APPENDIX C

Part II
Fish and Wildlife Service Memorandum
(March 16, 2009)

United States Department of the Interior

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

March 16, 2009

Memorandum

To: Area Manager, Bureau of Reclamation, Western Colorado Area Office, Grand Junction, Colorado

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

Subject: Final Fish and Wildlife Coordination Act Report for the Navajo – Gallup Water Supply Project, New Mexico and Arizona

Attached is the Final Fish and Wildlife Coordination Act Report (CAR) for the Navajo – Gallup Water Supply Project. The proposed project would supply approximately 38,000 acre-feet per year of San Juan River water to the Navajo Nation in New Mexico and the Window Rock area of Arizona, the Jicarilla Apache Nation in New Mexico, and Gallup, New Mexico, to meet their projected demand in the year 2040. The U.S. Fish and Wildlife Service (Service) sent the Bureau of Reclamation (Reclamation) a draft CAR on January 4, 2005. The Service has reviewed Reclamation's Addendum to Biological Assessment on Potential Effects of Climate Change on the Hydrology of the San Juan Basin and Navajo-Gallup Water Supply Project, dated July 7, 2008. As a result of that review the Service did not modify the 2005 CAR because our recommendations would not change.

This report has been prepared by the Service, New Mexico Ecological Services Field Office, under the authority of and in accordance with the requirements of Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e). Please provide us any comments concerning this report within 30 days.

Wally Murphy

Attachment

Fish and Wildlife Coordination Act Report
for the
Navajo - Gallup Water Supply Project
New Mexico

Submitted to:
U.S. Bureau of Reclamation
Grand Junction, Colorado

Prepared by:
John C. Branstetter
U.S. Fish and Wildlife Service
New Mexico Ecological Services Field Office
2105 Osuna Road NE
Albuquerque, New Mexico 87113

January 2005

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

This is a Fish and Wildlife Coordination Act Report (CAR) for the Navajo-Gallup Water Supply Project (Project) prepared by the U.S. Fish and Wildlife Service (Service) under the authority of and in accordance with the requirements of Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 USC 661-667e). This report addresses the Navajo - Gallup Water Supply Project and alternatives developed by the U.S. Bureau of Reclamation (Reclamation). This report describes fish and wildlife resources existing without the project, potential project impacts to fish and wildlife resources, a discussion of concerns related to fish and wildlife resources, and recommendations (mitigation) to decrease adverse effects to fish and wildlife resources.

The Navajo Nation and the City of Gallup (Gallup), New Mexico, currently rely on a diminishing groundwater supply. To meet future demand, Reclamation is proposing to construct a water supply project that would divert water from the San Juan River and Navajo Reservoir to the Navajo Nation, Jicarilla Apache Nation, and Gallup. The proposed project would supply approximately 38,000 acre-feet per year (afy) of water to meet the projected demand in the year 2040. The service area would include most of the Navajo Nation in New Mexico and the Window Rock area of Arizona, the Jicarilla Apache Nation in New Mexico, and Gallup. By the year 2040 the project would serve an estimated 203,000 people in the Navajo Nation, 1,300 people in the Jicarilla Apache Nation, and 47,000 people in Gallup.

The project would include the construction of two main water supply pipelines, the San Juan Lateral and the Cutter Lateral. The San Juan Lateral would receive water diverted from the existing Public Service Company of New Mexico (PNM) diversion dam. The Cutter Lateral would receive water diverted from the existing Navajo Indian Irrigation Project (NIIP) main canal at Cutter Reservoir. The project would include the construction of a treatment plant at each diversion point and the construction of main pumping plants that would supply water via 267 miles (430 kilometers (km)) of pipeline. The project would also include the construction of forebay tanks, booster pumping stations, water regulating tanks, water storage tanks, and approximately 107 miles of transmission lines along the pipeline routes. The capacity of the pumping and treatment plants would be staged with initial capacities adequate to meet the projected demand in the year 2020. Capacities would be increased as needed up to the projected demand of approximately 38,000 afy in the year 2040. By the year 2040, the project would supply approximately 26,064 acre-feet per year (afy) (3,585 hectare-meters (hmy)) of water to the Navajo Nation, 1,200 afy (148 hmy) to the Jicarilla Apache Nation, and 7,500 afy (925 hmy) to Gallup.

DESCRIPTION OF STUDY AREA

San Juan River

The San Juan River is a tributary to the Colorado River and drains approximately 38,300 mi^2 (99,200 km^2) in Colorado, New Mexico, Utah, and Arizona (Figure 1). From its origins in the San Juan Mountains of southwestern Colorado (at an elevation exceeding 13,943 ft) (4,250 meters (m)), the river flows westward through New Mexico, Colorado, and into Lake Powell,

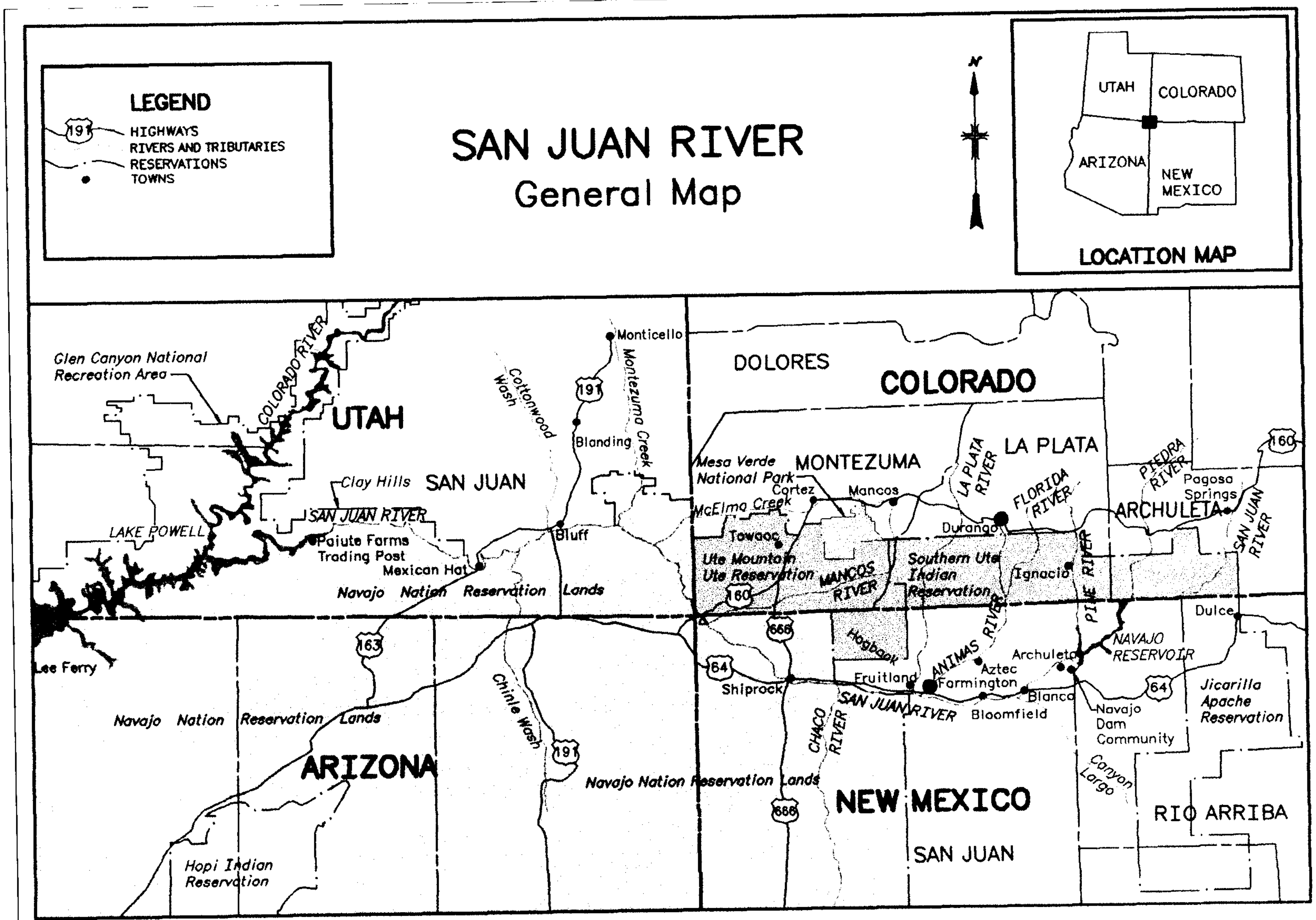

Figure 1. Location map of the San Juan River in the Navajo-Gallup Water Supply project area (provided by Reclamation).

Utah. The majority of surface water for the 345 mi (570 km) of river is from the mountains of Colorado. From a water resources perspective, the area of influence for the project begins at the inflow areas of Navajo Reservoir, and extends west from Navajo Dam approximately 224 mi (359 km) along the San Juan River to Lake Powell. The pre-dam median annual discharge near Bluff, Utah, was 1,620,000 afy (199,825 hmy) with a range of 618,000 afy (76,229 hmy) to 4,242,000 afy (523,245 hmy) (Bliesner and Lamarra 2000). The major perennial tributaries in the project area are the Los Pinos, Piedra, Navajo, Animas, La Plata, and Mancos Rivers, and McElmo Creek. There are also numerous ephemeral arroyos and washes that contribute little flow to the San Juan River, but large sediment loads.

Little is known about the historic condition of the San Juan River in northern New Mexico and southern Utah prior to the 1880s. However, during the past 120 years the San Juan River has undergone a variety of changes. Between 1883 and 1890 major watershed erosion contributed large quantities of sediment that moved through the Colorado River drainage including the San Juan River. In the early 1940s sediment inflow and outflow to the San Juan River was reduced (Thompson 1982). Theories for the change in sediment flow include climate change (Bryan 1925), invasion of tamarisk (Graf 1987), or the natural evolution of land forms (Gellis *et al.* 1991).

The San Juan River is typical of most rivers in the southwestern U.S., characterized by large flows during spring runoff, followed by low but variable summer, fall, and winter base flows. Stream gage data in the San Juan River are inconsistent and incomplete prior to 1929. However, by 1870 there was substantial diversion of water (about 16 percent of natural discharge) for irrigation, primarily during summer months (Bliesner and Lamarra 2000). Between 1929 and 1961 mean daily flows ranged from near 0 to 70,000 cubic feet per second (cfs) or 0 to 1,982 cubic meters per second (cms) near Bluff, Utah. The median daily peak discharge during spring runoff was 10,500 cfs (297 cms), with a range of 3,810 to 33,800 cfs (108 to 957 cms). An average annual hydrograph (USGS Bluff, Utah Gage Station) for the river below Navajo Dam shows that the seasonal peak runoff usually occurred March through July. Mean monthly base flows were as low as 65 cfs (2 cms).

Navajo Dam was completed and began operation in 1963. Navajo Reservoir is used for flood control, water storage, conservation, and irrigation (City of Farmington 1983). The total capacity for the reservoir at spillway crest elevation (6,085 ft) (1,855 m) is 1,708,600 acre-feet (ac-ft) (210,754 hectare-meters (hm)). Regulation from Navajo Dam reduced mean peak spring flows by 54 percent, but increased base flows by 285 percent (250 versus 65 cfs) (7 versus 2 cms) (Bliesner and Lamarra 2000). Completion of the reservoir isolated the upper 77 mi (124 km) of river, while the filling of Lake Powell in the early 1980s inundated the lower 54 mi (87 km). The dam is operated and maintained by Reclamation. Between 1962 and 1991 Navajo Dam was operated to provide stable flows for water storage in a manner that reduced peak spring discharge and elevated flows in other seasons (Bliesner and Lamarra 2000).

