving the river away from the levee system and over the grade control structure. This activity 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 banklines are also involved to assist in establishing the new channel bank and re-generating native species vegetation in the floodplain.

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

   Measures were implemented to minimize impacts on the flycatcher and their associated habitats and to enhance local riparian conditions. These environmental actions included: Adding sinuosity to the temporary channel; constructing the channel with variable width; constructing low water crossings along the temporary channel to allow overbank flows to inundate existing native riparian vegetation and encourage native revegetation; a channel widening project in the southern reach of the Refuge to improve aquatic and riparian habitat; and creation of an inflow channel to a portion of the eastern floodplain north of Black Mesa to encourage sediment deposition and new habitat creation.

5. Creation of a Conservation Pool for Storage of Native Water in Abiquiu and Jemez Canyon Reservoirs and Release of a Spike Flow: This Corps project created space (100,000 af) in Abiquiu and Jemez Canyon Reservoirs 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.

6. Bosque del Apache National Wildlife Refuge Conversion of Saltcedar to Native Habitats: The Refuge completed an intra-Service section 7 consultation in April 2000, on converting 1,845 acres of homogenous saltcedar *(Tamarix ramossima)* and mixed saltcedar/native bosque vegetative communities on the Refuge to native riparian, wetland, and agricultural habitats. The proposal includes restoration of flycatcher habitat in the southern portion of the Refuge. The proposed restoration encompasses two to three areas of riparian/wetland habitat, each 60 acres or larger in size, to be restored to suitable native flycatcher breeding habitat.

7. Programmatic Biological Opinion on the Effects of Actions Associated with the U. S. Bureau of Reclamation˜s, U.S. Army Corps of Engineers˜, and non-Federal Entities˜ Discretionary Actions Related to Water Management on the Middle Rio Grande: The Service completed this biological opinion on June 29, 2001, determining the effects of water management by the applicants on the silvery minnow and flycatcher. This biological opinion had one RPA with several elements. These elements described habitat improvements necessary to alleviate jeopardy to the flycatcher.

8. 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 are being 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.

9. Biological Opinion and Conference Report on U.S. Bureau of Reclamation˜s Amended Water Management Operations on the Middle Rio Grande through December 31, 2002: On August 30, 2002, Reclamation submitted a request for reinitiation because they could not meet the flow requirements of the June 29, 2001, biological opinion. The Service completed this biological opinion on September 12, 2002, determining the effects of water management by the applicants on the silvery minnow and flycatcher. This biological opinion was an amendment to the June 29, 2001, programmatic biological opinion, which addressed Water Management Operations on the Middle Rio Grande through 2003. The amendment covered Reclamation˜s water management actions through December 31, 2002. The biological opinion had no RPAs. However, because of cool fall weather and early precipitation, the programmatic biological opinion of June 29, 2001, remained in effect. Note: This biological opinion was never implemented, therefore it did not affect the baseline for the species.

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

The flycatcher recovery plan identifies five Recovery Units, the Basin and Mojave, Lower Colorado River, Upper Colorado River, Gila River, and Rio Grande. Flycatcher populations are not distributed evenly throughout these Recovery Units, with the majority of individuals found in the Coastal California, Lower Colorado, Gila, and Rio Grande Recovery Units (Appendix E, Table 1).

The Rio Grande Recovery Unit contains the eastern most population of flycatchers, and currently has 15 percent of known territories. Rio Grande Recovery Unit covers a major portion of the flycatcher˜s previous range. In order to be well protected against disease and catastrophe, the species should be well distributed geographically. The survival and recovery of the flycatcher is dependent on healthy, self sustaining populations of birds, which are able to exchange genetic information on occasion, and act as a source population should one area suffer significant losses (Soule 1986). The loss or reduction of a major population within a Recovery Unit could have potentially significant effects to the surrounding Recovery Units if genetic information is lost or if a source population which has been supporting other sites is significantly reduced.

Summary

The flycatcher˜s distribution and numbers have declined as a result of habitat loss, modification, and fragmentation. Known number of flycatcher pairs have increased throughout its range since the bird was listed in 1995, but still remain within the 500 to 1000 pairs estimated by Unitt (1987) (Appendix E, Table 1). Approximately half of all the known breeding pairs are found at three locations throughout the subspecies range (Cliff/Gila Valley, New Mexico, Roosevelt Lake and Gila/San Pedro river confluence, Arizona). Water diversions, agriculture return flows, flood control projects, development, livestock grazing, and changes in annual flows due to off stream uses of water have affected the ability of the aquatic habitats to support native fish, plants, and wildlife. Riparian habitats by nature are dynamic, with their distribution in time and space governed mostly by flood events and flow patterns. Current conditions along southwestern rivers and streams are such that normal flow patterns have been greatly modified, catastrophic flood events occur with greater frequency as a result of poor watershed conditions, stream channels are highly degraded, floodplains and riparian communities are reduced in extent, wildfires in riparian habitats are increasing, and the species composition of riparian communities are modified with exotic plant species. Habitat loss and fragmentation leads to increased brood parasitism and nest predation. These conditions have significantly diminished the potential for southwestern rivers and streams to develop suitable habitat for the flycatcher and for those habitats to remain intact and productive for nesting flycatchers.

IV. Effects of the Action

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that 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.

The primary effects of the proposed action on both the silvery minnow and the flycatcher are related to the management of flows in the Rio Grande. The proposed action is to manage water, in light of current drought conditions, in the most effective and efficient manner without precluding water management options in the future should drought conditions persist. Reclamation has estimated that due to the expected continuation of drought conditions, the proposed action will dewater a minimum of 105 river miles from May through early November in most years of the proposed action. Approximately 50 miles of stream would dry in the San Acacia Reach, approximately 40 to 50 miles would dry in the Isleta Reach, and about 6 miles is predicted to dry in the Angostura Reach. However, the Service estimates that 66 miles will dry in the San Acacia Reach and that 50 miles will dry in the Isleta Reach. In the Angostura Reach, it is expected that outflow from Albuquerque˜s WWTP would keep approximately nine miles of the river wet, down to the Isleta Diversion Dam. The amount of river dewatering after October 1, depends on precipitation and the ability of the action agencies to lease available supplemental water.

The actual number of river miles dewatered, the frequency and duration of drying events, and the number of years within the 10-year life of the proposed action in which major drying events occur are dependent on many variables in addition to the proposed action, including precipitation and other climactic conditions, the ability to store water in upstream reservoirs, and the availability of supplemental water for leasing. As of early March 2003, the State of New Mexico was experiencing drought conditions statewide affecting future spring runoff, soil moisture conditions, and streamflow outlooks. The long-term moisture deficits have led to extremely low soil moisture conditions that will significantly decrease spring runoff (Natural Resources Conservation Service 2003a). Forecasts predict that streamflow in the Rio Grande will be 61 percent of normal into Cochiti Lake and 53 percent of normal into Elephant Butte Reservoir (National Weather Service and Natural Resources Conservation Service 2003, Natural Resources Conservation Service 2003c). ™At an expected 65 percent runoff prediction, it will take more than several years to restore the normal lake level of nearly one million af or better in the [Elephant] Butte [Reservoir] (Natural Resources Conservation Service 2003a).š In Attachment C of the March 2002 Amendment to the Biological Assessment for the Rio Grande and LFCC Modification, Reclamation states that it would take 25 years of 100 percent normal runoff to bring Elephant Butte Reservoir up to full capacity. On the other hand, it would take 3 years of 200 percent of normal runoff to achieve the same goal (Reclamation 2002a).

There is evidence to support that Pacific Decadal Oscillation (PDO) cycles, a measure of sea surface temperatures in the northern Pacific Ocean, mimic precipitation levels in the Southwest, specifically New Mexico (Liles 2000a, 2000b). The previous positive cycle (i.e., high levels of precipitation in New Mexico) occurred from 1977 to the late 1990s (Liles 2000a). Data indicate that the PDO cycle has been negative since 1998, suggesting the beginning of a long term dry precipitation cycle in New Mexico (Liles 2000a). Since 1998, long term precipitation affecting the hydrologic cycle has run in deficit. ™The data would suggest, during an average 10-year period during the negative part of this [PDO] cycle, there would be 5 dry years, one wet year, and four normal years (Liles 2000a).š Overall, below average precipitation levels are expected to continue until at least 2010 and possibly until 2025 based upon this PDO cycle (Liles 2000a, 2000b). Consequently, it is reasonable to expect that over the next several years New Mexico will experience, at best, one wet year and several dry or average years, indicating that intermittency in the Rio Grande will most likely continue.

Changes in precipitation can have a disproportionate (e.g., nonlinear) change on streamflow in the Rio Grande and even small decreases in precipitation over the next ten years may lead to more drastic declines in discharge than are currently expected. Because of the current drought, the predicted below average years of precipitation until 2010 to 2025, and the disproportionate effect that low precipitation can have on discharge in the Rio Grande, it is possible that Article VII could be in effect for the duration of this proposed action (R. Schmidt-Peterson, New Mexico Interstate Stream Commission [NMISC], *pers. comm.* 2003). According to Reclamation, the NMISC and the New Mexico Drought Monitoring Workgroup (DMWG), it would take a well-above average amount of snowmelt runoff this winter to increase the amount of Rio Grande Project storage significantly enough to lift the Article VII restriction this year (Reclamation 2003, NMISC and DMWG 2003). This has not occurred. Under Article VII, native water cannot be stored if less than 400,000 af of usable Rio Grande Project water is available at Elephant Butte and Caballo Reservoirs. Under these conditions, it is expected that the snow melt hydrograph will peak higher but will be of shorter duration than if the water was being stored and released in a controlled manner (Reclamation 2003). Consequently, it is expected that river drying will occur earlier in the year and last for a longer period of time than when the peak flow is created from reservoir releases and is lower in magnitude but longer in duration (Reclamation 2003). Lack of water storage in the reservoirs will limit management options for the release of water for the benefit of silvery minnow.

Based on these climate factors and the potential for continued restrictions associated with Article VII of the Rio Grande Compact, it is the Service˜s opinion that ™wetš or even ™averageš hydrologic scenarios resulting in year-round continuous flows in the Middle Rio Grande are unlikely for most years of the 10-year proposed action. Although one wet year and four average years of precipitation would be expected during a ten-year cycle, the lingering effects of the current drought and the Article VII restrictions currently in place will likely result in mostly dry hydrologic years. Thus, the following effects analyses are based on the likelihood of having ™dryš hydrologic scenarios in most years of the proposed action.

Rio Grande Silvery Minnow

Direct Effects

During drought conditions, the proposed action is likely to impact a significant portion of the remaining wild population of silvery minnows in the Middle Rio Grande. Although river drying could occur absent the proposed action, it is likely to occur sooner and over a greater area as a result of the proposed action. Based on the Service˜s analysis of the proposed action, without precipitation or supplemental water, the proposed action will dewater approximately 62 percent of the currently occupied habitat. This conclusion is based on the fact that since the mid-1990s, silvery minnows have only been collected in the Angostura, Isleta, and San Acacia Reaches of the Middle Rio Grande. Silvery minnows have not been collected in the Cochiti Reach since 1994 (Platania 1995). There has not been access to the Pueblo/Tribal lands north of the Angostura Diversion Dam to permit adequate sampling. Silvery minnows are assumed to exist within this short reach of river (22.9 river miles); however, no recent information is available to determine the exact status of the species in the Cochiti Reach. All recent available information on the silvery minnow population is from the Angostura, Isleta, and San Acacia Reaches, where the fish will be more adversely affected under the proposed action than the Cochiti Reach. Although there are no definitive population estimates for the silvery minnow, it is estimated through long-term population monitoring, that the majority of the silvery minnow population has persisted below San Acacia Diversion Dam (Dudley and Platania 2002). However, due to intensive salvage efforts in the San Acacia Reach and augmentation efforts in the Angostura Reach, it is unknown if this is still the case. It is in the San Acacia Reach that the most extensive drying is predicted to occur.