In 1992, the San Juan River Basin Recovery Implementation Program (SJRBRIP) was initiated following consultation with the Service pursuant to section 7 of the Endangered Species of Act (Act) for the Animas-La Plata Project and NIIP in 1991. This consultation led to a 7-year research effort funded by Reclamation and the Bureau of Indian Affairs. The research was part of a 15-year recovery program for the Colorado pikeminnow (*Ptychocheilus lucius*) (pikeminnow), and razorback sucker (*Xyrauchen texanus*). During the 7-year research period (1992 to 1998) Navajo Dam was operated to mimic a natural hydrograph with the volume of release during spring linked to the amount of preceding winter precipitation. An average annual hydrograph (USGS Bluff, Utah Gage Station) for the river below Navajo Dam shows that the seasonal peak runoff between 1992 and 1998 usually occurred in May and June. Average monthly discharges at Bluff range from approximately 476 to 8,749 cfs (14 to 248 cms). The average winter base flow of approximately 500 cfs (14 cms) usually persists from November through February and average flows during the irrigation season (post runoff) (August through October) are typically 500 cfs (14 cms) and supplemented by summer storm events.

The environmental consequences of dam operations and main stem diversions include the narrowing and incising of the river channel, the loss of native wetland and riparian vegetation, changes in water temperature, and blockage or limiting of fish passage. Because the Animas River is largely unregulated, it ameliorates many of the impacts of dam operations in the San Juan River downstream of their confluence. The incised channel and dam operations limit overbank flows and periodic scouring of floodplain areas. The changed hydrology largely precludes natural regeneration of native cottonwoods and willows and promotes the growth of non-native vegetation such as salt cedar and Russian olive, which have largely replaced the native cottonwood/willow vegetative complex. Prior to 1962 there was no mention of Russian olive in survey notes along the San Juan River. Russian olive and salt cedar now account for more than 85 percent of the riparian vegetation along the San Juan River (Bliesner and Lamarra 2000). Cumulatively, these changes have altered aquatic habitat and its ability to support a healthy native fish community.

Pipeline Routes

The majority of the pipeline supply routes would be located in previously disturbed highway right-of-ways, primarily in semi-arid upland terrain (Figure 2). Much of the habitat in and adjacent to the pipeline routes has been heavily grazed and vegetative cover is limited. As a result, low densities of wildlife occur in upland areas in and adjacent to the pipeline routes. Dominant vegetative communities along the proposed routes include Great Basin foothill-Piedmont grassland, Great Basin lowland/swale grassland, and Great Basin microphyllous desert scrub (Ecosystems Research Institute [ERI] 2003a). Great Basin foothill-Piedmont grasslands occur at an elevation of 4,500 to 7,200 feet (ft) (1,400 to 2,200 m) and are dominated by galleta (*Hilaria jamesii*), indian ricegrass (*Oryzopsis hymenoides*), four-wing saltbush (*Atriplex canescens*), green rabbitbrush (*Ericameria viscidiflora*), and big sage (*Artemisia tridentata*). Great Basin lowland/swale grassland habitats occur at an elevation of 3,500 to 7,200 ft (1,150 to 2,220 m) and are dominated by alkali sacaton (*Sporobolus airoides*) (ERI 2003a). Great Basin microphyllous desert scrub habitats occur at an elevation of 5,250 to 7,200 ft (1,600 to 2,220 m) and are dominated by big sage, black sagebrush (*Artemisia nova*), four-wing saltbush, shadescale (*Atriplex confertifolia*), and greasewood (*Sarcobatus vermiculatus*).

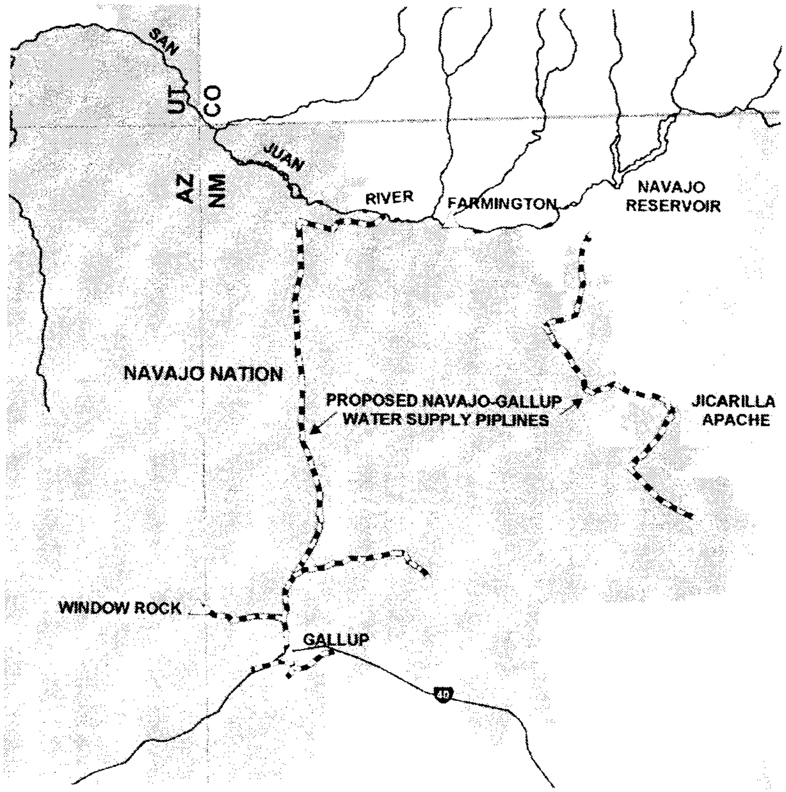

Figure 2. Navajo – Gallup Water Supply Project San Juan and Cutter Laterals (map provided by Reclamation).

The San Juan Lateral pipeline route would be located within federally threatened Mesa Verde cactus habitat. The Mesa Verde cactus occurs south-southeast of the junction of U.S. Highway 491 (U.S. 491) and Navajo Route 36 within the boundary of the proposed San Juan Lateral pipeline alignment and an associated booster pumping station. The cactus also occurs south of the Junction of U.S. 491 and Navajo Route 36 extending approximately 15 miles to the vicinity of Little Water, New Mexico, north of Navajo Route 36 and west of the Hogback diversion, and east of the Hogback diversion from Amarillo Canal to U.S. 491.

PROJECT DESCRIPTION

The Navajo - Gallup Water Supply Project began in 1968 when Reclamation initiated a reconnaissance investigation to formulate and evaluate plans for providing additional water to Gallup and other possible customers from the San Juan Basin and other water sources (Service 1981). The project was expanded in 1975 to include an evaluation of municipal-domestic water supplies for a number of other Navajo communities in New Mexico and Arizona. The Service originally analyzed and completed a Fish and Wildlife Coordination Act Report (CAR) for the proposed project in 1981. Following the completion of the CAR, Reclamation completed a Planning Report and Draft Environmental Impact Statement (DEIS) that evaluated five action

alternatives and a no action alternative for the proposed project (U.S. Bureau of Reclamation [Reclamation] 1984). However, the DEIS was never finalized.
In 2000, Reclamation published a *Federal Register* notice of intent to prepare a Draft Environmental Impact Statement on the construction and operation of the Navajo – Gallup Water Supply Project (Reclamation 2000). The Service provided Reclamation a Planning Aid Memorandum (PAM) for the proposed project in December 2002 that contained information on, and planning recommendations for, fish and wildlife resources in the project area. Reclamation anticipates a Record of Decision for the project in 2005.

Four alternatives are being analyzed in the Navajo - Gallup Water Supply Project EIS. Alternatives include: 1) the San Juan Public Service Company of New Mexico (PNM) 2040 Diversion Alternative (Preferred Alternative); 2) the Navajo Indian Irrigation Project (NIIP) Amarillo Alternative; 3) a water conservation alternative; and 4) a no action alternative;.

San Juan River PNM 2040 Alternative (Preferred Alternative)
Under the Preferred Alternative, 33,118 afy (4,085 hmy) of water would be diverted from the San Juan River at the existing PNM diversion dam at River Mile (RM) 166.7. Of the 33,118 afy of water diverted, 1,871 afy would be returned to the river downstream of Shiprock. Water would be diverted from the river and into the San Juan Lateral with a 60 cfs maximum capacity intake pump located immediately upstream of the existing PNM intake structure on the north bank of the river. Water entering the intake would pass through a self-cleaning screen with 3/32-inch (0.2 centimeter (cm)) openings and a through-screen velocity of less than 0.5 feet per second (0.2 m per second). Water passing through the screen would enter a sump where low-head pumps would lift the raw water into settling ponds for removal of suspended sediment. From the settling ponds, water would enter a water treatment and pumping plant. The treatment and pumping plant would occupy approximately 18 acres (7 hectares) of land.

The San Juan Lateral water treatment and pumping plant would include seven ultrafiltration units, seven ultraviolet (UV) disinfection units, a 797,000-gallon water tank, two wastewater ponds, two sediment drying beds, mixing and flocculation tanks, chemical storage buildings, an operation and maintenance building, a 4-unit pumping station, and electrical control equipment. The capacity of the treatment plant would be approximately 38.25 million gallons of water per day (59.19 cfs).

The San Juan Lateral pumping plant would pump treated water into approximately 145 miles (233 km) of buried 12- to 48-inch (30- to 122-cm) diameter pipeline. From the pumping plant, the pipeline would cross the San Juan River upstream of the treatment plant and PNM diversion dam and ascend a mesa south of the river. From the mesa, the pipeline would extend west along the right-of-way of Navajo Highway 64 to U.S. 491. At U.S. 491, the pipeline would extend south along the highway right-of-way to Yah-ta-hey, New Mexico. At Yah-ta-hey, the pipeline would connect to spur waterlines extending to Window Rock and Gallup. In Gallup, one new pumping plant would be constructed, and three existing pumping plants, five storage tanks, and 32 miles of pipeline would be upgraded. Seven booster pumping stations would be constructed along the San Juan Lateral. Each booster pumping station would occupy approximately one acre of land and consist of a water tank, pumping plant, air chamber, chlorination building, and electrical control structure. The San Juan Lateral would also include the construction of 17 water storage tanks, 3 water regulating tanks, junctions to the existing Shiprock, Burnham, and Gallup water supply systems, and a turnout to NIIP. The project would also include the construction of a new overhead electrical transmission line that parallels the San Juan Lateral pipeline, and provides power to the booster pumping stations.

The Preferred Alternative would also include construction of the Cutter Lateral pipeline. The Cutter Lateral would serve Huerfano, Nageezi, Counselor, Pueblo Pentado, Ojo Encino, Toreon, and the Whitehorse Chapters in the eastern portion of the project area in New Mexico. It would also serve the Jicarilla Apache Nation. The Cutter Lateral would originate at Cutter Reservoir and provide up to 4,645 afy (537 hmy) of water to the eastern service area. This lateral would include a water treatment and pumping plant that occupies approximately 3 to 4 acres of land. The Cutter Lateral water treatment and pumping plant would be smaller than the San Juan Lateral plant, but would contain much of the same equipment. The plant would include three ultrafiltration units, three UV disinfection units, a 112,000 gallon subsurface pumping plant forebay, two wastewater ponds, mixing and flocculation tanks, chemical storage buildings, an operation and maintenance building, a 4-unit pumping station, and electrical control equipment. The capacity of the Cutter Lateral treatment plant would be approximately 5.39 million gallons of water per day (8.34 cfs).

The Cutter Lateral pumping plant would pump treated water into approximately 89 miles (143 km) of buried 10- to 24-inch (25- to 61 cm) diameter pipeline. The Cutter Lateral would include the construction of five one-acre booster pumping stations, three community water storage tanks, and two water regulating tanks. Similar to the San Juan Lateral, an overhead electrical transmission line would be constructed along the Cutteral Lateral to power the booster pumping stations. A substation would also be constructed to provide power from an existing PNM transmission line to the newly constructed transmission line.

The Preferred Alternative would also include the release of approximately 40 cfs (1.1 cms) through the NIIP canal down Ojo Amarillo in May when maximum releases from Navajo Dam are 5,000 cfs (142 cms). Ojo Amarillo discharges to the San Juan River at RM 170 downstream from the confluence with the Animas River. Increasing releases from Navajo Dam by 40 cfs (1.1 cms) above 5,000 cfs would violate the Corps of Engineers San Juan River flood control restrictions above the confluence with the Animas River.

NIIP Amarillo Alternative

Under the NIIP Amarillo Alternative, 37,763 afy (4,658 hmy) of water would be diverted from Navajo Reservoir at the NIIP diversion. Of the 37,763 afy of water diverted, 1,871 afy would be returned to the river downstream of Shiprock. The remaining 35,892 afy (4,427 hmy) of water would be supplied to Gallup and the Navajo Nation in Arizona and New Mexico. Under this alternative, water would be diverted from Navajo Reservoir through the existing NIIP Main and Burnham Lateral Canals and delivered to an 8,800 ac-ft (1,085 hm) reservoir that would be constructed as part of this alternative. A water treatment plant and pumping station would be constructed near Moncisco Reservoir. From the treatment plant, water would be piped south to an existing natural gas line right-of-way. The waterline would follow the gas line right-of-way to the vicinity of Twin Lakes, New Mexico, and then to Yah-ta-hey. At Yah-ta-hey it would connect to smaller waterlines and proceed west along Highway 64 to Window Rock, then south along U.S. 491 to Gallup. Three additional spur waterlines would connect to the mainline, including a pipeline from Naschitti, New Mexico, north along U.S. 491 to Sanostee, New Mexico; a pipeline from Twin Lakes east along Indian Route 9 to Dalton Pass, New Mexico; and a pipeline along Highway 550 to Nageezi, then south to Torreon.

Water Conservation Alternative
The Water Conservation Alternative does not include any structural elements. Under this alternative, efforts would be made to conserve and reuse water using existing infrastructure. Opportunities to conserve water and the amount of water available would be limited by the amount of water in use. Reuse opportunities may be limited by regulations under the Safe Drinking Water Act.

No Action Alternative
Under the No Action Alternative, Reclamation would not construct the project. Gallup and the Navajo Nation in New Mexico and Window Rock, Arizona, would continue to rely on a diminishing groundwater supply. Water would also not be supplied to the Jicarilla Apache Nation in New Mexico. Water for economic growth and improvement of the standard of living for current and future populations in the project area would not be provided. Groundwater withdrawal would continue to lower the water table in the Gallup area.

EVALUATION METHODOLOGY

Since project planning began in 2000, the Service has attended meetings with Reclamation and others to discuss project features, design, and construction methods. Additional biological data and background information were derived through review of relevant literature and personal communications. Reclamation has provided a majority of the technical and background information. Wildlife and vegetation surveys of the project area were performed by ERI in 1999, 2000, and 2002 (ERI 2003a). ERI used Gap Analysis Project (GAP) data to quantitatively delineate vegetation communities along the proposed pipeline routes (ERI 2003a). ERI also developed reports identifying potential project related impacts to fish and wildlife resources and mitigation for those impacts (ERI 2003a, ERI 2003b, ERI 2003c). Numerous fishery studies have been conducted in the San Juan River in and near the project area as part of the SJRBRIP.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

Prior to the SJRBRIP research management (1962-1991), discharges from Navajo Reservoir were relatively stable year-round from 1,200 to 1,400 cfs (34 to 40 cms). Regulated releases reduced spring flows and increased base flows. Between 1992 and 1998 winter releases from Navajo Dam were typically about 500 cfs (14 cms). Non-winter releases were typically 500 to 5,000 cfs (14 to 142 cms). In 1999, the SJRBRIP developed flow recommendations for the recovery of the endangered pikeminnow and razorback sucker. The flow recommendations are designed to mimic the natural hydrograph of the San Juan River. Reclamation is proposing to implement the flow recommendations as part of the Navajo Operations Environmental Impact Statement.

Under the flow recommendations Navajo Reservoir would be operated so that releases from Navajo Dam would range from 250 cfs to 5,000 cfs (7 to 142 cms). Navajo Reservoir would provide a peak spring release of 5,000 cfs (142 cms) in most years and make releases to support 500 to 1,000 cfs (14 to 28 cms) base flows downstream of the Animas River confluence for fish habitat. This would require maintaining minimum releases of 250 cfs (7 cms) during certain times of the year. Excess summer water would be released in spike peaks in the fall and winter.

Most juvenile fish prefer shallow, low velocity habitats. For native fishes such as the pikeminnow these habitats include backwaters, shoals, eddies, pools, and slackwaters. In the San Juan River, these habitats comprise less than 15 percent of the total habitat (Bliesner and Lamarra 1996). Habitat modeling results show that area of backwater habitats downstream of the Animas River confluence are maximized between approximately 800 and 1,100 cfs (23 to 31 cms) (Holden 1999). Between 1,100 and 2,500 cfs (28 to 71 cms) there is a decline in area of backwater habitat. Backwater habitat is least abundant at flows near 2,500 cfs (71 cms). At flows between 2,500 and 4,000 cfs (71 to 113 cms) there is an increase in area of backwater habitats and at flows above 4,000 cfs (113 cms) there is little change in area. Shoal, pool, eddy, and slackwater habitats are generally more abundant than backwater habitats; though differ in area with changes in flow. Area of pool and shoal habitats decline from 500 to 1,500 cfs (14 to 42 cms). At flows above 1,500 cfs (42 cms) there is little change in area of pool and shoal habitats. Pool and shoal habitats generally increase with decreasing flows. Area of slackwater habitat varies with flow, but generally increases from 500 to 1,000 cfs (14 to 28 cms) with little change above 1,000 cfs (28 cms). Eddy habitat increases in area as flows increase. Except for eddy and slackwater habitats, low velocity habitats generally decline with increasing flows. However, at flows greater than 4,000 cfs (113 cms) there is nearly as much backwater area as there is at 800 to 1,100 cfs (23 to 28 cms) (Holden 1999).

For larger fish species, habitat preferences are more diverse but tend toward deeper, moderate velocity water compared to juveniles. In the San Juan River, runs typically comprise at least 70 percent of the total habitat at any discharge (Bliesner and Lamarra 1996). Thus, there appears to be adequate adult fish (non-spawning) habitat available for both native (Miller and Ptacek 2000, Ryden 2000a) and non-native species (Holden 1999, Propst and Hobbes 1999).

Nearly all native fishes in the San Juan River require high spring flows to clean and prepare cobble bars for successful reproduction. Lack of suitable spawning habitat for endangered species may be a contributing factor to the poor condition of the San Juan River fishery. At present there is only one confirmed spawning site used by pikeminnow in the San Juan River. As more pikeminnow stocked as young-of-the-year (YOY) reach sexual maturity, additional spawning sites may be identified. Spawning habitat for razorback suckers may also be limited, though individuals stocked as juveniles appear to be locating spawning habitats adjacent to those used by native flannelmouth and bluehead suckers as they reach sexual maturity (Ryden 2000b).

Aquatic Resources

The aquatic resources in the San Juan River evolved in a system that is different than what exists today. Navajo Reservoir altered the temperature and flow regime of the river and has limited the upstream migration of native fishes. The downstream impoundment of Lake Powell has permanently inundated potentially important nursery habitats. The available fish habitat in the San Juan River from these two reservoirs has been reduced by about 80 mi (129 km) (Holden 2000). Encroachment of non-native terrestrial plant species, such as salt cedar and Russian olive, has armored and incised the river channel. Habitat loss and fragmentation from water development, including several (6 major) diversion structures, has contributed to changing the fishery downstream of Navajo Dam to Lake Powell. In addition, fish poisoning prior to the closure of Navajo Dam and the subsequent introduction of non-native fishes (both predators and competitors) has also permanently changed the fish community. Consequently, the existing aquatic communities in the project area differ from those that occurred historically (Platania 1990, Holden 1999).

Comprehensive studies of fish presence, abundance, distribution, or life history were not conducted in the San Juan River until the late 1980s (Holden 2000). Earlier studies were generally conducted to determine fish presence. The native ichthyofauna of the San Juan River is believed to have consisted of at least nine species, four of which are endemic to the Colorado River Basin (Tyus *et al.* 1982, Sublette *et al.* 1990, Platania 1990). Three of these are federally listed as endangered (bonytail chub, *Gila elegans*, pikeminnow, and razorback sucker) and one is State listed by New Mexico as threatened (roundtail chub, *Gila robusta*).

Bonytail chub remains have been collected in middens near Aztec, New Mexico, but are thought to have been extirpated from the San Juan River by the mid-1800s (Sublette *et al.* 1990). Razorback suckers were extirpated from the New Mexico portion of the San Juan River until they were reintroduced during the 7-year research period. Between 1991 and 1997 only 17 adult pikeminnow were collected between Shiprock, New Mexico, and Mexican Hat, Utah (Ryden 2000a). Historically, these latter two species are believed to have occurred in the basin (Animas River) upstream as far as Durango, Colorado and downstream in the San Juan River to the confluence of the Colorado River. Roundtail chub, commonly found in previous surveys, were only occasionally collected during this same period. The reduction of native fish and the proliferation of non-native fish species in the San Juan River illustrates that the hydrologic and morphological changes in the channel have had an impact on aquatic resources. A list of common and scientific names of fish discussed in this report or that occur in the San Juan River project area is provided in Appendix A.

The San Juan River between Navajo Dam and Lake Powell supports a fish community consisting of 26 known species (and three hybrid sucker forms), including 7 native species (Ryden 2000a). Flannelmouth sucker are the most common large native species. Channel catfish are the most abundant large non-native species, particularly downstream of PNM weir, while red shiner is the most abundant small non-native. Other common native species include bluehead sucker and speckled dace. Other common non-native species include common carp, fathead minnow, and western mosquitofish. Game fish include rainbow trout, brown trout, channel catfish, striped bass, bluegill, largemouth bass, and walleye. Hence, the fishery in this section of river is varied and includes cold-water species in the upper reach, and a mix of warm- and cool-water species in the middle and lower reaches. The popular cold-water fishery is primarily dependent on stocking of rainbow trout by the NMDGF, natural reproduction by brown trout, and on cold water released from the bottom of Navajo Reservoir. Of the non-native species found in the river, at least three originate from Lake Powell. These include striped bass, walleye, and threadfin shad. Many more species probably originate from the drains and off-channel impoundments, particularly largemouth bass and sunfish. In summers with clear base flows, large numbers of striped bass move upstream from Lake Powell as far as the PNM diversion dam (RM 166.7).