If the current drought continues as predicted, it is highly likely that extensive river drying will occur during the 2003 irrigation season, and possibly in 2004, and beyond. Stream drying causes direct mortality to silvery minnow when the pools in which they are trapped dry up. Like most living organisms, silvery minnow depend on oxygen to live. The oxygen they depend on is dissolved in the water. If the water dries up, the fish suffocate because they cannot use oxygen present in air. Silvery minnow are unable to burrow and cannot find refuge in the substrate. Mortality can occur before complete drying of the pools if the combination of dissolved oxygen level (too low) and water temperature (too high) becomes lethal. Changes in pH, salinity, carbon dioxide, and ammonia levels can make the fish more vulnerable to changes in dissolved oxygen or can be lethal on their own. Fish trapped in pools are easy prey for both terrestrial and avian predators and may also be eaten by predatory fish if they are trapped in the same pool (Tramer 1977).

It is difficult to predict the exact duration of channel drying or its extent. The longer the period of intermittency and the greater the extent, the greater the magnitude of impact on the silvery minnow population. It is reasonable to predict that drying will occur after spawning. Consequently, all of the larval fish, and eggs that are not collected, will die in reaches that dry. Because silvery minnow are pelagic spawners and the eggs and larvae are carried downstream, drying of the Isleta and San Acacia Reaches will effectively eliminate recruitment in these reaches in years that these reaches dry completely. Typically, eggs and juvenile fish are more vulnerable to environmental extremes than adults (Hoar and Randall 1969). Consequently, drying events that occur after the spawn can potentially have a great impact on the reproductive success of the silvery minnow. Mortality of YOY is often high but with the added stress of environmental extremes, we predict that mortality of eggs and larvae trapped in isolated pools will be even higher than under natural conditions. Because the silvery minnow is a short-lived fish, poor reproductive success of one year class can have an impact on the population. When two below-average flow years occur consecutively, a short-lived species such as the silvery minnow can be impacted, if not completely eliminated from the dry reaches of the river (Service 1999). If there are consecutive years of intermittency with reduced recruitment, the wild population can soon be reduced to low levels

Silvery minnow eggs and larvae are semibuoyant and are carried in the current. Although eggs will be captured for captive propagation efforts, a proportion of eggs and larvae will be entrained in diversion canals and into Elephant Butte Reservoir. The eggs and larvae will die in the reservoir from predation and lack of appropriate habitat. The degradation of silvery minnow habitat, which has led to a narrowing of the channel and lack of slack and back water habitats, results in fewer eggs and larvae being retained in the river and a greater proportion being transported into Elephant Butte Reservoir. Eggs, larvae, and adults that are entrained into diversion canals may die when they are carried in irrigation water onto agricultural fields. Individuals that do survive in the canals are isolated from the population in the river and are unlikely to contribute to the viability of the species (Smith 1999a).

Indirect Effects

The indirect effects of intermittency on silvery minnow have not been investigated but based on knowledge of stream ecology and fish biology, several indirect effects can be predicted. It is more difficult to predict how many silvery minnow may die or be harmed from indirect effects. Fish typically function best within a relatively narrow range of water quality characteristics such as water temperature, pH, dissolved oxygen, and salinity. When fish are subjected to conditions outside their preferred range it causes physiological stress (Schreck 1990). The longer the fish is subjected to unfavorable conditions the greater the stress (Barton *et al.* 1986). Consequences of physiological stress are typically a decrease in fitness (lowered reproductive success)(Donaldson 1990) and an increased susceptibility to disease (Anderson 1990). Fish can be afflicted by viral, bacterial, and fungal infections and internal and external parasites. Disease can cause death or lead to decreased fitness. When fish are trapped in isolated pools and the water quality of the pools deteriorates, the fish become increasingly stressed. If continuous flow is restored before the fish dies, the fish may survive but eventually succumb to disease or produce fewer (or smaller) eggs as a consequence.

In a flowing river, food resources and nutrients are carried downstream continuously (Allan 1995). When the flow is interrupted, this transport of material is stopped. Nutrient cycling and nutrient spiraling systems are disrupted (Stanley *et al.* 1997). How long it takes for the system to regain its equilibrium is unknown. Possible consequences of this disruption of nutrient cycles are changes in the amount and quality of food available to silvery minnow. If less food is available or if it is of lesser quality it could affect the growth, condition, and fitness of silvery minnow. Consequently, fewer, or smaller (less fit), eggs may be produced. If intermittency occurs several years in a row, the net effect would be the production of fewer silvery minnow.

It is anticipated that salvage of silvery minnows will occur once intermittency begins. It is unknown what effect salvage operations have on silvery minnow survival. Salvage operations begin once the fish are trapped in isolated pools. Water quality conditions in isolated pools can deteriorate quickly, stressing the fish. The fish are then seined, handled, transported, and introduced into a new location in the river. Sigismondi and Weber (1988) found that handling lengthened the time required for chinook salmon to seek cover and that each successive handling experience added to the time needed to reach cover. Although cyprinids in general are a hardy fish, it is how the stress of salvage operations affects the survival of silvery minnows released into a new location in the river.

Since 1996, silvery minnows have been salvaged during drying events and transported to flowing water in an attempt to minimize mortality. Significant steps have been made within the last 7 years to improve the survivability of salvaged silvery minnows during collection, transport, and release (Smith and Muúoz 2002). Beginning in 1998, the Service developed and has followed specific protocols for handling and transporting silvery minnows during river intermittency and other salvage operations (J. Smith, Service, *pers. comm.* 2002). Since that time, refinements in silvery minnow salvage and rescue protocol have reduced handling and transport mortality (Smith and Muúoz 2002). The survival rate for salvaged silvery minnows released into a new location in the river is unknown. The Service has improved, and will continue to refine, salvage and handling techniques to increase survival rates up to the point at which the silvery minnows are released. The survival of silvery minnows that have been salvaged and released into the river will be investigated.

Survival of silvery minnows in captivity after handling was documented in 2000 and 2001. In 2000, two sampling events to collect adult silvery minnows for captive spawning occurred during the spring. During these two events, the Service, in conjunction with the City, collected approximately 198 adult silvery minnows during low flows near San Marcial. Due to unavoidable circumstances during the first collection event, collections were made in the mid-morning (J. Smith, Service, *in litt.* 2000). Air Temperature was approximately 30 ^{1}C and water temperatures ranged from 16 to 20 ^{1}C (J. Smith, Service, *in litt.* 2000). Even under these harsh collecting conditions, silvery minnow experienced no initial mortality. After time, about 5 percent of the silvery minnows in captivity perished and that mortality was likely a result of the induced spawning (C. Altenbach, City, *pers. comm.* 2002).

In June of 2001, an attempt to salvage YOY silvery minnows was made by the Service. Approximately 5,000 YOY silvery minnows were captured near San Marcial and transported to the NMFRO propagation facility. Handling protocol was strictly followed during this salvage attempt; however, these fish experienced high mortality levels (J. Brooks, Service, *in litt.* 2001). No cause of the high mortality rate was determined. It was speculated that collection conditions and post-handling effects caused the high mortality. Young fish are not as resistant to stress as adults and that may have been a factor in the high mortality rate. Mortality can be decreased when moving YOY by using oxygenated plastic bags, rather than the large distribution truck used in 2001.

In the worst case scenario, the primary source of persistent water in the lower portion of the Angostura Reach may be from effluents from WWTPs and from irrigation return flow. These sources of water will be of a lesser quality than would be found in a fully connected, flowing river. Unless a spill of toxic material or a peak in ammonia or chlorine discharge happens to occur at the time when silvery minnow are depending on these water sources, it is unlikely that direct mortality will occur due to decreased water quality. However, because of the higher levels of nutrients, total dissolved solids, heavy metals, semi-volatile compounds, volatile compounds, pesticides, and other compounds found in sewage effluent, it is likely that these multiple compounds may cumulatively have a negative impact on the health, fitness and condition of the silvery minnow living in this water (Beyers *et al.* 1999, Buhl 2002)

Because conditions in the river below the Isleta Diversion Dam are expected to be unfavorable for the survival of silvery minnow, more effort is being placed on the capture of eggs for captive propagation. Great care needs to be exercised to maintain as much genetic diversity as possible within the population, as dependence on captive propagation increases. The silvery minnow population currently occupies about 5 percent of its former range. Within this limited range, monitoring indicates that the population has declined over the past several years (Dudley and Platania 2002) and other research indicates that the net effective population size (the number of individuals that contribute to maintaining the genetic variation of a population) is approximately 60-250 fish (T. Turner, UNM, *pers. comm.* 2003). The population is likely at the lowest level recorded. A severe reduction in population size is called a ™population bottleneckš (Avise 1994). The consequence of a population bottleneck is that it can greatly depress the amount of genetic variability available for future generations (Avise 1994). The silvery minnow selected for the broodstock are coming from a smaller gene pool than once existed. The consequences of this for the long-term viability of the population are unknown.

The location and timing of egg capture, and method of rearing can all affect the genetics and long-term effectiveness of captive propagation. Currently egg collection efforts are concentrated during one time (peak spawn in May), in one location (San Acacia Reach), and target a portion of the water column (upper two feet [61 cm]). By concentrating the egg collection effort in this manner, eggs from a limited number of females may be collected for propagation. Evidence suggests that silvery minnows also spawn during monsoonal peak flows Smith (2002). Because eggs for propagation have been collected only during the peak spawning period, managers may be selecting for fish that only spawn in a narrow time frame. This could lead to propagated fish that have less reproductive plasticity. In addition, eggs and larvae that are produced during monsoons will likely perish during subsequent river drying, possibly eliminating from the gene pool the gene(s) that trigger fish to spawn over an extended time frame.

Because the number of wild silvery minnows is currently at the lowest level recorded, captive reared fish can influence the population genetics of the silvery minnow because of the large number of fish that are being augmented. Wild habitats and hatcheries differ in many ways, including food, temperature, light, substrate, flow regime, and environmental stimuli. Fish that survive in a hatchery may not survive well in the wild. As Minckley (1995) pointed out there is a distinction between the ™prevention from extinctionš and the ™maintenance of evolutionary potential.š The latter considers the long term future of the species and its ability to evolve to changing conditions. While captive propagation may ensure the short term survival of silvery minnow, the long term effect of the program is unknown, and data are still being collected.