The most commonly collected non-native species, channel catfish, common carp, red shiner, and western mosquitofish, are tolerant of disturbed habitat. In the San Juan River, smaller species such as red shiner typically are most abundant in years with low spring peaks and lower, stable base flows (Propst and Hobbes 1999). Red shiners share common food resources (i.e., compete) with and prey upon larval native species including pikeminnow and native suckers (Propst and Hobbes 1999). Channel catfish both prey upon and use common food resources with native fishes (Brooks *et al.* 2000). Native suckers (up to 315 mm SL) have been collected in channel catfish stomachs in the San Juan River (Brooks *et al.* 2000). Channel catfish which have spiny pectoral spines have been documented to become lodged in the mouths of pikeminnow who try to prey upon them (Dale Ryden, Service, pers. comm.).

Though many of the same species were collected in New Mexico, Colorado, and Utah, there were longitudinal differences in species composition and abundance. Coldwater species (e.g., rainbow trout, brown trout, mottled sculpin) were more abundant in upstream reaches, and warmwater species (e.g., channel catfish, red shiners) were more abundant in downstream reaches, particularly downstream of PNM weir. Coolwater species (e.g., speckled dace, common carp) were generally abundant throughout most reaches. The highest proportion of native fishes (>90 percent) collected was between Hammond diversion and the Animas River confluence (NMDGF 1994, unpublished data).

The NMDGF does not intensively manage the river downstream of the tailwater trout fishery (approximately 15 mi (24 km) downstream of Navajo Dam) for any particular species, though there is a substantial channel catfish and a seasonal striped bass fishery downstream of PNM weir (Marc Wethington, NMDGF, pers. comm.). Protecting and enhancing the native fish community is also an objective of both the NMDGF and the Service.

Terrestrial Resources

Vegetation

The project area lies within two physiographic regions including the southern Rocky Mountains and the Colorado Plateau (Dick-Peddie 1993, Brown 1982). Representative plants commonly occurring in the area downstream of Navajo Dam include: bluestems, indian grass, switch grass, sideoats, Harvard shin oak, sand sagebrush, soapweed yucca, mesquites, fourwing saltbush, rabbit brush, and snakeweed. Cacti include several hedgehogs, prickly-pears, and chollas.

Riparian communities comprise the majority of the vegetation community along the San Juan River between Navajo Dam and Lake Powell. Riparian vegetation includes Fremont cottonwood, coyote willow, Russian olive, salt cedar, Siberian elm, black locust, and honey locust. A list of common and scientific names of vegetation discussed in this report is provided in Appendix B.

Much of the project area has been disturbed by cattle and sheep grazing, urban development, oil and gas drilling, and surface mining. The cumulative habitat alterations, combined with large-scale water development, have altered much of the native wetland and riparian communities along the San Juan River. Although native willows and cottonwoods still exist, more than 85 percent of the vegetation community along the floodplain of the San Juan River has been replaced by non-native Russian olive and salt cedar.

Prior to large scale water development projects, the San Juan River floodplain was comprised of trees, shrubs, and grassland dependent upon periodic flooding. A major historical component of native vegetation along the San Juan River was cottonwood woodland. This deciduous woodland is best developed along alluvial floodplains of large, low-gradient, perennial streams that flow through wide, unconstrained valleys. The vegetation is dependent on a subsurface water supply and varies considerably with the height of the water table. Major flood events and consequent flood scour, overbank deposition of water and sediments, and stream meandering are important factors that shape this community (USGS 1998).

Most of the project area is located in upland habitat. Representative shrubs commonly occurring in the uplands include: four-wing saltbush, green rabbitbrush, big sage, black sage, shadscale, grease wood and winterfat. Representative forbs and grasses include indian ricegrass, western wheatgrass, mallow, and galetta.

Wildlife

Wildlife habitats in the project area can be broken into three general categories: 1) bottomland riparian/wetland habitat; 2) irrigated agriculture and urban vegetation; and 3) arid upland (ERI 2003c). Bottomland habitats are located along the San Juan River, Chaco River, and arroyos. These habitats are critical to many species of amphibians, reptiles, birds and mammals (ERI 2003a). Irrigated agriculture and urban areas provide important habitat for many wildlife species in the project area as well. Many bird and mammal species rely on these habitats with the highest number of birds found in the project area occurring within agricultural fencerow habitats (ERI 2003c). Arid upland habitats in the project area have been impacted by grazing (Service 1981). Impacts associated with upland grazing have limited plant and wildlife diversity in the project area.

Reclamation conducted habitat investigations within a portion of the project area in 1983 (Reclamation 1984). During their investigations, Reclamation identified 84 mammals, 11 amphibians, 34 reptiles, and 150 bird species in the general project area (ERI 2003c). As a part of their project area investigations, Reclamation reviewed New Mexico Department of Game and Fish hunter survey reports from the late 1960's and early 1970's to evaluate wildlife density (ERI 2001). Hunter survey reports indicated low densities of game species in the project area.

Recent wildlife information for the project area is limited to elk and deer censuses (ERI 2003c). New Mexico Department of Game and Fish aerial surveys of Game Management Unit (GMU) 7 (Cutter Lateral area) in 2002 revealed approximately 4 elk and less than 1 deer per square mile. The NMDGF estimates that Game Management Unit 2B (also in the general Cutter Lateral area) contains a total of approximately 5,100 deer and 1,350 elk (ERI 2003c).

Although upland habitats have been heavily impacted by grazing, San Juan and McKinley Counties exhibit relatively high trapping rates for fur bearing mammals. During the 1999-2000 season, 23 percent of the fur bearing mammals was trapped in these two New Mexico counties (ERI 2003c). Many of these species are associated with bottomland habitats and habitats associated with irrigated agriculture and would not typically be found in disturbed semi-arid upland habitats that dominate the pipeline routes.

Representative bird species found in bottomland riparian/wetland habitats include: Cooper's hawks, peregrine falcons, Gambel's quail, western sandpipers, mountain plovers, gulls, yellow-bellied sapsuckers, yellowlegs, lark sparrows, dippers, flycatchers, belted kingfishers, great-horned owls, red-winged blackbirds, tree swallows, mountain chickadees, nuthatches, grackles, sparrows, medowlarks, pied-billed grebes, northern shovelers, double-breasted cormorants, warblers, and teals. Representative bird species found in arid upland habitats include: hawks, peregrine falcons, osprey, chuckar, scaled quail, pheasant, willet, plovers, terns, gulls, doves, short-eared and burrowing owls, swifts, sparrows, orioles, shrikes, swallows, towhees, phoebes, meadowlarks, thrashers, warblers, grebes, and ducks. A list of common and scientific names of birds discussed in this report is provided in Appendix C.

Representative mammal species found in bottomland riparian/wetland habitats include: pallid and big brown bats, little brown and small-footed myotis, free-tailed bats, cottontail, jackrabbit, squirrel, Gunnison's prairie dogs, mice, coyotes, mountain lions, striped skunks, raccoons, black bear, and mule deer. Representative mammal species found in arid upland habitats include: shrews, pallid bats, silver-haired bats, myotis, Townsend's big-eared and Mexican free-tailed bats, cottontail, jackrabbit, beaver, Gunnison's prairie dog, kangaroo rats, mice, squirrels, coyotes, river otter, long-tailed weasel, mink, raccoons, skunks, foxes, pronghorn, and mule deer. A list of common and scientific names of mammals discussed in this report is provided in Appendix D.

Representative amphibians found in bottomland riparian/wetland habitats include: tiger salamanders, toads, and frogs. Representative reptiles include: whiptails, corn snakes, many-lined skinks, common kingsnakes, desert spiny lizards, and garter snakes. Representative amphibians found in arid upland habitats include: tiger salamanders, toads, and frogs. Representative reptiles include: whiptails, rattlesnakes, gopher snakes, and lizards. A list of common and scientific names of amphibians and reptiles discussed in this report is provided in Appendix E.

Threatened and Endangered Species

As the quality and quantity of the fish and wildlife habitat within the San Juan River has decreased over time from habitat alteration and large-scale water development, so has its ability to sustain native flora and fauna. Several species native to the project area have been listed as federally threatened and endangered under the Act. Listed species that are present include the pikeminnow, razorback sucker, southwestern willow flycatcher, bald eagle, and Mesa Verde cactus.

Colorado Pikeminnow

The project is also within the known and historic range of the pikeminnow. The pikeminnow was listed by the Service as endangered March 11, 1967 (32 FR 4001). The current range of the pikeminnow includes Colorado, New Mexico, Utah, and Wyoming. Critical habitat for the pikeminnow was designated March 21, 1994 (59 FR 13374). Critical habitat for the pikeminnow begins at the State Highway 371 bridge (T 29 N, R 13 W, Sec. 17) in Farmington, New Mexico, and includes the 100-year floodplain downstream to the mouth of Neskahai Canyon (T 41 S, R 11 E, Sec. 16), Utah, on the San Juan arm of Lake Powell. Critical habitat includes areas of the floodplain that when flooded would provide fish habitat. The primary constituent elements for critical habitat include, but are not limited to, the river channel, bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated, provide spawning, nursery, feeding or rearing habitat. Areas within the 100-year floodplain that do not provide the primary constituent elements do not meet the definition of critical habitat. For example, a parking lot within the 100-year floodplain would not be considered critical habitat.

Razorback Sucker

The project is also within the known and historic range of the razorback sucker. The razorback sucker was federally listed by the Service as endangered on October 23, 1991 (56 FR 54947). The current range of the razorback sucker includes Arizona, California, Colorado, New Mexico, Nevada, Utah, Wyoming, and Mexico. Critical habitat for the razorback sucker was designated March 21, 1994 (59 FR 13374). Critical habitat for razorback sucker begins at the Hogback diversion (T 29 N, R 16 E, Sec. 9) and includes the 100-year floodplain downstream to the mouth of Neskahai Canyon, Utah, on the San Juan arm of Lake Powell. The primary constituent elements for critical habitat are similar to those for pikeminnow and fall into three general areas: water, physical habitat, and the biological environment (Maddux *et al.* 1993).

Southwestern Willow Flycatcher

The Service listed the southwestern willow flycatcher (flycatcher) as endangered on February 27, 1995 (60 FR: 10694-10715). The flycatcher is also classified as endangered by the State of New Mexico (New Mexico Department of Game and Fish 1987). The current range of the flycatcher includes southern California; southern portions of Nevada and Utah, Arizona, New Mexico, western Texas, and southwestern Colorado (Unitt 1987, Browning 1993). In New Mexico, the species has been observed in the Rio Grande, San Juan, Rio Chama, Zuni, San Francisco, and Gila River drainages. Available habitat and overall numbers have declined statewide (62 FR: 39129-39147). A final recovery plan for the flycatcher has been developed (68 FR: 10485).