Effects on Designated Critical Habitat

The proposed action will adversely affect three of the four primary constituent elements of designated critical habitat for the silvery minnow. These three elements require water to provide the essential habitat necessary to ensure the conservation of the silvery minnow. The first primary constituent element provides water of sufficient flows to reduce the formation of isolated pools. The second primary constituent element provides low velocity habitat necessary for the development and survival of silvery minnow larvae. The fourth primary constituent element provides protection from degraded water quality conditions, such as, the increasing water temperatures, pH, or decreasing dissolved oxygen found in isolated pools during river drying events (Service 2003).

As described in Reclamation˜s biological assessment, at least 105 river mi (169 km) will be dewatered out of the 157 river mi (252 km) proposed as critical habitat. This means that at least 67 percent of designated critical habitat will lack 3 of the 4 primary constituent elements that provide the essential habitat necessary to ensure the conservation of the silvery minnow. Furthermore, the effects of this action may not be readily apparent or quantifiable within the duration of this action and may extend beyond rewetting of the designated critical habitat. Such effects may include, but are not limited to: Reduction in the productivity of the dewatered and rewet reaches, which may limit or reduce food for the silvery minnow; alteration or elimination of debris piles or other habitat structures necessary to the silvery minnow during the winter; and possible lowering of the ground water table, necessitating increased quantities of water for rewetting the dewatered reaches and recovery of continuous flow.

Encroachment of non-native vegetation, such as Russian olives and salt cedar, into the river channel and resultant channel narrowing can be additional indirect effects of river dewatering on designated critical habitat. Such channel narrowing can cause downcutting and limit overbank flooding, reducing the potential for recruitment of native riparian vegetation, especially cottonwoods and willows (Reclamation 2003). Overbank flooding is needed to create shallow, low velocity backwaters that are a component of silvery minnow critical habitat. Channel narrowing by encroachment of non-natives would reduce both the quantity and quality of silvery minnow critical habitat.

Southwestern Willow Flycatcher

Effects to the flycatcher are addressed in the following pages by first analyzing the impacts to the known 2002 territories, and second the effects to the riparian system along the Rio Grande. It should be noted, that given the life span for this consultation, the indirect effects (effects to the riparian system) will most likely be highly significant and will not be measurable until a few years into the consultation period.

Direct Effects

The proposed action is likely to contribute to river drying in 43 active flycatcher territories. Because drying is likely to occur early in the breeding season, flycatchers using those territories will be forced to seek alternative sites for territory establishment. If flycatchers do not abandon territories that have dried, food availability may be limited, thereby reducing nesting success. In addition, drying of large portions of the Rio Grande for prolonged periods is likely to result in reduction of suitable flycatcher habitat within the Rio Grande Recovery Unit (as designated in the Southwestern Willow Flycatcher Recovery Plan).

Under Reclamation˜s proposed action, drying could occur as early as late April or early May. This time period can be critical to flycatchers attempting to establish territories and nest sites. For flycatcher territory selection, a number of habitat characteristics have been identified as important factors (Service 2002a). One of these factors is the availability of standing water, and/or moist soils, during the breeding season. If nest sites are dry early in the breeding season, those sites may be abandoned before completion of the breeding cycle (Johnson *et al.* 1999). If flycatchers do establish territories and insect availability is reduced due to drying, then reduced food supply may force egg abandonment or chick starvation. Incubation of eggs requires that the male flycatcher feed the female on the nest for much of the day and provide sufficient food for the incubating female and for himself. After eggs hatch, energetic requirements increase, as both adults must feed the young. Feeding demands from the young increase for the first week after hatching, then decrease until fledging at approximately day 12 (Sedgwick 2000).

If occupied sites become less desirable due to river drying, and there is no suitable habitat nearby, the birds in those sites may be forced to disperse in search of new territories, which may expose individuals to increased predation as they navigate through new areas. Additionally, the increased energetic cost of locating and traveling to suitable habitat may impact the fitness and reproduction of adult flycatchers. If individuals do find suitable habitat, it is likely that the new site will be colonized by only one, or few, individuals. Sites with few individuals are more susceptible to extirpation (Gilpin and Soule *in* Soule 1986). Since 1993, 65 of the 221 known Flycatcher breeding sites have been extirpated and 63 of those 65 sites were occupied by fewer than 5 individuals (Sogge *et al.* 2002).

Flycatchers may also abandon sites if they are dry in May and early June, during the birds˜ pair bonding and early nesting chronology (Johnson *et al.* 1999). Once flycatchers have invested their energy laying eggs (usually in early June along the affected reaches of the Rio Grande), the birds would most likely attempt to incubate those eggs and raise the young. Lack of water in established territories may reduce insect populations, limiting food supplies needed to produce eggs or feed young and potentially reducing fledgling success. Such an event occurred in 1996, when the San Marcial area was dry in April and remained dry until late June. Based on surveys, only one nesting attempt was located and it failed (Johnson *et al.* 1999).

Diversion of native flows into irrigation canals will alter the distribution of water in the river. Flycatcher territories that are below the diversion dams and upstream from irrigation returns (n = 35) would be the most severely affected by drying (Appendix E, Table 10). However, flycatchers that reside below the irrigation returns (n = 18) would be negatively affected by the lack of irrigation return flows if irrigation terminates during the breeding season. If irrigation season is shortened significantly and return flows cease in May, then the flycatchers may abandon territories and any reproductive effort would be lost.

The severity of drying in established territories is dependent on when the site dries (the date when soils are no longer saturated) and the number of breeding seasons the drying is repeated. Territories in the Isleta and San Acacia Reaches (Belen, Sevilleta/La Joya, San Acacia to the Refuge, and Refuge sites listed above) would be most severely impacted by the proposed action because these reaches are affected by the Isleta Diversion Dam and San Acacia Diversion Dam, where irrigation flows are diverted from the river. Of particular concern are the sites located in Sevilleta National Wildlife Refuge (SV-09) and La Joya State Wildlife Refuge (SV-03), which in 2002 produced 13 nests in 12 territories. These sites could be subjected to drying during the life of the proposed action.

In 2002, there were four territories identified in the reach from San Acacia to the Refuge (LF04, LF-08, LF-33, LF-43a) and three territories identified near the northern Refuge boundary (BA-06N). These seven territories were thought to be occupied by single males, were located along the river, and would be subject to drying under the proposed action. We anticipate that drying in these areas is likely to render the habitat unsuitable for breeding (as described above) and may induce these individuals to seek alternative breeding locations.

In the San Marcial Reach (south boundary of the Refuge to the headwaters of Elephant Butte Reservoir), 62 territories were located in 2002. Two sites (LF-22 and LF-21) relocated just south of the Refuge boundary along the river and consisted of 3 territories and one nesting attempt that apparently failed. These sites were located just downstream from the South Boundary Pumps, which are used to pump water from the LFCC back into the Rio Grande. In 2003, under the proposed action, these pumps will likely be shut off by June. These sites may dry if pumping is discontinued.

Of the 62 territories found in 2002, between the south boundary of the Refuge and Elephant Butte Reservoir, the 19 territories located along the Rio Grande (LF-12,14,16, 18, 21, 22, 31, and DL-3) are likely to be subject to drying in the early part of the breeding season, increasing the potential of nest abandonment, and increasing energetic costs to adult flycatchers as they search for new territories. Increased energetic costs and susceptibility to predation may result in mortality or decreased reproductive success.

The biological assessment states that the territories along the LFCC will not dry, and that the flycatcher territories supported by the breach in the LFCC will not be adversely affected. We agree with this determination. The potential for the LFCC to go dry is remote and is therefore discountable. Should the LFCC become dry (cfs = 0 at the breach above LF-17) at any time during the life of the proposed action, Reclamation shall reinitiate this consultation.

Indirect effects

Indirect effects from water operations include reduction of suitable habitat along the Rio Grande during the 10-year life of the project and beyond. Flycatcher habitat is ephemeral. Areas which are currently occupied may not be suitable in future years as the trees mature and the habitat begins to thin. Having areas of riparian vegetation along the Rio Grande that are maturing into suitable habitat while other areas are reaching a maturity level that makes them unsuitable for flycatchers is crucial to the long-term survival of the species. River drying in May and June in any year of the proposed action may kill riparian vegetation that currently supports flycatcher territories. Drying may also kill vegetation that has the potential to become suitable habitat. Reductions in overbank flows, as described in the biological assessment, will likely reduce the quantity and quality of suitable flycatcher habitat along the Rio Grande. Without sufficient overbank flooding, flycatcher habitat development in the Rio Grande could be severely limited even beyond the life of the project. The degree to which flycatcher habitat is reduced will depend on several variables, including the amount dried, the length of time they are dry, and the number of years in which these drying events occur. The reduction in suitable habitat available to the flycatcher could, in turn, limit the potential for population growth in the Rio Grande or reverse current positive population trends.

Lack of overbank flooding in spring, lack of sediment for seed germination, and water management between Cochiti Lake and the headwaters of Elephant Butte Reservoir have resulted in a monotypic age-class structure of native vegetation, particularly older cottonwood trees, and increased encroachment of exotic plant species, such as saltcedar and Russian olive (Howe and Knopf 1991, Crawford *et al.* 1993). Furthermore, the lateral extent of suitable habitat for the flycatcher is constrained by water operations that limit overbank flooding to sites located close to the river˜s edge, resulting in a relatively narrow strip of suitable nesting habitat for flycatchers. The narrowness of suitable riparian vegetation increases the risk to flycatchers of adverse effects from flooding, predation, parasitism, and other disturbances. Stromberg (1993) found that the width of riparian vegetation communities and their biomass increases with mean and median annual flow volume and drainage size in alluvial river channels. The flycatcher depends on large patch sizes of riparian vegetation with adequate insect food supply in July, August, and September to raise young.

El Vado Reservoir Storage

With Article VII in effect, only water for the six Middle Rio Grande Pueblos can be stored in El Vado. The spring runoff will be allowed to flow down the Rio Chama and Rio Grande to

Elephant Butte Reservoir. In theory, this restriction in storage could have a beneficial effect to flycatcher habitat along these rivers since more overbank flows would be expected during the spring runoff. Irrigation diversions, however, are not constrained by Article VII; under Article VII, storage water for non-pueblo irrigation may not be available. Therefore, it is likely that the amount of water diverted at the various irrigation diversion dams will be maximized to take advantage of water when it is available. In years when spring runoff is high, the effects of irrigation diversions may not be significant. In such years, sufficient overbank flooding will occur below the irrigation diversion dams; however, during years when there is little runoff, the irrigation diversions may appreciably reduce runoff flows, including elimination of overbank flows.

When Article VII is not in effect, storage of native water in El Vado Reservoir typically occurs during spring runoff and summer rain events. This storage results in a decrease in the amount of water that is passed through Abiquiu Reservoir and Cochiti Lake to the Middle Rio Grande below Cochiti Dam. Depending on the amount of water already stored and the magnitude of spring runoff, El Vado Reservoir may capture part or all of the flow associated with spring runoff and rain events. For example, the volume of spring runoff on the Rio Chama in 2000, was very low due to drought conditions. The available storage space in El Vado Reservoir was sufficient to capture all of these flows (USGS 2002b), resulting in low flows in the Rio Grande.

Spring runoff into the Rio Chama is one component of the overall runoff on the Middle Rio Grande below Cochiti Dam. Runoff into the mainstem of the Rio Grande is the other significant source of water in the river during this time period. The relative volume of spring runoff contributed by the Rio Chama and the mainstem of the Rio Grande is largely dependent on local snowpack conditions. Thus, the relative significance of runoff flows from the Rio Chama on the Rio Grande is also dependent on the volume of runoff in mainstem flows. In the last 20 years, the Rio Chama contributed about 30 œ 45 percent of runoff flows in the Middle Rio Grande each year. In years with high mainstem runoff, an increased volume of Rio Chama runoff flow could be stored without adversely impacting the flycatcher downstream. However, in years with little to no peak flow input from the mainstem Rio Grande, the impacts of storing Rio Chama runoff flows at El Vado Reservoir may be more severe.

Effects of reducing peak flows in the Rio Grande by storing native flows in El Vado Reservoir during spring runoff include: (1) Reduction in overbank flooding and associated loss of low velocity habitat used by flycatchers, and (2) continued narrowing of the Rio Grande channel downstream due to the long-term reduction in channel-forming discharge. Channel narrowing reduces the availability of shallow, low velocity habitat that is needed to create/maintain suitable flycatcher habitat. Flycatcher territories on the Rio Grande upstream of the confluence of the Rio Chama would be unaffected by operations at El Vado Dam and Reservoir.

Reduction in overbank flooding in the Rio Chama and Rio Grande, due to the storage of peak native flows in El Vado Reservoir, will adversely affect flycatcher nest establishment and the rearing and fledging of juveniles at sites throughout the action area. Overbank flooding associated with spring runoff and summer rain events is an important component of flycatcher nesting success. The presence of overbank flooding to provide low-velocity flows or standing water in flooded vegetation is a key component in the physical structure selected as nest locations by flycatchers.

Reduction in overbank flooding adversely affects the maintenance and establishment of riparian vegetation downstream. High discharges are important for the creation and maintenance of the riparian ecosystem, and specifically, migratory and nesting habitat for flycatchers. Also, the rate and timing of flows augmented by spring runoff is important to recruitment of native cottonwood and willow vegetation utilized by flycatchers for migrating, nesting, and foraging. Storage in El Vado may restrict the development of flycatcher habitat from El Vado Dam to the confluence with the Rio Grande.

Diversion Dams

When Article VII is in effect, water for irrigation will be most available during the spring runoff and irrigators will likely divert as much water as possible during this time. Diversion of water at the dams reduces the flow in the river under most operational scenarios, however, during dry hydrologic years, these reductions are more likely to result in adverse effects to flycatchers and their habitat.

Flows in the Rio Grande above the confluence of the Rio Chama are unregulated and are not significantly influenced by any Reclamation water operation. Thus, future baseline conditions and the potential effects of Reclamation˜s actions on flycatchers in the Velarde Reach will be addressed only in the context of river maintenance activities.

Corps Discretionary Actions

Flood Control Operations

When combined inflows to Cochiti and Jemez Canyon dams exceed 7,000 cfs, the Corps will only release up to 6,000 cfs from Cochiti Dam (or a combined release from Cochiti and Jemez Canyon Dams), even though the current safe channel capacity at Albuquerque is 7,000 cfs. The channel constriction (5,000 cfs capacity) at the San Marcial Railroad Bridge downstream limits the release to 6,000 cfs. This reduces the amount of overbank flooding that can occur and, thus, may reduce formation of flycatcher habitat.

Summary

The Rio Grande Recovery Unit contains the eastern most population of flycatchers, and currently has 154 (15 percent of total known) territories. The proposed action will directly affect approximately 43 territories (28 percent of territories in the Recovery Unit, and 4.5 percent of total known territories). The survival and recovery of the flycatcher is dependent on healthy, self sustaining populations of birds, which are able to exchange genetic information on occasion, and act as a source population should one area suffer significant losses (Soule 1986). The proposed action may result in a significant loss to the flycatcher population within the Rio Grande Recovery Unit. The loss of a major population within a Recovery Unit could have potentially significant effects to the surrounding Recovery Units if genetic information is lost, and a source population which has been supporting other sites, is extirpated.

The Rio Grande Recovery Unit contains approximately 154 flycatcher territories (Appendix E, Table 3). The action area for the proposed project contains 123 flycatcher territories, 99 in the Middle Rio Grande Subunit and 24 in the Upper Rio Grande Subunit. Of these, approximately 43 may be dried by the proposed action (Appendix E, Table 10). In 1996, the San Acacia Reach was dewatered beginning in April and flycatchers did not breed successfully. Flycatchers may not nest in otherwise appropriate habitat when the habitat is dewatered. When dewatering occurs, the forage base for flycatchers is reduced and the habitat may be damaged depending on the amount and extent of dewatering. When this occurs, the flycatchers may go elsewhere to nest or may not breed that year. While we do not know the impact of such temporary habitat loss on subsequent breeding seasons, if the river remained dry during consecutive years, the quality of the nesting vegetation/habitat would decline and flycatchers may abandon this breeding/nesting area. Loss of these territories means that approximately 43 percent of flycatcher territories within the Middle Rio Grande Subunit, and 28 percent of territories for the entire Recovery Unit would be dewatered, and would be vacated, jeopardizing the Rio Grande population, and thus the persistence of the species. Impacts to suitable of potential flycatcher habitat may be expected from long-term dewatering.

River Maintenance

Rio Grande Silvery Minnow and Southwestern Willow Flycatcher

All proposed river maintenance activities occur within the historic range of the silvery minnow and flycatcher. However, due to the likely extirpation of the silvery minnow upstream of Cochiti Lake and downstream of Elephant Butte Reservoir, river maintenance projects upstream of Cochiti Lake and below Elephant Butte Reservoir will not directly affect the silvery minnow. However, river maintenance projects that promote channelization in these reaches could adversely affect the flycatcher and its potential habitat.

River maintenance projects vary in duration, depending on the scope, immediate need, time of year, river flow conditions, and project location. In some cases, such as the Santa Ana Project referenced in the assessment, river maintenance projects may be completed in phases over several years. Some river maintenance projects may last only a few days. These two types of projects may affect many miles of river or only a few hundred feet.

The assessment does mention, in a broad sense, the number and location of potential river maintenance projects; however, it does not provide exact locations. The biological assessment indicates that a total of 57 projects could occur in approximately 226 river miles. The effects of each project are likely to vary. Each reach defined in the biological assessment is geomorphically and hydrologically different. Each maintenance/restoration project should be consulted on prior to construction, and should tier to this programmatic biological opinion.

As documented in the assessment, channel narrowing has occurred at an increasing rate in all reaches. There has been at least a 40 percent reduction in the active channel over the last 80 years, with the channel shrinking from 1400 feet to 600 feet in width in many reaches of the Rio Grande. It has been hypothesized that this channel narrowing has accelerated the decline of silvery minnow populations (Service 2000). Channel narrowing or channelization was a goal of many early river engineering projects. These projects were initiated in the 1930s and 1950s for flood control and improved water deliveries. Early river maintenance projects included levees, jetty jacks, rip rap, and other non-permeable engineering techniques. These and other river engineering methods are proposed in the assessment and will adversely affect the silvery minnow and its habitat and the flycatcher by reducing overbank flooding and facilitating channel narrowing.

Although channel narrowing may not be the only factor contributing to the decline of the silvery minnow in these reaches, it is one of the factors that can be addressed. Any river maintenance project that facilitates channel narrowing, such as those outlined in the biological assessment as river engineering projects, will adversely affect both the silvery minnow and flycatcher. The adverse impacts to both listed species include, but are not limited to, controlling and limiting overbank flooding, and reducing channel width and the amount of peak discharge needed to produce overbank flooding and channel widening.

Habitat restoration and bioengineering projects would have positive effects on both the silvery minnow and flycatcher. Although unequivocal analysis cannot be made on the effects of each proposed action, the general conceptual methods proposed will have beneficial effects for listed species. General improvements to the river and riparian areas by habitat restoration and bioengineering projects, planned in consultation with the Service, include the following:

› re-connectivity of floodplain to the river with overbank flows;

› improved riparian habitat with removal of invasive non-native vegetation that has been demonstrated to be unsuitable for, or unoccupied by flycatchers, in conjunction with reintroduction of native vegetation and periodic inundation of riparian areas; and

› widening of the river channel to allow active geomorphological river conditions which produce natural aquatic habitats conducive to native fish and riparian habitats.

Adverse effects of river maintenance include, but are not limited to, the following:

› localized dewatering of the river by redirecting water flows to perform necessary work may adversely affect the silvery minnow and its habitat and may adversely affect the flycatcher;

- introduction of non-native types of substrate, i.e., large boulders, rip rap, non-erodible materials, which will modify the channel making it unsuitable for silvery minnows and making the floodplain unsuitable for flycatchers;

- removal of native and some non-native species of vegetation from the action area could adversely affect the flycatcher by destroying potentially suitable habitat; and

- increased human activities in the project area during construction may adversely affect the flycatcher if construction occurs during the breeding or nesting season.

Increased human access to areas once relatively remote may adversely affect flycatchers, depending on proximity of activities and the potential for human-caused fires and wood cutting. Vandalism and human-caused fires can also increase negative impacts to native riparian vegetation. Heavy equipment use in the action area for an undetermined amount of time may impact the flycatcher if used during the breeding or nesting season. The potential exists for fuel or oil spills causing contamination in the river, adversely affecting the silvery minnow and its habitat. The construction of borrow pits and spoils will adversely affect the flycatcher if placed near potentially suitable habitat by limiting potential occupation of breeding territories.

V. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Cumulative effects include:

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

- 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 and flycatcher.

- Contamination of the water (i.e., sewage treatment plants, runoff from feed lots, dairies, and residential, industrial, and commercial development). A decrease in water quality could adversely affect the silvery minnow and its habitat.

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

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

› Private, local, and State grazing actions that create abundant brown-headed cowbird foraging opportunities, thereby increasing the likelihood of brood parasitism on local flycatcher populations.

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

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

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

VI. Conclusion

The Service has analyzed the full spectrum of water management options described in the February 19, 2003, final biological assessment, including those described in Appendices A and B. We have analyzed the threats to the species and have developed alternatives based on the biological needs of the species, independent of sources of water and discretionary authority.

After reviewing the current status of the silvery minnow and flycatcher, the environmental baseline for the action area, including current and expected drought conditions, the effects of the proposed water operations and river maintenance activities, and the cumulative effects, it is the Service˜s biological opinion that water operations and river maintenance of the Middle Rio Grande, as proposed in the February 19, 2003, biological assessment, are likely to jeopardize the continued existence of the silvery minnow and the flycatcher and adversely modify critical habitat of the silvery minnow. Critical habitat for the flycatcher is not currently designated in the action area, so none will be affected.

Silvery Minnow

The silvery minnow now occupies less than 5 percent of its historic range and the entire extant population now exists within the action area. Entrainment at the diversion dams may result in the death of silvery minnows by stranding eggs, larvae, and adult fish on irrigated agricultural fields (Service 1999, Smith 1999, Smith 1998). The diversion dams block upstream passage by silvery minnows and therefore prevent repopulation of areas upstream of the dams (Service 1999). Dam operations result in reduced sediments and water temperatures that cause habitat degradation and loss. Dewatering of river reaches traps and subsequently kills silvery minnows in isolated pools. Dewatering decreases water quality and quantity and availability of forage items and removes shelter (Service 1999). In a worst case scenario (severe drought), the majority of the Angostura, Isleta, and San Acacia Reaches could be dewatered, killing a significant number of silvery minnows. In years when Article VII is in effect, which could be most years of the proposed action (R. Schmidt-Peterson, NMISC, *pers comm.* 2003), river drying could occur to an extent that would result in the loss of all silvery minnows below Isleta Diversion Dam.