Loss and modification of nesting habitat is the primary threat to this species (Phillips *et al.* 1964, Unitt 1987, 58 FR: 39495-39522). Loss of migratory stopover habitat also threatens the flycatcher's survival. Large scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats that are used by the flycatcher (Phillips *et al.* 1964, Carothers 1977, Rea 1983, Johnson and Haight 1984, Howe and Knopf 1991). The flycatcher is a riparian obligate and nests in riparian thickets associated with streams and other wetlands where dense growths of willow, buttonbush, boxelder, Russian olive, salt cedar or other plants are present. Nests are often associated with an overstory of scattered cottonwood. Throughout the flycatcher's range, these riparian habitats are now rare, reduced in size, and widely separated by vast expanses of arid lands. Flycatchers begin arriving in New Mexico in late April and May to nest, and the young fledge in early summer. Flycatchers nest in thickets of trees and shrubs approximately 6.5 - 23 ft in height or taller, with a densely vegetated understory from ground or water surface level to 13 ft or more in height. Surface water or saturated soil is usually present beneath or next to occupied thickets (Phillips *et al.* 1964, Muiznieks *et al.* 1994). At some nest sites, surface water may be present early in the nesting season with only damp soil present by late June or early July (Muiznieks *et al.* 1994, Sferra *et al.* 1995). Habitats not selected for nesting or singing are narrower riparian zones with greater distances between willow patches and individual willow plants. Suitable habitat adjacent to high gradient streams does not appear to be used for nesting. Areas not selected for nesting or singing may still be used during migration.

Occupied and potential flycatcher nesting habitat exists along the San Juan River. Although no territories were identified along the San Juan River in 2001, three territories were documented as recently as 1998. Occupied and potential habitat is primarily composed of riparian shrubs and trees, chiefly Goodding's willow and peachleaf willow, Fremont cottonwood, coyote willow, and salt cedar. The habitat within the project area does provide nesting habitat for the flycatcher, and some flycatchers may use the area during migration. Habitat in nesting areas has mature cottonwoods, often bordered or mixed with salt cedar and Russian olive, with small patches of willows along the high flow channels.

Bald Eagle

The project area is also within the known and historic range of the bald eagle. The Service reclassified the bald eagle from endangered to threatened on July 12, 1995 (60 FR: 36000-36010). Adults of this species are easily recognized by their white heads and dark bodies. Wintering bald eagles frequent all major river systems in New Mexico from November through March, including the San Juan River. Bald eagles prefer to roost and perch in large trees near water. Bald eagle prey includes fish, waterfowl, and small mammals.

Mesa Verde Cactus

The Mesa Verde cactus is federally listed as a threatened species (Service 1984). This species is also protected by the State of New Mexico.

Mesa Verde cactus has spherical stems which grow alone or in clusters, and are about 5-8 cm tall (Service 1984). There are about 8-10 tan or straw colored radial spines per areole (spine cluster), and no central spines. The color of the spines allows the plants to blend in well with the fine soil on which they grow (Service 1984). Flowers are yellow to greenish-white, and appear in the spring. The cactus is restricted to dry clay soils along drainage ways on the eastern edge of the Navajoan Desert and is associated with *Atriplex spp.* at 1,219-1,829 m in elevation (Service 1984).

The Mesa Verde cactus was historically found in San Juan County, New Mexico, and Montezuma County, Colorado (Service 1984). Presently, it is found in the same counties, but reduced in distribution and numbers.

Reasons for decline in the Mesa Verde cactus include: limited distribution, over-collecting, habitat degradation due to overgrazing, habitat destruction due to mining, oil and gas exploration and drilling, commercial and residential development, off-road vehicle use, road building and maintenance, construction of power lines and pipelines, and pesticide use (Service 1984).

Future Conditions without the Project

The No Action Alternative for this project is the affected environment with trends through the life of the project. No project elements would be implemented under the No Action Alternative. Baseline biological conditions were projected through time and include effects associated with implementation of the Navajo Reservoir Operations EIS.

Fish and wildlife habitat in the project area would likely improve as a result of restoring natural processes associated with the SJRBRIP and mimicry of a natural hydrograph (e.g., recruitment of native riparian vegetation, establishment and maintenance of native fish and endangered species habitats) downstream of the Animas River confluence. The frequency of 5,000 cfs releases in the project area are anticipated to increase more than three-fold while lower flows would occur in the summer, winter, and fall. Lower flows would decrease wetted streambed area, reduce primary and secondary productivity, and reduce carrying capacity in the project area.

The frequency of 5,000 cfs (142 cms) peak releases from Navajo Dam during spring runoff would increase above historic spring releases from about 16 to 69 percent, while minimum releases during summer, fall, and winter (July through February) would be about 50 percent lower (250 cfs versus 500 cfs, 7 versus 14 cms). Average monthly releases during summer and fall (July through October) would be about 57 percent lower (430 cfs versus 1,000 cfs, 12 cms versus 28 cms), and during winter about 51 percent lower (390 cfs versus 790 cfs, 11 versus 22 cms).

In most years, peak spring releases from Navajo Dam would increase with a target release of 5,000 cfs. This increase in flow would continue approximately 44 river mi (71 km) downstream to the Animas River. Flows would then continue to increase, or stabilize, to Lake Powell as a result of tributary inflows.

Winter base flow decreases in more than 44 mi (71 km) of river would provide little or no benefit to the native fish community and trout fishery. While lower winter base flows would not likely produce acute effects, these fisheries would be limited by reduced habitat availability, reduced primary and secondary productivity, and possible competition from non-native fishes.

Lower winter, summer, and fall base flow releases would decrease the wetted streambed perimeter. Aquatic productivity is generally related to the amount of streambed area that is wetted. Shallow areas, especially riffles, are the primary production areas for aquatic invertebrates, which constitute much of the food base for fish and many shorebirds. Some losses in wetted perimeter would be realized with reductions in dam releases from 500 cfs (14 cms) to 250 cfs (7 cms). These reductions would be most pronounced upstream of the Animas River confluence where average winter releases would decrease by about 50 percent and summer and fall releases would decrease by about 57 percent. In addition, irrigation depletions and changing releases from Navajo Dam to meet downstream endangered species needs in summer and fall would result in frequent flow fluctuations. These fluctuations would further reduce or limit aquatic productivity. Lower base flows and frequent fluctuations in summer and fall releases would reduce the forage base and the carrying capacity of fisheries upstream of the Animas River confluence. Downstream of the Animas River confluence to Lake Powell, minimum base flows of 500 cfs (14 cms) would be maintained through critical habitat for endangered species.

Decreased winter base flows would increase shallow water habitat, particularly in areas upstream of the Animas River confluence. These habitats are important to shorebirds (e.g., killdeer, least sandpiper), wintering migratory birds, hibernating amphibians and reptiles, and juvenile fish species. Although lower flows would provide more shallow water habitats, they could also reduce the forage or prey base for many of these same species.

During the spring season, reservoir releases would increase to 5,000 cfs (142 cms), primarily to meet endangered fish species spawning and young-of-the-year habitat needs. Flows downstream of the Animas River confluence, for example, would periodically increase to 10,000 cfs (2,830 cms), or greater.

The duration and timing of high flows typical of the spring season (greater than 10,000 cfs, 2,830 cms) provide better spawning habitat for the fish community and provide better conditions for the (native) riparian-wetland plant community. The flow decreases in the San Juan River upstream of the Animas River confluence during summer, fall, and winter seasons would have varying effects on the fish community. Although the effects of reduced flows on the hydrology supporting the riparian-wetland plant community was minimal during low flow tests, long term impacts to these habitats are not known.

The baseline depletion limit for the San Juan River basin is approximately 853,000 afy (105,216 hmy). Approximately 623,000 afy (76,846 hmy) of the baseline are currently being depleted. Of the 853,000 afy, 280,600 afy (34,612 hmy) has been allocated to NIIP. Of the 280,600 afy depletion allocated to NIIP, approximately 160,330 afy (19,777 hmy) are currently being depleted. Therefore, approximately 120,271 afy (14,835 hmy) of NIIP depletions are available for development. By the year 2040, it is reasonable to assume that the remaining unused depletions would be developed. With the project, approximately 33,600 afy (4,145 hmy) of the future NIIP depletions would be passed downstream through Navajo Dam to facilitate the diversion of 33,118 afy into the San Juan Lateral at the PNM diversion dam. Without the project, the full future NIIP depletion would likely be diverted from Navajo Reservoir and an opportunity to allow more than 33,000 afy of water to remain in the river between Navajo Dam and the PNM diversion dam could be missed.

Without the project, construction related impacts to fish, wildlife, and plants would not occur. Impacts to fish and wildlife resources associated with the operation and maintenance of the diversion pump, treatment and pumping plant, pipeline, powerlines, booster pumping stations, and other project features would also not occur.

Threatened and Endangered Species

Issues with federally listed species will be addressed in detail during section 7 consultation under the Act.

FISH AND WILDLIFE RESOURCES WITH THE PROJECT

The proposed project would include both short- and long-term construction related disturbances. Short-term construction related impacts would occur from noise, dust, and the presence of workers and machinery in the project area. Installation of the pipeline across the river could temporarily increase turbidity and reduce water quality in the construction area. Runoff from construction work sites, access routes, staging areas, and unprotected fills could further degrade water quality. Accidental spills of fuels, lubricants, hydraulic fluids and other petrochemicals, although unlikely, would be harmful to aquatic life. Changes in flow caused by de-watering of the construction sites and excavation could cause direct mortality to fish and aquatic invertebrates, disrupt fish spawning, and cause mortality of incubating eggs downstream of construction sites.

Construction of the intake structure, pipeline crossing of the San Juan River and associated facilities would disturb approximately 17.2 acres (7 hectares) of riparian habitat. Construction of 267 miles of San Juan and Cutter Lateral pipelines, 107 miles of overhead transmission lines, booster pumping stations, and other facilities would temporarily disturb approximately 31,477 acres (12,738 hectares) of primarily upland habitat. Pipeline construction activities could temporarily disturb potential raptor nesting habitats along the Defiance Monocline, Nutria Monocline, and areas near Blanco and Cutter Canyons. These activities could disturb raptor hunting areas southwest of Nageezi and east of Sheep Springs. Construction activities could also temporarily impact golden eagles along the corridor from Cutter Canyon to Largo Canyon.

Construction of the proposed pipeline could also disturb the federally threatened Mesa Verde cactus and its habitat. The Mesa Verde cactus occurs south-southeast of the junction of U.S. 491 and Navajo Route 36 within the boundary of the proposed San Juan Lateral pipeline alignment and an associated booster pumping station.

Under the proposed project, 33,600 afy of NIIP water would be released through Navajo Dam to facilitate diversions of 33,118 afy at the PNM diversion dam (RM 166.7). Of the 33,118 afy diverted at the PNM diversion dam, an average of 1,871 afy would return to the San Juan River via the Shiprock wastewater treatment plant. Between Navajo Dam and the PNM diversion dam mean monthly flows would increase 17 to 98 cfs (0.5 to 2.8 cms). Minimum mean monthly flows would remain unchanged or increase up to 32 cfs (0.9 cms). Maximum monthly flows in this same reach would decrease by 54 cfs (1.5 cms) in February, and increase by 405 cfs (11.5 cms) in October. Downstream of the PNM diversion dam, mean monthly flows would increase up to 38 cfs (1.1 cms) in June, and decrease by 37 cfs (1.0 cms) in July. Minimum mean monthly flows would remain unchanged or decrease by 59 cfs (1.7 cms). Maximum mean monthly flows in this same reach would decrease by 92 cfs (2.6 cms) in February, and increase by 361 cfs (10.2 cms) in October.