Every year since 1996, there has been at least one drying event in the river that has further reduced the silvery minnow population. During 1996, approximately 27 percent of the occupied range of the silvery minnow was dry for several days. In the San Acacia Reach, where the majority of the silvery minnow population occurred, approximately 60 œ 64 percent of the reach dried (Reclamation 2001). Although the consequences of the 1996 mortality event are unknown in terms of the total number of silvery minnows or percentage of the population that perished, the species˜ status and long-term recovery potential were adversely affected (Platania and Dudley 1999). Dead silvery minnows have been documented in a dry riverbed in 1999, 2000, 2001, and 2002 (Platania and Dudley 1999; J. Smith, NMESFO, *pers. comm.* 2002; Service 2002b).

Data collected during the summers of 2000, 2001, and 2002 indicate a near-absence of Age 0 silvery minnows in the Middle Rio Grande, suggesting that the population has dramatically decreased since 1999. There was a slight increase in silvery minnow abundance in the Angostura and Isleta Reaches in 2001; however, these slight gains were lost in 2002 (Dudley and Platania 2002). The population is unable to expand its distribution, because three diversion dams currently block upstream movement and Elephant Butte Reservoir blocks downstream movement (Service 1999). When extensive river drying occurs after the spawn, we anticipate that recruitment of silvery minnow in the Isleta and San Acacia Reaches will be eliminated.

Water withdrawals from the river and water diversions from dams may limit the survival of silvery minnows (Service 1999). The consumption of 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. However, under State law, the municipal and industrial users are required to offset the effects of groundwater pumping on the surface water system to the extent that those effects are in excess of prior appropriations, retired rights, and return flow credits permitted by the Office of the State Engineer. The City, for example, has been offsetting their surface water depletions with 60,000 af per year. The combined effect of water withdrawals and the drought mean that discharge from WWTPs and irrigation return flows will have greater importance to silvery minnow and water quality issues become increasingly important and problematic. Lethal levels of chlorine and ammonia have been released from the WWTPs in the last several years (C. Abeyta and J. Lusk, Service, *in litt.* 2003). In addition, a variety of organic chemicals, heavy metals, nutrients, and pesticides have been documented in the river and contribute to the overall degradation of water quality (Ong *et al.* 1991, Ellis *et al.* 1993, Roy *et al.* 1992, Levings *et al.* 1998).

In combination, the impacts to the silvery minnow described above are likely to jeopardize the continued survival and recovery of the silvery minnow in its entire occupied range.

Designated Critical Habitat for the Silvery Minnow

In light of current and expected drought conditions, the proposed action will adversely affect three of the four primary constituent elements of designated critical habitat for the silvery minnow. These three elements require water to provide the essential habitat necessary to ensure the conservation of the silvery minnow. The first primary constituent element provides water of sufficient flows to reduce the formation of isolated pools. The second primary constituent element provides low velocity habitat necessary for development and hatching of eggs and the survival of the silvery minnow from larvae to adult. The fourth primary constituent element provides protection from degraded water quality conditions, such as, increasing water temperatures, pH, or decreasing dissolved oxygen found in isolated pools during river drying events (Service 2003).

As described in Reclamation˜s biological assessment, at least 105 river mi (169 km) will be dewatered out of the 157 river mi (252 km) proposed as critical habitat. This means that at least 67 percent of designated critical habitat will lack 3 of the 4 primary constituent elements that provide the essential habitat necessary to ensure the conservation of the silvery minnow. Furthermore, the effects of this action may not be readily apparent or quantifiable within the duration of the proposed action and may extend beyond rewetting of the designated critical habitat. Such effects may include, but are not limited to: Reduction in the productivity of the dewatered and rewet reaches, which may limit or reduce food for the silvery minnow; alteration or elimination of debris piles or other habitat structures necessary to the silvery minnow during the winter; and possible lowering of the ground water table, necessitating increased quantities of water for rewetting the dewatered reaches and recovery of continuous flow. Because the proposed action is expected to result in a temporary loss of three of the four primary constituent elements in portions of silvery minnow critical habitat in most years of the proposed action, and possibly beyond, it is thus likely to cause adverse modification to critical habitat.

Southwestern Willow Flycatcher

The proposed action will directly affect approximately 43 territories (28 percent) in the Rio Grande Recovery Unit and 4.5 percent of total known territories for the species, and may result in a significant loss to the flycatcher population within the Recovery Unit. The loss of a major population within a Recovery Unit could have significant negative effects to the surrounding Recovery Units if genetic information is lost, and a source population which has been supporting other sites, is extirpated.

In 2002, the Rio Grande Recovery Unit contained approximately 154 flycatcher territories (Appendix E, Table 3). The action area for the proposed project contains 123 flycatcher territories, 99 in the Middle Rio Grande Subunit and 24 in the Upper Rio Grande Subunit. Of these, approximately 43 territories could be dried by the proposed action (Appendix E, Table 10). In 1996, the San Acacia Reach was dewatered beginning in April and flycatchers did not breed successfully. Flycatchers may not nest in otherwise appropriate habitat when the habitat is dewatered. When dewatering occurs, the forage base for flycatchers is reduced and the habitat may be damaged depending on the amount and extent of dewatering. When this occurs, the flycatchers may go elsewhere to nest or may not breed that year. While we do not know the impact of temporary habitat loss on subsequent breeding seasons, if the river remained dry during consecutive years, the quality of the nesting vegetation/habitat would decline and flycatchers may permanently abandon this breeding/nesting area. Loss of these territories means that approximately 43 percent of flycatcher territories within the Middle Rio Grande Subunit, and 28 percent of territories for the entire Recovery Unit would be dewatered, and could be vacated, jeopardizing the Rio Grande population. Recovery of the subspecies in the Rio Grande Recovery Unit is dependent on attainment of goals for suitable, protected habitat and number of territories within the Middle Rio Grande Subunit. Impacts to suitable and potential flycatcher habitat may be expected from long-term dewatering. Additionally, proposed water operations and river maintenance may not include a channel forming discharge to reverse incisement of the river channel. The incised channel will continue to limit the formation and maintenance of flycatcher habitat in the action area, thereby jeopardizing the recovery of the Rio Grande population.

VII. Reasonable and Prudent Alternative

Regulations (50 CFR °402.02) implementing section 7 of the ESA define RPAs as alternative actions, identified during formal consultation, that: (1) Can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency˜s legal authority and jurisdiction; (3) are economically and technologically feasible; and (4) would, the Service believes, avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

The Service has developed the following RPA to the March 10, 2003, through February 28, 2013, water operations and river maintenance proposed action that we believe will avoid jeopardy to the silvery minnow and flycatcher and adverse modification to silvery minnow critical habitat.

The Service has given careful consideration to the comments submitted by the Indian Pueblos and Tribes, as well as information provided by action agencies, the Bureau of Indian Affairs, and other interested parties. Based on all of this information, we have determined that this biological opinion and RPA is consistent with our trust responsibilities. When planning and implementing elements of the below RPA, the action agencies and the parties to the consultation should conduct such activities consistent with the tribal management plans of the Pueblos of Isleta, Sandia, Santa Ana, and Santo Domingo. Implementation of any elements of the RPA that involve access to or use of Indian Pueblo or Tribal lands requires the consent of the affected Indian Pueblo or Tribe. If the Federal agencies plan or implement elements of the RPA that may affect Indian Pueblo or Tribal trust resources, then government-to-government consultation is required.

The Service, the action agencies, and parties to the consultation have been engaged in ongoing discussions to examine all possible water management options to benefit the silvery minnow and the flycatcher. Management options available over the 10-year consultation period include limited water management options during dry years, especially during Article VII restrictions. However, water management options for stored water, supplemental water, possible silvery minnow conservation water, and examinations of diversions exist, and were analyzed and considered in determining the RPA below.

In formulating this RPA, we recognized that the Middle Rio Grande could be under restricted water conditions throughout the ten-year period of this consultation. These conditions impact the silvery minnow and flycatcher. The parties mentioned in the biological opinion have been working together to increase management capabilities to benefit the listed species. Parties to the consultation have demonstrated their willingness to seek long-term solutions to the water management challenges facing the Middle Rio Grande Basin in a collaborative manner. We welcome and appreciate the cooperative effort and commend all parties for their contributions. We have determined that there will be a significant negative impact on the listed species, however, we conclude that the following RPA will reduce the impacts to the listed species and alleviate jeopardy.

The effects of a probable long term dry period coupled with Article VII of the Rio Grande Compact create significant challenges to management of water resources in the Middle Rio Grande Basin. Without creative, intensive, and focused management, these impacts could result in the extinction of the silvery minnow and a significant reduction of the potential to recover the flycatcher. Substantial actions can be taken to remove the threat of jeopardy to the silvery minnow and flycatcher while addressing the long-term recovery needs of both species.

According to information we have cited from several meteorological and hydrologic analyses, during the majority of years over the next decade, circumstances could mimic those predicted for

2003, where either Article VII of the Compact is in place or a dry hydrologic year exists. In 2003, for example, the hydrologic expectation is that significant stretches of the Middle Rio Grande will become dry by mid to late summer whether or not water is diverted from river flow for irrigation purposes. Impacts of Middle Rio Grande Project operations have been evaluated in light of this expected drying to determine the impacts to listed species.

During dry hydrologic years or when Article VII of the Compact is invoked, most water diversions for irrigation will occur from March until June. It is expected that the overall impact of the dry year (river diversions, and the inability of non-Indian irrigators to store water upstream) may result in the river drying 30-45 days earlier than would be expected in an average or wet year when Article VII is not in effect.

The most significant concern from March until June of any given year is to ensure that a successful spawn occurs and silvery minnow eggs and larvae have a chance to develop to the sub-adult stage. At that time, the fish are more hearty and capable of capture and movement with much less impact than during the egg and larval stages. When Article VII restrictions are in place, no water can be stored except for prior and paramount water that is delivered to and used by Indian Pueblos and Tribes. The ability to significantly augment river flows from June to October may not be possible. By focusing on conservation actions such as providing water during key silvery minnow life history stages (pre-spawn, spawn, and post-spawn), we believe impacts can be minimized.

Middle Rio Grande water operations have created significant changes in the morphology of the river bed and the composition of the in-river components. The Rio Grande Silvery Minnow Recovery Plan states that the silvery minnow is most commonly collected in habitats with depths less than 8 in (20 cm) and between 12-16 in (31-40 cm) with water velocity less than 0.32 cfs and a silty sediment bottom. There are few places in the Middle Rio Grande that still provide these habitats. Water quality considerations have been overlooked in the past, but by focusing efforts on creating both quality habitats and water, increased benefits to the population will be realized. This should equate to more efficient silvery minnow conservation with the same or less water quantity.

The San Acacia and Isleta Diversion Dams are barriers (total or partial) to upstream fish movement. The natural drift of eggs and larvae downstream and over these diversion dams and the inability of adults to recolonize upstream areas effectively fragments and isolates populations in lower river reaches. By providing a mechanism for adults to move upstream without the aid of capture and relocation, we believe significant benefits to the survival of the population can occur.

The only remaining wild population of silvery minnow is in the Middle Rio Grande. The survival and recovery of the species is dependant upon management actions taken in this area as well as the expansion of the population to areas outside of this area. The reliance on a single population of silvery minnows in the wild increases the risks of long-term persistence of the species. We have stated in The Rio Grande Silvery Minnow Recovery Plan and critical habitat designation that additional populations of silvery minnow must be established. It is imperative to examine the possibility of re-establishing a population of silvery minnows above Cochiti Reservoir. We will also begin the process to re-introduce an experimental, non-essential population of silvery minnows in the Big Bend area of the Rio Grande in Texas.

It is critical to recognize the value of captive propagation, augmentation and, when necessary, rescue/salvage and movement of adult silvery minnows away from the damaging effects of river drying. The Service does not believe captive propagation is the long term operational remedy to accomplish recovery. However, these methods have withstood the test of more than100 years of implementation. Concerns regarding captive or artificial culture of fish are legitimate, but by no means unreconcilable. The primary concern is genetic stability and ensuring against the loss of potentially unknown, yet valuable genes or alleles. However, there has been considerable improvement in the established techniques of captive propagation that we believe will ensure genetic viability. The Service will investigate the survivability of both salvaged wild silvery minnows and captively propagated silvery minnows released into the wild.

In consideration of the positive benefits of using all available tools in the scientific and management toolbox; it is our opinion that the following RPA will not only remove the threat of jeopardy from the additive impacts of carrying out the proposed action during a time drought, but will begin the positive movement toward recovery that all parties to this biological opinion desire. Habitat improvement and water quality elements will alleviate adverse modification of critical habitat by preventing encroachment of salt cedar in the river channel and providing the quality of water necessary to protect the silvery minnow.

This long term biological opinion does not emphasize water alone. It provides river flows for silvery minnow spawn and larvae development, habitat maintenance and restoration, captive propagation/augmentation, and water quality protective of the silvery minnow. The combined effect of implementing all RPA elements alleviate jeopardy and adverse modification.

Reclamation is the lead Federal agency for this consultation and is representing the Corps, and the non-Federal agencies. These non-Federal agencies include the State of New Mexico and MRGCD. For the purposes of this opinion, Reclamation and the Corps are referred to as the ™action agenciesš and the non-Federal agencies are collectively referred to as ™parties to the consultation.š Indian Pueblos and Tribes within the action area did not request to be party to this consultation and are not ™parties to the consultationš in this biological opinion.

The following items are elements of the single RPA:

<u>Water Operations Elements</u>

The following elements apply in all years.

A) Between April 15 and June 15 of each year, the action agencies, in coordination with parties to the consultation, shall provide a one-time increase in flows (spawning spike) to cue spawning. The need for, timing, magnitude, and duration of this flow spike will be determined in coordination with the Service.

Rationale œ The intent of element A is to provide sufficient water for peak flows necessary to induce silvery minnow spawning. Because the silvery minnow is a short-lived fish, poor reproductive success of one year class can have a major impact on the population. If there are consecutive years of intermittency with decreased reproductive success, the population can soon be reduced to extremely low levels.

B) In coordination with the Service, Reclamation and the Corps shall release any supplemental water in a manner that will most benefit listed species.

Rationale œ The intent of element B is to provide as much habitat as possible for the silvery minnow and flycatcher. Managing available water efficiently is necessary to create habitats that allow these species to persist whenever possible.

C) Reclamation, in coordination with parties to the consultation, shall conduct routine monitoring of river flow conditions when flows are 300 cfs or less at San Acacia, and report information regularly to the Service through the water operations conference calls and meetings.

Rationale œ Having current information on the flows will allow parties to the consultation and the Service to react quickly to rapidly changing conditions on the river (such as thunderstorm events) and facilitate better coordination among agencies to prevent unexpected drying, prepare for silvery minnow rescues, and provide water to flycatcher nest sites.

D) Reclamation, in coordination with parties to the consultation, shall ensure that active flycatcher territories supported by pumping from the LFCC are provided with surface water or moist soils in the Rio Grande from June 15 to September 1. If, as a result of the proposed action, active territories are dried along the Rio Grande or irrigation drains, options for providing these territories with surface water or moist soils will be pursued and implemented if at all practicable. We anticipate that implementation of this element would not require ponded surface water throughout the entire nesting season. For example, water could be provided to a site for a few days, the water source cut off, the area allowed to move from standing water to moist soils, and the water source turned back on prior to the site drying. The practicability and methods (releases from drains, pumping, or other means) of providing water to a site will be determined through coordination with the Service.

Rationale œ The presence of surface water is considered one of the most important factors in determining suitable flycatcher breeding sites. Providing the necessary water under and around nest sites should encourage flycatchers to continue their breeding attempt. Renesting is known to *occur at numerous Middle Rio Grande sites and egg laying can continue during August. For this reason, water in proximity to territories is needed through September 1 of each year.*

The following water operations elements are designed specifically for dry, average, or wet years. For the purposes of this consultation dry, average, and wet years are defined as follows based on the Natural Resources Conservation Service˜s (NRCS) April 1 ™Most Probableš Streamflow Forecast (generally available by April 7). The hydrologic year scenario will be determined by the Service each year. The Service will coordinate with action agencies and parties to the consultation to make this determination and will consider all factors that influence runoff and streamflow, including Compact Article VI and VII restrictions. The hydrologic year is defined in this biological opinion as from the beginning of runoff in a given year to the beginning of runoff the subsequent year.

Dry year: NRCS April 1 Streamflow Forecast at Otowi Gage is less than 80 percent of average*,
Average year: NRCS April 1 Streamflow Forecast at Otowi Gage is 80 to 120 percent of average*, and
Wet year: NRCS April 1 Streamflow Forecast at Otowi Gage is 120 percent or higher of average*

* Average is defined by NRCS as being the average streamflow at the point of reference (Otowi Gage) for the 30- year period from 1971 through 2000.

Each year will be assessed individually, and the determination of the hydrologic year will be made once the April 1 forecast has been release. Additional modifications in defining a hydrologic year may be made if the May 1 forecast reflects a different reality from earlier forecasts. If additional information is needed, the Service may also request that NRCS provide a May 15 forecast to assist in the decision making process.

Because of gage error and the fluctuations in river flow, the Service recognizes the difficulties in maintaining a specific flow. Because of these difficulties, the flows might drop below that required for very short durations. These minor fluctuations may not necessarily trigger the need for reinitiation of consultation. Therefore, the action agencies and parties to the consultation, in coordination with the Service, will develop protocols and procedures for monitoring deviations from the flow requirements in this RPA for reinitiation purposes. These protocols and procedures shall be developed within 30 days of the date of this biological opinion.

Dry years and/or when storage restrictions from Article VI and/or VII of the Compact are in effect

E) Action agencies, in coordination with parties to the consultation, shall provide continuous river flow from Cochiti Dam to the southern boundary of silvery minnow critical habitat from November 16 to June 15.

F) Action agencies, in coordination with parties to the consultation, shall provide year-round continuous river flow from Cochiti Dam to Isleta Diversion Dam with a minimum flow of 100 cfs at the Central Bridge gage.

Rationale œ Elements E and F keep the river connected throughout the Cochiti and Angostura Reaches and provide at least a minimal amount of habitat for adult and juvenile silvery minnows through the summer months and will help to alleviate jeopardy. These reaches of the Rio Grande are also the focus of augmentation efforts for the silvery minnow, with over 100,000 marked silvery minnows released in the last year. Additional augmentation activities are planned for 2003 and beyond. It is essential to provide a sufficient amount of habitat to support these silvery minnows and ensure that the primary constituent elements of their critical habitat are available to sustain them in the Cochiti and Angostura Reaches. Habitat conditions that include sufficient flowing water to supply food and cover for all life stages; prevent degradation of water quality as a result of stagnation (elevated temperatures, decreased oxygen, carbon dioxide build-up, etc.); and adequate water quantity to prevent streambed dessication and the formation of management-caused isolated pools must be maintained in these reaches. Water is a necessary component for all silvery minnow life-history stages and provides for hydrologic connectivity to facilitate fish movement. It is important to provide the necessary flows and other habitat requirements for silvery minnows during pre-spawn, spawn, and post-spawn to provide for survival of breeding adults and recruitment of juveniles. Because the silvery minnow is a short-lived fish, poor reproductive success can have a major impact on the population. If there are consecutive years of intermittency with decreased reproductive success, the population can soon be reduced to extremely low levels. As a result of maintaining a continuous flow through the Cochiti and Angostura Reaches, sufficient habitat will be available to conserve and augment silvery minnow populations during dry years. The presence of surface water is considered one of the most important factors in determining suitable flycatcher breeding sites. Providing the necessary moisture under and around nest sites should encourage flycatchers to continue their breeding attempt.

G) Reclamation shall pump from the LFCC as soon as needed to manage river recession. The pumping capacity must meet or exceed the total capacity of pumps used in the 2002 irrigation season (150 cfs). Pumping shall continue when it will benefit the flycatcher and its habitats. Areas upstream, downstream, and between pumps shall be surveyed prior to intermittency for the presence of breeding flycatchers and pumping continued, if the Service determines it will benefit flycatchers. Coordination with the Service regarding managing river recession and keeping flycatcher areas wet will occur.

Rationale œ The presence of surface water is considered one of the most important factors in determining suitable flycatcher breeding sites. Providing the necessary moisture under and around nest sites should encourage flycatchers to continue their breeding attempt.

Average Years

H) Action agencies, in coordination with parties to the consultation, shall provide continuous river flow from Cochiti Dam to the southern boundary of silvery minnow critical habitat from November 16 to June 15.

I) Action agencies, in coordination with parties to the consultation, shall, from June 16 to July 1 of each year, ramp down the flow to achieve a target flow of 50 cfs over San Acacia Diversion Dam through November 15.

J) Action agencies, in coordination with parties to the consultation, shall provide year-round continuous river flow from Cochiti Dam to Isleta Diversion Dam with a target flow of 100 cfs over Isleta Diversion Dam.

K) Reclamation shall pump from the LFCC if needed to manage river recession and maintain connectivity. The pumping capacity must meet or exceed the total capacity of pumps used in the 2002 irrigation season (150 cfs). Pumping shall continue when it will benefit the flycatcher and its habitats. Areas upstream, downstream, and between pumps shall be surveyed prior to intermittency for the presence of breeding flycatchers and pumping continued, if the Service determines it will benefit flycatchers. Location of pumps and decisions regarding cessation of pumping will be made in coordination with the Service.