Overall, withdrawals would reduce annual base flows by less than 0.5 percent on average with the greatest mean monthly reduction being less than 3 percent. Given the magnitude of flow in the river, project related flow reductions of less than 0.5 percent are not expected to negatively impact aquatic habitats, particularly downstream of the Animas River confluence. Increases in flow, particularly upstream of the Animas River confluence, may provide some benefit to aquatic resources. For example, at the Archuleta gage in July, mean monthly flows would increase by approximately 25 cfs (0.7 cms) with the project. During low flow conditions, this could equate a 10 percent increase (or more) in flow between Navajo Dam and the confluence with the Animas River. These flows could help maintain suitable water temperatures and increase available habitat for both the coldwater trout fishery and the native fish community.

Assuming the SJRBRIP flow recommendations are met, the Preferred Alternative should have minimal effects on water quality in the river. For instance, concentrations of constituent elements (i.e., nutrients) in the river water column would increase by approximately 0.2 percent on average with a maximum increase of approximately 1.2 percent below the PNM diversion dam. Conversely, constituent elements would correspondingly decrease between Navajo Dam and the PNM diversion dam due to increases in releases associated with Preferred Alternative. Return flows from the Shiprock wastewater treatment plant would average approximately 5.0 cfs (0.14 cms) annually, equating to about one percent of minimum base flows under the SJRBRIP flow recommendations. The net increase in constituent elements associated with returns from the wastewater treatment plant would be approximately 1.2 percent. Overall, increases in constituent elements would be difficult to detect and would not be expected to negatively impact the San Juan River fishery.

Operation of the intake at the PNM diversion dam could negatively impact fishery resources at the point of diversion. The approximate 60 cfs diversion at the PNM diversion dam would withdraw between 1.2 and 3.87 percent of the flow during peak larval drift for several fish species (ERI 2003b). Assuming that entrainment of larval fish is directly proportional to the diverted flow, ERI (2003b) estimated that as pikeminnow begin spawning above the PNM diversion dam, approximately 3.87 percent of pikeminnow larvae could be entrained at the intake structure. ERI (2003b) also estimated that approximately 1.2 percent of bluehead sucker larvae, flannelmouth sucker larvae, and speckled dace larvae produced upstream of the PNM diversion dam could be entrained at the intake structure.

Short-term, entrainment of pikeminnow larvae is not expected because pikeminnow spawning has not been documented above the PNM diversion dam. Should pikeminnow access spawning areas above the diversion structure, entrainment of their larvae would likely occur. Entrainment of other species currently spawning above the structure would also occur. However, entrainment should be minimized because of the proposed design, location, and low approach velocities associated with the intake structure. As a result, entrainment of larvae would not be expected to be directly proportional to the diverted flow. Thus, the ERI entrainment estimates should be considered the worst case scenario.

Although the Preferred Alternative would entrain a small proportion of the eggs and larvae produced above the PNM diversion dam, long-term the Preferred Alternative would cause the least impacts to the San Juan River fishery of all the alternatives analyzed, assuming the SJRBRIP flow recommendations are met. The Preferred Alternative would ensure that at least 33,118 afy more water would remain in the river between Navajo Dam and the PNM diversion dam than would occur without the project. The release of 33,600 afy from Navajo Dam should slightly increase the amount of habitat available to fish between Navajo Dam and the PNM diversion dam, and could offset project related impacts downstream. Releases associated with the project could also benefit the native fish community and recreational trout fishery downstream of Navajo Dam, while still meeting the flow recommendations.

The Preferred Alternative would also include diversions of 4,645 afy at Navajo Reservoir for Cutter Lateral. To meet this supply, the mean elevation of Navajo Reservoir would increase by approximately 1.3 ft (0.4 m). Depending on the bathometric profile of Navajo Reservoir this increase could change the amount of near shore spawning and foraging habitat.

NIIP Amarillo and Water Conservation Alternatives

Under the NIIP Amarillo Alternative all of the project water (37,763 afy) would be diverted at Navajo Reservoir. This would result in less water in the river between Navajo Dam and the PNM diversion dam than would occur under the Preferred Alternative. Although entrainment would be avoided under the NIIP Amarillo Alternative, more project related impacts to fish and wildlife resources would be expected because of the reduced flows. The NIIP Amarillo Alternative would also include slightly more upland impacts during project construction than would occur under the Preferred Alternative.

Under the Water Conservation Alternative, project related diversions would not occur and project related infrastructure (e.g., pipelines, pumping plants, etc.) would not be constructed. Although entrainment and construction related impacts would be avoided, future depletions at Navajo Reservoir could mean more impacts to fish and wildlife resources downstream of Navajo Dam.

Threatened and Endangered Species

Issues with federally listed species will be addressed in detail during section 7 consultation under the Act.

DISCUSSION

The Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) directs the Federal action agency to consult with the Service for purposes of "preventing a net loss of and damage to wildlife resources." It further directs the action agency to give wildlife conservation measures equal consideration to features of water resource development. Consideration is to be given to all wildlife, not simply those that are legally protected under the Endangered Species Act or those with high economic and recreational value. Further, the recommendations of the Service which follow are to be given full consideration by the action agency. All aspects of the Navajo – Gallup Water Supply Project should be designed and constructed to avoid and minimize impacts to wildlife resources.

Construction projects that result in adverse impacts to fish and wildlife require the development of mitigation plans. These plans consider the value of fish and wildlife habitat affected. The Service has established a mitigation policy used as guidance in recommending mitigation (Service 1981). The policy states that the degree of mitigation should correspond to the value and scarcity of the fish and wildlife habitat at risk. Four resource categories in decreasing order of importance are identified:

Resource Category No. 1 Habitats of high value for the species being evaluated that are unique and irreplaceable on a national basis or in the ecoregion section. No loss of existing habitat value should occur.
Resource Category No. 2 Habitats of high value that are relatively scarce or becoming scarce on a national basis or in the ecoregion section. No net loss of in-kind habitat value should occur.
Resource Category No. 3 Habitats of high to medium value that are relatively abundant on a national basis. No net loss of habitat value should occur and loss of in-kind habitat should be minimized.
Resource Category No. 4 Habitats of medium to low value. Loss of habitat value should be minimized.

The habitats in the immediate project area are classified as follows: Resource Category No. 2 - riparian vegetation (includes trees and shrubs such as willows) and aquatic habitat, and Resource Category No. 4 - irrigated agriculture and arid upland habitats.

Riparian habitats are classified in category 2 because they are scarce and are rapidly disappearing. About 90 percent of the historic wetland and riparian habitat in the southwest has been eliminated (Johnson and Jones 1977). The mitigation goal for riparian areas (trees and shrubs) in the project area is no net loss in wildlife value as a result of the proposed project. To ensure that mitigation is successful for project related impacts, we recommend that a long-term mitigation plan be developed.

Aquatic habitats are classified in category 2 because they are relatively scarce in the Southwest and provide high wildlife value for several native fish species (e.g., Colorado pikeminnow, razorback sucker, flannelmouth sucker). The mitigation goal for aquatic habitat (e.g., backwaters, riffles, and runs) in the project area is to have no net loss of habitat value as a result of the proposed project.

Irrigated agricultural and arid upland habitats are classified in category 4 because they are relatively common in the Southwest, yet they provide important wildlife habitat. Project related disturbances should be mitigated to ensure that impacts to these habitats are avoided or minimized.

The Service has ranked the Project alternatives in terms of their potential impacts on aquatic and terrestrial resources from least to most:

- San Juan PNM 2040 Diversion Alternative (Preferred Alternative)
- Water Conservation Alternative
- No Action Alternative
- NIIP Amarillo Alternative

Short-term, the No Action and the Water Conservation Alternatives would be the most environmentally beneficial alternatives, followed by the Preferred Alternative and the NIIP Amarillo Alternative. This is because approximately 230,000 afy (28,370 hm) of San Juan River depletions have yet to be developed, meaning less water would be diverted, and more water would remain in the San Juan River than would remain in the river under the Preferred Alternative or the NIIP Amarillo Alternative. Construction, operation, and maintenance related disturbances would also be avoided since the No Action and Water Conservation Alternatives would not include the infrastructure proposed under the Preferred Alternative and the NIIP Amarillo Alternative.

As water development continues depletions will approach the 853,000 afy San Juan River baseline depletion limit. Of the 230,000 afy (28,370 hmy) of undeveloped depletions, approximately 120,270 afy are designated for NIIP. Under the No Action and Water Conservation Alternatives, the Navajo Nation would continue to develop their unused NIIP depletions until all of their available water has been developed. Under the proposed action, the Navajo Nation would allow 33,600 afy of water to be released downstream of Navajo Dam to facilitate project related diversions into the San Juan Lateral. Thus, the proposed project would ensure that more water would remain in the river than would occur under the No Action, Water Conservation, and NIIP Amarillo Alternatives.

Of all the alternatives evaluated, the NIIP Amarillo Alternative would have the most short- and long-term impacts to fish and wildlife resources. Under this alternative, 37,763 afy (4,658 hmy) of water would be diverted from the San Juan River at the NIIP diversion in Navajo Reservoir. Short-term impacts would include lower flows downstream of Navajo Dam and possibly lower water quality compared to the Preferred Alternative. Long-term, an opportunity to release 33,600 afy of water from Navajo Dam and remain in the river could be missed. The NIIP

Amarillo Alternative would also cause temporary construction related disturbances to approximately 31,841 acres (3,928 hectares) of habitats along its pipeline routes.

The Service anticipates minor short-term impacts to fish and wildlife resources associated with project construction. To minimize adverse impacts to birds protected under the Migratory Bird Treaty Act, tree stands or other adequately vegetated areas slated for grubbing or clearing should be surveyed for the presence of nesting birds during the general migratory bird nesting season of March through August. Disturbance to nesting areas should be avoided until nesting is completed.

Vegetation clearing and construction related soil disturbances can cause sediment-laden runoff to enter waterways. To minimize impacts associated with erosion, the contractor should employ silt curtains, coffer dams, dikes, straw bales, or other suitable erosion control measures. Loss of riparian habitat should be avoided or kept to a minimum when avoidance is not possible. Should loss of riparian habitat occur, mitigation would be necessary. Mitigation plantings of coyote willow and black willow whips or poles, and cottonwood poles should be dense and planted down to the water table to help ensure that mitigation is successful.

Under the proposed project, a portion of the eggs and larvae in the drift above the PNM diversion dam would likely be entrained in the San Juan Lateral intake structure. However, the design, location, and approach velocities of the proposed intake structure would minimize the amount of entrainment that could occur. The Service believes that the impacts associated with entrainment would be offset by the benefits of releasing 33,600 afy of NIIP water through Navajo Dam rather than through the NIIP diversion structure. Therefore, the Service believes that the Preferred Alternative meets the mitigation goal of no net loss for this resource category. Although the Preferred Alternative should meet the mitigation goal for this resource category, the Service recommends that Reclamation monitor the intake pump, sump, and settling ponds to estimate entrainment during periods of larval drift. If larval entrainment exceeds the estimates of ERI (2003b), then Reclamation should contact the Service to determine if further project review under the Fish and Wildlife Coordination Act is necessary.