Rationale œ Elements H through K will provide the primary constituent elements needed to sustain the silvery minnow, which include sufficient flowing water to supply food and cover for all life stages; prevention of water quality degradation as a result of stagnation (e.g., elevated temperatures, decreased oxygen, carbon dioxide build-up, etc.); and adequate water quantity to prevent streambed dessication, and/or the formation of management-caused isolated pools. Water is a necessary component for all silvery minnow life-history stages and provides for hydrologic connectivity to facilitate fish movement. It is important to provide the necessary flows and other habitat requirements for silvery minnows during pre-spawn, spawn, and post-spawn to provide for survival of breeding adults and recruitment of juveniles. Because the silvery minnow is a short-lived fish, poor reproductive success can have a major impact on the population. If there are consecutive years of intermittency with decreased reproductive success, the population can soon be reduced to extremely low levels. As a result of maintaining a continuous flow through the Cochiti, Angostura, Isleta, and San Acacia Reaches, sufficient habitat will be available to conserve and augment silvery minnow populations during average years. This water will also provide water adjacent to flycatcher nesting areas, which is an element of their preferred breeding habitat. These flows assist in maintaining and regenerating essential riparian vegetation for flycatcher shelter, feeding, and breeding. These flows, outlined in the 2001 Biological Opinion that was affirmed by the courts, were sufficient to sustain the silvery minnow.

Wet years

L) Action agencies, in coordination with parties to the consultation, shall provide continuous river flow from Cochiti Dam to the southern boundary of silvery minnow critical habitat from November 16 to June 15, with a target flow of 100 cfs at the San Marcial Floodway gage.

M) Action agencies, in coordination with parties to the consultation, shall, from June 16 to July 1 of each year, ramp down the flow to achieve a target flow of 100 cfs over San Acacia Diversion Dam through November 15.

N) Action agencies, in coordination with parties to the consultation, shall provide year-round continuous river flow from Cochiti Dam to Isleta Diversion Dam with a target flow of 150 cfs over Isleta Diversion Dam.

Rationale œ Higher flows (Elements L through N) are necessary in wet years to allow populations of the silvery minnow and flycatcher to rebound from marginal habitat conditions maintained during dry years. It is expected that higher flows will lead to better recruitment and survival for both species because of increases in habitat availability and suitability. The relationship between increased water availability and habitat availability for silvery minnow has not yet been established. However, the silvery minnow evolved in a big river system and the flows required in wet years are lower than the mean annual monthly flows and much lower than the maximum flows that would typically occur (USGS 2002a). Higher flows will provide water adjacent to flycatcher nesting areas, which is an element of their preferred breeding habitat. These flows will also assist in maintaining and regenerating essential riparian vegetation for flycatcher shelter, feeding, and breeding. Although populations of both species may not immediately rebound, if wet years occur, we anticipate that the populations of the silvery minnow and flycatcher would respond positively based on improved habitat conditions and an increase in habitat.

O) Reclamation shall pump from the LFCC if needed to manage river recession and maintain river connectivity. The pumping capacity must meet or exceed the total capacity of pumps used in the 2002 irrigation season (150 cfs). Pumping shall continue to maintain river connectivity.

Rationale œ The presence of surface water is considered one of the most important factors in determining suitable flycatcher breeding sites. Pumping will provide continuous flow for a longer period of time leading to greater insect production, increased chick survival, and potentially the opportunity for a second brood. A connected river maintains more stable water chemistry and water temperatures leading to less stress for silvery minnow. In addition, food resources and nutrient cycles are not interrupted, leading to a more stable and less stressful environment for the fish. We would anticipate survival and reproductive success to increase.

Habitat Improvement Elements

P) Action agencies, in coordination with parties to the consultation, shall prevent or minimize destruction of potential or suitable flycatcher habitat when installing pumps or groundwater wells and coordinate with the Service prior to their installation if this action may affect flycatcher habitat.

Rationale œ Transects through, or openings in, the riparian vegetation of suitable flycatcher habitat can fragment the habitat patch, reducing its attractiveness to newly arriving flycatchers. Fragmentation can also increase the risk of predation and parasitism to nesting flycatchers by increasing access to the nest site. Suitable habitat can be destroyed or compromised by groundwater pumping through reduction in extent or health of riparian vegetation or by reducing production of insects needed by flycatchers for food.

Q) Action agencies, in coordination with parties to the consultation, shall improve gaging and real-time monitoring of water operations to provide dependable, accurate readings, including installation of gages near Los Lunas, and Highway 380, and all diversions, drains, returns and main ditches.

Rationale œ Gaging in the past has been inadequate to reliably monitor flows. As a result, flow variability has at times resulted in intermittency. There is a need for an accurate accounting of water use. This can only be accomplished if diversions, drains, and ditches are gaged.

R) Reclamation, in coordination with the Service and parties to the consultation, shall complete fish passage at San Acacia Diversion Dam to allow upstream movement of silvery minnows by 2008. Reclamation and parties to the consultation, in coordination with the Service and Isleta Pueblo, shall work to complete fish passage at Isleta Diversion Dam, located on lands owned by Isleta Pueblo, by 2013. Processes successful in achieving fish passage at San Acacia Diversion Dam should be incorporated into the construction of fish passage at Isleta Diversion Dam. A plan for monitoring the effectiveness of fish passage must be completed, funded, and implemented for each year˜s operation and maintenance. In the interim, implement all feasible short-term fish passage/river reconnectivity actions.

Rationale œ In recent years, diversion dams have resulted in restricting the majority of the population to below the San Acacia Diversion Dam. Providing fish passage will restore river connectivity above and below diversion dams, allowing silvery minnows to move upstream of diversion dams and aiding in a more even distribution of the population within the Middle Rio Grande.

S) In consultation with the Service and appropriate Pueblos and in coordination with parties to the consultation, action agencies shall conduct habitat/ecosystem restoration projects in the Middle Rio Grande to increase backwaters and oxbows, widen the river channel, and/or lower river banks to produce shallow water habitats, overbank flooding, and regenerating stands of willows and cottonwood to benefit the silvery minnow, the flycatcher, or their habitats. Projects should be examined for depletions. It is the Service˜s understanding that the objective of the action agencies and parties to the consultation is to develop projects that are depletion neutral. By 2013, additional restoration totaling 1,600 acres (648 hectares) will be completed in the action area. In the short term (5 years or less), the emphasis for silvery minnow habitat restoration projects shall be placed on river reaches north of the San Acacia Diversion Dam. This restoration will be distributed throughout the action area. Habitat restoration projects fulfilling RPA element J, from the June 29, 2001, biological opinion, shall be completed. The action agencies and parties to the consultation, in coordination with the Service, shall develop time tables and prioritize areas for restoration. Projects should result in the restoration/creation of blocks of habitat 24 hectares (60 acres) or larger. Consultation with the Service for each site will tier to this biological opinion.

Monitoring will be conducted for each project annually for 10 years in order to assess whether created habitats are self-sustaining, successfully regenerating, and are supporting the flycatcher and silvery minnow. Monitoring reports will be provided to the Service by January 31 of each year. Adaptive management principles will be used, if necessary, to obtain successful restoration of silvery minnow and flycatcher habitats. The environmental evaluation process for two projects should begin within 30 days of issuance of this biological opinion and construction should begin no later than twelve months from that date.

Rationale œ Creation of riparian habitat will help distribute and stabilize sediment and provide the low velocity, backwater habitats needed by the silvery minnow and flycatcher. Overbank flooding is necessary to sustain the native riparian vegetation and wetlands that the flycatcher requires for shelter, feeding, and breeding. The project size is derived from a flycatcher site on the Middle Rio Grande that has contained several nesting pairs in recent breeding seasons. Element S will help alleviate jeopardy to the continued existence of the species by improving existing habitat and increasing the total amount of habitat for silvery minnows. Low velocity habitat and silt and sand substrates provide food, shelter, and sites for reproduction, and are essential for the survival and reproduction of silvery minnow. This element will help alleviate adverse modification to silvery minnow critical habitat by providing for the necessary habitat components of primary constituent elements 1 and 2.

T) When bioengineering (as described in Reclamation˜s biological assessment) cannot be used in Reclamation river maintenance projects, habitat restoration will be implemented to offset adverse environmental impacts resulting from river alteration. Habitat restoration efforts should replace the ecological functions and values of the affected area, both temporally and spatially. A restoration plan, to be approved by the Service, should be produced for each restoration site that includes (but is not limited to): (1) The acreage and ecological value of the habitat to be impacted and restored, (2) measurable success criteria, (3) time frames for achieving project objectives, and (4) a remediation plan should the restoration site not succeed. Habitat restoration will occur within the same or adjoining reach as the river maintenance project, or in tributaries of those reaches, in consultation with the Service.

Rationale œ Habitat restoration will help offset the adverse effects to silvery minnow and flycatcher habitat caused by river engineering techniques. Based on the importance of the riverine and riparian habitats along the Rio Grande to the flycatcher and silvery minnow, detailed restoration planning and implementation is necessary for ensuring no net loss of *ecological function and value. This element will help alleviate adverse modification to silvery minnow critical habitat by providing for the necessary habitat components of primary constituent elements 1 and 2.*

U) Action agencies, in coordination with parties to the consultation, shall collaborate on the river realignment and proposed relocation of the San Marcial Railroad Bridge project, which is necessary to increase the safe channel capacity within the Middle Rio Grande. Construction for the relocation of the San Marcial Railroad Bridge will be initiated by September 30, 2008.

V) Each year that the NRCS April 1 Streamflow Forecast is at or above average at Otowi and flows are legally and physically available, the Corps shall bypass or release floodwater during the spring to provide for overbank flooding. The overbank flooding will be used to create an increased number of backwater habitats for the silvery minnow and flycatcher. The timing, amount, and locations of overbank flooding will be planned each year in conjunction with the Service and may be conducted in coordination with compact deliveries.

W) The Corps, in coordination with the Pueblo of Santa Ana, shall investigate and increase sediment transport through Jemez Canyon Dam. The Corps, in coordination with the Pueblo of Santo Domingo, shall also investigate and increase sediment transport through Galisteo Dam. By December 31, 2007, the Corps, in coordination with Cochiti Pueblo, shall complete an environmental baseline study and investigate the feasibility of transporting sediment from Cochiti Lake. The environmental baseline study shall address the issue of contaminated sediment raised by Cochiti Peublo in comments received in response to the draft biological opinion. Prior to the release of any sediment from Cochiti Lake, the Corps shall conduct government-to-government consultations with Cochiti Pueblo as well as other downstream Pueblos that may be affected by this action. The action agencies and parties to the consultation shall investigate other locations in which sediment transport could be improved.

X) Action agencies, in coordination with parties to the consultation and in consultation with the Service, shall prevent encroachment of saltcedar on the existing channel and destabilize islands, point bars, banks, or sand bars in the Angostura, Isleta, and San Acacia Reaches. The methods used and areas proposed for destabilization should be agreed upon by the Service, Reclamation, the Corps, and appropriate Pueblos and landowners. This activity should not adversely affect flycatcher habitat. This action should be undertaken where reaches are dry and the Service encourages the action agencies and parties to the consultation to begin this action during the summer of 2003. Projects should be examined for depletions. It is the Service˜s understanding that the objective of the action agencies and parties to the consultation is to develop projects that are depletion neutral.

Rationale œ The purpose of elements U through X is to maintain or improve the quality and quantity of habitat available for the silvery minnow and flycatcher. These elements avoid the destruction or adverse modification of silvery minnow critical habitat by ensuring primary constituent elements are provided or restored. It is expected that by improving the habitat *condition that reproduction, recruitment, and survival of the species will increase. This element will help alleviate adverse modification to silvery minnow critical habitat by providing for the necessary habitat components of primary constituent elements 1 and 2.*

Salvage and Captive Propagation Elements

Y) Action agencies, in coordination with parties to the consultation, shall provide $300,000 annually to NMESFO for distribution to propagation facilities for the continuation of captive propagation activities (including egg collection, transportation, relocation, rearing, breeding, etc.). The City has committed to coordinate egg collection activities for propagation efforts and will identify egg collection locations in coordination with the NMESFO, NMFRO, the action agencies, and parties to the consultation.

Z) Action agencies, in coordination with parties to the consultation, shall provide $200,000 annually for the first three years of this consultation for the expansion of facilities propagating silvery minnows (the Hatchery, NMFRO, New Mexico State University, the City, Rock Lake State Fish Hatchery, and any other approved locations).

AA) Upon the successful operation and evaluation of the recently constructed naturalized refugium (Breeding and Rearing Facility #1), the action agencies, in coordination with parties to the consultation, shall construct two new naturalized refugia breeding and rearing facilities for the captive propagation of the silvery minnow. The first new breeding and rearing facility must be completed by May 31, 2005, and the second new facility must be completed by May 31, 2006. One facility should be located in the Cochiti or Angostura Reach and the other facility should be located in the Isleta or San Acacia Reach. The design, siting, and operation of the facility should be determined in coordination with the Service and Pueblos, as appropriate, and should include design adaptations following the ™lessons learnedš from the operation of the Breeding and Rearing Facility #1.

Rationale œ These activities (Elements Y œ AA) will increase captive populations and facilitate augmentation efforts in the Middle Rio Grande. The proposed action and existing drought conditions will result in extensive drying events in the Isleta and San Acacia Reaches. To alleviate jeopardy to the silvery minnow, egg collection and captive propagation activities will be of increased importance for maintaining silvery minnow numbers and genetic diversity during times when adequate habitat (i.e., river flow) is not available in the wild. Because extensive drying is expected to occur in a large portion of the silvery minnow˜s habitat, there will need to be a more intensive effort to collect eggs during the spring spawn, and transport them to captive facilities for hatching and rearing. In addition, the successful breeding and rearing of silvery minnows will be essential for providing captive stock that can be used for augmentation efforts within the Middle Rio Grande, as well as for reintroduction efforts in currently unoccupied areas within the silvery minnow˜s historic range. These activities are imperative to improve the status of the silvery minnow in the wild. The capacity of the current captive propagation facilities must be expanded to accommodate an increased number of silvery minnows so that an increased *number of silvery minnows are available for any augmentation activities. Survivability of augmented silvery minnows will be investigated so that appropriate level of augmentation in the wild can be achieved.*

BB) Beginning in 2008, action agencies, in coordination with parties to the consultation, shall provide the NMESFO $100,000 annually for five years for monitoring and augmentation of silvery minnows reintroduced into its historic range under section 10(j) (experimental populations) of the ESA.

Rationale œ To meet the goals set forth in the Rio Grande Silvery Minnow Recovery Plan, the Service must establish populations outside of the Middle Rio Grande, within the silvery minnow˜s historic range. The reintroduction of silvery minnows to other locations would reduce the likelihood that a catastrophic event could result in the extinction of the species, would help to ensure the long-term survival and recovery of the species and would help to alleviate jeopardy. The Service received $200,000 in 2002 for reintroduction efforts. Those funds have initiated a baseline habitat study at Big Bend National Park. The 2002 funds are sufficient to complete NEPA and promulgation of the 10(j) proposed and final rules, and begin reintroduction efforts. Scoping and NEPA activities will begin in FY 2003. Initial augmentation and monitoring activities will occur by 2008.

CC) The Service in coordination with the New Mexico Department of Game and Fish and all appropriate Pueblos, shall conduct silvery minnow surveys and habitat assessment studies in the Rio Grande above Cochiti Lake in preparation of silvery minnow releases under the Service˜s Regional Director˜s 10(a)(1)(A) permit. All silvery minnows that may be released will be marked. These surveys will be completed by December 31, 2004.

Rationale œ To meet the goals set forth in the Rio Grande Silvery Minnow Recovery Plan, the Service must establish populations outside of the Middle Rio Grande, within the silvery minnow˜s historic range. The reintroduction of the silvery minnows to other locations would reduce the likelihood that a catastrophic event could result in the extinction of the species, would help to ensure the long-term survival and recovery of the species and would help alleviate jeopardy. Silvery minnow surveys and habitat assessments in the reach of the Rio Grande above Cochiti Lake will provide information necessary to determine the feasability of releasing silvery minnow in this area and is the first step in establishing a silvery minnow population in the reach above Cochiti Lake. The historic range of the Rio Grande silvery minnow included the Rio Grande upstream of present-day Cochiti Lake. A great deal of uncertainty exists regarding whether this portion of the Rio Grande can still provide the physical, chemical, and biological resources necessary to sustain the life cycle of the minnow and allow for persistence through time. Using the section 10(a)(1)(A) permitting process, the Service and its partners may release silvery minnow in the Rio Grande above Cochiti Lake for purposes of investigating the conservation benefits that may still exist in this segment of river. The Service recognizes, a priori, that such releases are experimental and any potential outcomes are uncertain. Under this permitting scenario, agencies would not be relieved from having to address the impacts of their actions to *the introduced minnows under section 7. The Service believes that the majority of any resulting consultations would be effectively concluded informally, and does not anticipate any formal consultations resulting in jeopardy to the species from impacts to minnows above Cochiti Lake.*

<u>Water Quality Elements</u>

DD) With the increased emphasis and importance of the Angostura Reach for silvery minnow conservation, it is imperative that the addition of treated wastewater to the river provides water quality conditions protective of silvery minnow. The protective concentration of total residual chlorine (chlorine) for silvery minnow is less than or equal to 0.013 mg/L. The protective concentration of ammonia, as nitrogen [ammonia] (at 25 C and pH 8), for silvery minnow is less than or equal to 3.09 mg/L for larvae and less than or equal to 9.3 mg/L for post-larvae.

Elements DD and EE of the RPA in the draft biological opinion (February 21, 2002) have been replaced with new water quality elements (also DD and EE) in this final biological opinion in order to more appropriately address this issue with the U.S. Environmental Protection Agency (USEPA) and the City. Although the City has been closely involved in this consultation, it is not a party to the consultation, but willing to assist in various activities that will benefit the silvery minnow and the flycatcher. The USEPA is not a party to this consultation. The Service, USEPA and the City have agreed to begin immediate consultation on the effects of the NPDES permit for the City˜s wastewater treatment plant operations and the City˜s Drinking Water Project.

The City has explained that it believes that it is meeting the water quality conditions envisioned in draft elements DD and EE in a letter to the Service commenting on the Draft Biological Opinion (March 5, 2003). The City also agreed to develop a pollution response plan for discharges attributable to the City˜s wastewater treatment plant that result in conditions that are protective of silvery minnow. This plan will be developed in cooperation with the Service by June 15, 2003. Actions taken as a result of consultation on the City˜s NPDES permit for the wastewater treatment plant, when implemented, should reduce the likelihood of chlorine and ammonia concentrations in silvery minnow habitat that could be harmful. Implementation of the pollution response plan will minimize injury in case of an accidental release.

Rationale œ This water quality element should reduce or eliminate the immediate threats to the silvery minnow due to poor water quality from releases of chlorine, ammonia, or other chemicals at levels that are harmful to the silvery minnow. With the increased emphasis on the Angostura Reach for silvery minnow conservation, these protective measures are imperative to the persistence of the silvery minnow. Additional pollution response planning will allow for a faster response time to reduce the effects of any accidental spills. The Service will be consulting with the USEPA and the City on the NPDES permit for the City˜s WWTP within the next year, at which time these issues will be further addressed.

EE) Action agencies, in coordination with parties to the consultation, shall provide funding for a comprehensive water quality assessment and monitoring program in the Middle Rio Grande to assess water quality impacts on the silvery minnow. This assessment and monitoring program should use available data from all sources.

Rationale œAlthough the lethality of some toxic substances is well documented (i.e., ammonia and chlorine), the toxicity of other compounds is not well known. In addition, the chronic effects of many toxic substances either alone or in combination are not known for the silvery minnow. A comprehensive water quality assessment and monitoring program will provide information and allow managers to better evaluate important water quality issues as they relate to silvery minnow health and habitat. An assessment of chemicals that either alone or in combination may affect the silvery minnow will alleviate jeopardy by providing information to determine if additional protective measures are necessary to ameliorate their effects.

In addition to wastewater effluent sources, there are a number of other sources that discharge pollutants to the Middle Rio Grande, such as storm runoff, irrigation, and riverside drains returns. Additional water quality and toxicity studies are needed to identify and quantify the effects of these discharges to the silvery minnow and its habitat. The quality of these discharges should be determined, and steps should be taken to address those posing the greatest harm to the silvery minnow and its habitat.

Reporting Element

FF) Action agencies, in coordination with parties to the consultation, shall provide a consolidated report on the status of all RPA elements to the Service by December 31 of each year.

INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary and must be undertaken by the Federal agencies so that they become binding conditions of any Federal grant or permit issued to any non-Federal water users, as appropriate, for the exemption in section 7(o)(2) to apply. The Federal agencies have a continuing duty to regulate the activity covered by this incidental take statement. If the Federal agencies: fail to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Federal agencies must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR °402.14(i)(3)]

Amount or Extent of Take Anticipated

The Service has developed the following incidental take statement based on the premise that the RPA will be implemented.

Rio Grande Silvery Minnow

The Service anticipates that up to 38,000 silvery minnows (greater than 30 mm [1.2 in]) may be taken in any year due to the Federal and non-Federal actions described and analyzed in this biological opinion. It is the Service˜s opinion that approximately 1 of every 50 silvery minnows that are injured or killed will be found because of predation, the cryptic nature of the silvery minnow, and its small size. This approximation was determined based on salvage activities and field observations during the 2002 irrigation season (H. Dale Hall, Service *in litt.* 2002)

In 2002, 1,640 isolated pools were sampled during channel drying events in both the Isleta and San Acacia Reaches and a total of 269 dead silvery minnows were collected. Silvery minnow rescue operations occurred on approximately 43 river miles, with some areas salvaged on multiple occasions when areas rewetted and then dried again. During these drying events, 249 dead silvery minnows were collected and counted towards the Incidental Take Statement. Twenty dead silvery minnows were collected, but not counted against the Incidental Take Statement because their death was the result of natural river rewetting and drying, not management activities.

In the Isleta Reach, 32 dead silvery minnows were found in approximately18 dry river miles and 237 dead silvery minnows were found in approximately 25 dry river miles in the San Acacia Reach (total number collected was 269). Using this limited amount of data, we have determined that approximately 2 and 10 dead silvery minnows were found per dry mile in the Isleta Reach and San Acacia Reach, respectively. Under the effects of the action, the Service estimates that up to 50 miles of river may dry in the Isleta Reach and 66 miles in the San Acacia Reach. Therefore, if more than 760
minnows greater than 30 mm (1.2 in) are found dead in any year, the level of anticipated take will have been exceeded.

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