Although no specific mitigation is recommended for long-term project related impacts to aquatic habitats, the Service anticipates that minor short-term construction related impacts to aquatic habitats would occur. To minimize construction related impacts to fishery and other aquatic resources, we recommend that the in-channel construction sites for the intake pump and pipeline crossing of the San Juan River be dewatered and that flows be diverted around the construction sites. Diverted flows should be sufficient to provide fish passage through the construction areas. To further reduce construction related impacts to aquatic resources, construction activities should be conducted during low-flow periods and periods of low precipitation.

To minimize construction related impacts to water quality, we recommend that Reclamation consult with the Surface Water Quality Bureau of the New Mexico Environment Department regarding the proposed project and potential impacts. To ensure that impacts to water quality are minimized during construction, the contractor should conduct water quality monitoring before, during, and after construction to ensure that New Mexico water quality standards are met.

To minimize impacts associated with concrete and concrete-batching, the contractor should contain poured concrete in forms and/or behind cofferdams to prevent discharge into the river. The contractor should also contain and treat or remove for off-site disposal any wastewater from concrete-batching, vehicle wash-down, and aggregate processing.

To minimize the likelihood of petrochemical spills, the contractor should clean construction equipment prior to construction to ensure that no leaks or discharges of lubricants, hydraulic fluids or fuels occur in aquatic or riparian habitats. The contractor should also store and dispense fuels, lubricants, hydraulic fluids and other petrochemicals outside the floodplain, and inspect construction equipment daily to ensure that no leaks or discharges of lubricants, hydraulic fluids or fuels occur in aquatic or riparian habitats. If petrochemical spills or leaks occur, the contractor should contain and remove any petrochemical spills, including contaminated soil, and dispose of these materials at an approved upland site.

To minimize potential impacts to fish and wildlife resources associated with riprap or other fill, we recommend that the contractor use only clean cobble or quarry stone from an upland source. Uncontaminated earth or alluvium suitable for revegetation with indigenous plant species should be used for backfill. Backfill should be revegetated or reseeded with native plants or seeds to accelerate revegetation of disturbed areas. Staging areas should also be revegetated with native plants or reseeded with native vegetation to minimize erosion and reduce impacts to fish and wildlife resources.

Construction of the proposed project would disturb approximately 31,477 acres of primarily upland habitat. The majority of this habitat would be located in previously disturbed highway right-of-ways. To minimize trapping of wildlife during trenching operations we recommend, where possible, that trenching and burying of pipeline be done concurrently. In addition, we recommend leaving the least amount of trench open overnight and providing escape ramps for trapped wildlife. We also recommend that areas disturbed during construction be reseeded with native vegetation to minimize erosion and expedite revegetation. For those upland areas where soils have become compacted by use of heavy equipment, soils should be scarified and/or additional topsoil added prior to revegetation.

The proposed project would include the construction of approximately 107 miles of overhead transmission lines. Birds of prey such as eagles, hawks, and owls frequently use power lines and support structures for perching and nesting. These raptors can be electrocuted while using power lines, thus contributing to the cumulative mortality factors affecting these biologically important and environmentally sensitive birds. Standard techniques have been developed to prevent raptor electrocutions at electric distribution lines. This latest guidance is included in the publication Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996 by the Avian Power Line Interaction Committee. The document may be requested from Edison Electric Institute, P.O. Box 266, Waldorf, Maryland, 20604-0266, telephone (800) 334-5453, or may be requested from the Raptor Research Foundation at 12805 St. Croix Trail, Hastings, Minnesota 55033, phone (612) 437-4359 or by email at JMFITZPTRK@aol.com. New or modified electric distribution lines should be designed and constructed to prevent the electrocution of raptors, using the above-referenced guidance. Proper design should include adequate separation of energized hardware or insulation of wires where sufficient separation cannot be attained. Closely spaced transformer jumper wires, bushing covers, protective cutouts, or surge arresters can be made raptor-safe by the use of special insulating material. The use of grounded steel crossarm braces should be avoided. These measures should be implemented on each line and pole associated with new or converted lines as necessary.

RECOMMENDATIONS

To minimize project related impacts to fish and wildlife resources, we recommend that Reclamation incorporate into their project the mitigation and minimization measures recommended by ERI. We also recommend that Reclamation:

1. Replace any woody vegetation (e.g., willows) unavoidably lost by establishing 2 acres of native vegetation for every acre impacted. If trees are removed, we recommend a minimum ratio of ten saplings be planted for each mature tree lost. Planting of willow and cottonwood poles should be dense and in a location where adequate water is available to ensure that mitigation is successful. Mitigation should cover the direct removal of vegetation during construction, as well as induced mortality that may occur in future years.

2. Tree stands or other vegetated areas slated for grubbing or clearing should be surveyed for the presence of nesting birds during the general migratory bird nesting season of March through August. Avoid disturbing nesting areas until nesting is complete.

3. Employ silt curtains, cofferdams, dikes, straw bales or other suitable erosion control measures during construction.

4. Monitor the intake pump, sump, and settling ponds to estimate larval entrainment during periods of drift. Contact the Service to determine if further project review under the Fish and Wildlife Coordination Act is appropriate if entrainment exceeds the estimates of ERI (2003b).

5. Dewater in-channel construction areas prior to construction. Maintain river flows up- and downstream of construction areas. Maintain fish passage around dewatered construction areas during construction. Construct the project during periods of low flow and low precipitation.

6. Monitor water quality before, during, and after construction to ensure compliance with State Water Quality Standards.

7. Contain poured concrete in forms and/or behind cofferdams to prevent discharge into the river. Contain and treat or remove for off-site disposal any wastewater from concrete-batching, vehicle wash-down, and aggregate processing.

8. Store and dispense fuels, lubricants, hydraulic fluids, and other petrochemicals outside the 100-year floodplain. Inspect construction equipment daily for petrochemical leaks. Contain and remove any petrochemical spills and dispose of these materials at an approved upland site. Park construction equipment outside the 100-year floodplain

during periods of inactivity.

9. Carry an oil spill kit or spill blanket at all times. Ensure equipment operators are knowledgeable in the use of spill containment equipment. Develop a spill contingency plan prior to initiation of construction. Immediately notify the proper Federal and State authorities in the event of a spill.

10. Use only clean cobble or quarry stone from an upland source. Use uncontaminated earth or alluvium suitable for revegetation with indigenous plant species for backfill. Revegetate or reseed backfill and other disturbed areas with native plants or seeds to accelerate revegetation with native species.

11. Where possible, minimize trapping of wildlife during pipeline installation by trenching and burying pipeline concurrently. Leave the least amount of trench open overnight, and provide escape ramps for trapped wildlife.

12. Re-vegetate all upland areas disturbed during construction, using native plants or seeds. For those upland areas where soils have become compacted as a result of heavy equipment operation, soils should be scarified or additional topsoil placed prior to revegetation.

13. Minimize electrocution risk to raptors by installing perch guards or raptor safe configurations on all transmission structures. Minimize collision risk to raptors and other bird species by marking transmission lines that pose a high collision risk with spiral vibration dampers or bird flight diverters.

LITERATURE CITED

Bliesner, R. and V. Lamarra. 1996. San Juan River habitat studies, 1995 Annual Report. Keller-Bliesner Engineering and Ecosystems Research Institute for San Juan River Basin Recovery Implementation Program, Fiscal Year 1995, U.S. Fish and Wildlife Service, Albuquerque, NM.

Bliesner, R. and V. Lamarra. 2000. Hydrology, geomorphology, and habitat studies. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, NM.

Brooks, J., M. Buntjer, and J. Smith. 2000. Non-native species interactions: management implications to aid in recovery of the Colorado pikeminnow and razorback sucker in the San Juan River. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, NM.

Brown, D.E. (Ed.). 1982. Biotic communities of the American Southwest - United States and Mexico. Special issue of Desert Plants, vol. 4, numbers 1-4.

Browning, M. 1993. Comments on the taxonomy of *Empidonax traillii* (willow flycatcher). Western Birds 24:241-257.

Bryan, K. 1925. Data of channel trenching (arroyo cutting) in the arid Southwest. Science 62:338-334.

Carothers, S. 1977. Importance, preservation, and management of riparian habitats: an overview. General Technical Report RM-43. United States Department of Agriculture, Forest Service, Denver, CO.

City of Farmington. 1983. Navajo Dam hydroelectric project. FERC Project No. 4720. Volume II (Exhibit E). City of Farmington, NM.

Dick-Peddie, W. 1993. New Mexico Vegetation: Past, Present, and Future. University of New Mexico Press, Albuquerque, NM.

Ecosystems Research Institute. 2001. Draft Chapters: Navajo-Gallup Pipeline Environmental Assessment. U.S. Department of Interior, Bureau of Reclamation, Draft Environmental Assessment. 30 pp.

Ecosystems Research Institute. 2003a. Project Update: Navajo - Gallup Water Supply Project Vegetation Disturbance. U.S. Department of Interior, Bureau of Reclamation. 31 pp.

Ecosystems Research Institute. 2003b. Navajo - Gallup Water Supply Project Aquatic Disturbance. U.S. Department of Interior, Bureau of Reclamation. 30 pp.
Ecosystems Research Institute. 2003c. Project Update: Navajo - Gallup Water Supply Project Wildlife Disturbance. U.S. Department of Interior, Bureau of Reclamation. 24 pp.

Gellis, A., R. Hereford, S.A. Schumm, and B.R. Hayes. 1991. Channel evolution and hydrologic variations in the Colorado River Basin: factors influencing sediment and salt loads. Journal of Hydrology 124:317-344.

Graf, W.L. 1987. Late Halocene sediment storage in canyons of the Colorado Plateau. Geological Society of American Bulletin 99:261-271.

Holden, P.B. (Ed.). 1999. Flow recommendations for the San Juan River. San Juan River Basin Recovery Implementation Program, U.S. Department of Interior, Fish and Wildlife Service, Albuquerque, New Mexico.

Holden, P.B. 2000. Program evaluation report for the 7-year research period (1991-1997). San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, NM.

Howe, W., and F. Knopf. 1991. On the imminent decline of Rio Grande cottonwoods in central New Mexico. Southwestern Naturalist 36(2):218-224.

Johnson, R., and D. Jones. 1977. Importance, preservation and management of riparian habitat: a symposium. U.S. Department of Agriculture, Forest Service. General Technology, Report RM-43. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Johnson, R., and L. Haight. 1984. Riparian problems and initiatives in the American Southwest: a regional perspective. Pages 404-412 *in* California Riparian Systems: Ecology, Conservation, and Productive Management. University of California Press, Berkeley, CA. 1035 pp.

Maddux, H.R., L.A. Fitzpatrick, and W.R. Noonan. 1993. Colorado River endangered fishes critical habitat: Biological Support Document. U.S. Fish and Wildlife Service, Salt lake City, UT. 225 pp.

Miller, J.M. and J.A. Ptacek. 2000. Colorado pikeminnow habitat use in the San Juan River, New Mexico and Utah. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service. Albuquerque, NM.

Muiznieks, B., S. Sferra, T. Corman, M. Sogge, and T. Tibbitts. 1994. Arizona partners in flight southwestern willow flycatcher survey, 1993. Draft technical report: nongame and endangered wildlife program, Arizona Game and Fish Department, Phoenix, AZ. April 1994. 28 pp.

New Mexico Department of Game and Fish. 1987. The status of the willow flycatcher in New Mexico. Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe, New Mexico. 29 pp.

Phillips, J., R. Marshall, and G. Monson. 1964. The Birds of Arizona. University of Arizona Press, Tucson, Arizona. 212 pp.

Platania, S. 1990. Biological Summary of the San Juan River Ichthyofaunal Study New Mexico-Utah, 1987 to1989. U.S. Department of Interior, Bureau of Reclamation, Salt Lake City, Utah. Contract No. 78-FC-40-05060. 143 pp.

Propst, D.L., and A.L. Hobbes. 1999. Seasonal abundance, distribution and population size-structure of fishes in San Juan River secondary channels: 1991-1197. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, NM.

Rea, A. 1983. Once a River: Bird Life and Habitat Changes on the Middle Gila. University of Arizona Press, Tucson, AZ. 285 pp.

Ryden, D.W. 2000a. Adult fish community monitoring on the San Juan River,1991 - 1997. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, NM.

Ryden, D.W. 2000b. Monitoring of experimentally stocked razorback sucker in the San Juan River: March 1994 - October 1997. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, NM.

Sferra, S., R. Meyer, and T. Corman. 1995. Arizona partners in flight 1994 southwestern willow flycatcher survey. Technical Report 69. Arizona Game and Fish Department, Nongame and Endangered Wildlife Program, Phoenix. 46 pp.

Sublette, J., M. Hatch, and M. Sublette. 1990. The Fishes of New Mexico. New Mexico Department of Game and Fish. University of New Mexico Press, Albuquerque, NM. 393 pp.

Thompson, K.R. 1982. Characteristics of suspended sediment in the San Juan River near Bluff, Utah. United States Geological Survey, Water-Resources Investigations 82-4104.

Tyus, H.M., B.D. Burdick, R.A. Valdez, C.M. Haynes. T.A. Lytle, and C.R. Berry. 1982. Fishes of the upper Colorado River basin: distribution, abundance, and status. Pages 12-70 *in* W.H. Miller, H.M. Tyus, and C.A, Carlson, editors. Fishes of the Upper Colorado River system: present and future. Western Division, American Fisheries Society, Bethesda, MD.

Unitt, P. 1987. *Empidonax traillii extimus*: An endangered subspecies. Western Birds 18:137-162.

U.S. Bureau of Reclamation. 1984. Gallup - Navajo Indian Water Supply Project, Planning Report and Draft Environmental Statement. United States Department of the Interior, Bureau of Reclamation, Amarillo, Texas.

U.S. Bureau of Reclamation. 2000. Notice of Intent To Prepare A Draft Environmental Impact Statement on the Construction of the Navajo - Gallup Water Supply Project and Announcement of Public Scoping Meetings. *Federal Register*. Vol. 65, No. 59.

U.S. Fish and Wildlife Service. 1981. Fish and Wildlife Coordination Act Report: Gallup-Navajo Indian Water Supply Project, San Juan County, New Mexico.

U.S. Fish and Wildlife Service. 1984. Mesa Verde Cactus Recovery Plan. Endangered Species Office, Albuquerque, New Mexico

U.S. Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants: proposed rule to list the southwestern willow flycatcher (*Empidonax traillii extimus*) as endangered with critical habitat. *Federal Register*. Vol. 58.

U.S. Fish and Wildlife Service. 1995a. Endangered and Threatened Wildlife and Plants; Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher. *Federal Register*. Vol. 60, No. 133.

U.S. Fish and Wildlife Service. 1995b. Endangered and Threatened Wildlife and Plants; Final Rule to Reclassify the Bald Eagle From Endangered to Threatened in All the Lower 48 States. *Federal Register*. Vol. 60, No. 133.

U.S. Fish and Wildlife Service. 1997. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Southwestern Willow Flycatcher. *Federal Register*. Vol. 62, No. 140.

U.S. Geological Survey. 1998. USGS-NPS Vegetation Mapping Program, Tuzigoot National Monument Vegetation Descriptions. Washington, D.C. http://www.nbs.gov/npsveg/TUZI/descript.html.

Appendix A. Common and Scientific Names of Fish That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Iowa darter	*Etheostoma exile*
Mottled sculpin	*Cottus bairdi*
Roundtail chub	*Gila robusta robusta*
Bonytail chub	*Gila elegans*
Colorado pikeminnow	*Ptychocheilus lucius*
Speckled dace	*Rhinichthys osculus*
Bluehead sucker	*Catostomus discobolus discobolus*
Flannelmouth sucker	*Catostomus latipinnis*
Razorback sucker	*Xyrauchen texanus*
White sucker	*Catostomus commersoni*
Black bullhead	*Ictalurus melas*
Channel catfish	*Ictalurus punctatus*
Zuni bluehead sucker	*Catostomus discobolus yarrowi*
Western mosquitofish	*Gambusia affinis*
Plains killifish	*Fundulus zebrinus*
Red shiner	*Cyprinella lutrensis*
Common carp	*Cyprinus carpio*
Fathead minnow	*Pimephales promelas*
Green sunfish	*Lepomis cyanellus*
Largemouth bass	*Micropterus salmoides*
Threadfin shad	*Dorosoma petenense*
Red shiner	*Cyprinella lutrensis*
Green sunfish	*Lepomis cyanellus*
Longear sunfish	*Lepomis megalotis*
Bluegill	*Lepomis macrochirus*
White crappie	*Pomoxis annularis*
Yellow perch	*Perca flavescens*
Striped bass	*Morone saxatilis*
Walleye	*Stizostedion vitreum*
Rainbow trout	*Oncorhynchus gairdneri*
Brown trout	*Salmo trutta*
Mottled sculpin	*Cottus bairdi*

Appendix B. Common and Scientific Names of Plants That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Box elder	*Acer interius*
Poison ivy	*Rhus radicans*
Squawbush	*Rhus trilobata*
Water hemlock	*Cicuta douglasii*
Cymopterus	*Cymopterus newberryi*
Cymopterus	*Cympoterus fendleri*
Indian root	*Aristolochia watsoni*
Milkweed	*Asclepias fascicularis*
Tarragon	*Artemisia dracunculoides*
Black sagebrush	*Artemisia nova*
White sagebrush	*Artemisia ludoviciana*
Basin big sagebrush	*Artemisia tridentata*
Golden aster	*Heterotheca villosa*
Rubber rabbitbrush	*Chrysothamnus nauseosus*
Green rabbitbrush	*Ericameria viscidiflora*
Chicory	*Cichorium intybus*
Parry's thistle	*Circium parryi*
Canadian fleabane	*Erigeron canadensis*
Common sunflower	*Helianthus annuus*
Blue lettuce	*Lactuca pulchella*
Cutleaf coneflower	*Rudbeckia laciniata*
Senecio	*Senecio cymbalarioides*
Goldenrod	*Solidago sparsiflora*
Common dandelion	*Taraxacum officinale*
Rough cockleburr	*Xanthium strumarium*
Water birch	*Betula occidentalis*
Rockcress	*Arabis perennans*
Western tansymustard	*Descurainia pinnata*
Blister cress	*Erysium rapandum*
Hoary cress	*Lepidium drapa*
Desert pepperweed	*Lepidium fremontii*
Clasping pepperweed	*Lepidium perfoliatum*
Watercress	*Rorippa nasturtium-aquaticum*
Spreading yellowcress	*Rorippa sinuata*
European watercress	*Nasturtium Officinale*
Tumbling mustard	*Sisymbrium altissimum*
Rocky mountain beeplant	*Cleome serrulata*
Four-wing saltbush	*Atriplex canescens*
Annual atriplex	*Atriplex hastata*

Appendix B continued. Common and Scientific Names of Plants That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Redscale	*Atriplex rosea*
Shadescale	*Atriplex confertifolia*
Lambsquarters	*Chenopodium album*
Russian thistle	*Salsola kali tenuifolia*
Tumbleweed	*Amaranthus graecizans*
Field bindweed	*Convolvulus arvensis*
Redosier dogwood	*Cornus stolonifera*
Missoure gourd	*Cucurbita foetidissima*
Emory's Sedge	*Carex emoryi*
Stalkgrain sedge	*Carex stipata*
Fox sedge	*Carex vulpinoidea*
Spike rush	*Eleocharis macrostachya*
Creeping spike rush	*Eleocharis palustris*
Hardstem bulrush	*Scirpus acutus*
Olney bulrush	*Scirpus americanus*
Bulrush	*Scirpus paludosus*
Cloaked bulrush	*Scirpus pallidus*
Giant bulrush	*Scirpus validus*
Russian olive	*Elaeagnus angustifolia*
Common horsetail	*Equisetum arvense*
Smooth scouring rush	*Equisetum laevigatum*
Dwarf horsetail	*Equisetum kansanum*
Ridgeseed spurge	*Euphorbia glyptosperma*
Thyme leaved spurge	*Euphorbia serpyllifolia*
Aspen pea	*Lathyrus laetivirens*
Spurred lupine	*Lupinus laxiflorus*
Small lupine	*Lupinus pusillus*
Black medick	*Medicago lupulina*
Alfalfa	*Medicago sativa*
White sweetclover	*Melilotus albus*
Yellow sweetclover	*Melilotus officinalis*
Rancheria clover	*Trifolium albopurpureum*
White clover	*Trifolium repens*
American licorice	*Glycyrrhiza lepidota*
Red-stemmed filaree	*Erodium cicutarium*
Wax currant	*Ribes cereum*
Wiregrass	*Juncus balticus*
Torrey's rush	*Juncus torreyi*
Horehound	*Marrubium vulgare*

Appendix B continued. Common and Scientific Names of Plants That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Mint	*Mentha penardi*
Pony beebalm	*Monarda pectinata*
Skullcap	*Scutellaria galericulata*
False soloman's seal	*Smilacina stellata*
Blue flax	*Linum lewisii*
Cheeseweed mallow	*Malva parviflora*
Emory's globe mallow	*Sphaeralcea emoryi*
New Mexico olive	*Forestiera neomexicana*
American willowherb	*Epilobium adenocaulon*
Evening primrose	*Oenothera marginata*
Narrowleaf plantain	*Plantago lanceolata*
Common plantain	*Plantago major*
Western wheatgrass	*Agropyron smithii*
Slender wheat grass	*Agropyron trachycaulum*
Redtop	*Agrostis alba*
Creeping bentgrass	*Agrostis palustris*
Water foxtail	*Alopecurus aegaulilis sobol*
Wild oat	*Avena fatua*
American slough grass	*Beckmannia syzigachne*
Meadow brome	*Bromus commutatus*
Cheatgrass	*Bromus tectorum*
Orchard grass	*Dactylis glomerata*
Salt grass	*Distichlis stricta*
Hairy crabgrass	*Digitaria sanguinalis*
Barnyard grass	*Echinochloa crusgalli*
Canada wildrye	*Elymus canadensis*
Meadow fescue	*Festuca elatior*
Reed manna grass	*Glyceria grandis*
Foxtail barley	*Hordeum jubatum caespitosum*
Wall barley	*Hordeum murinum*
Cultivated barley	*Hordeum vulgare*
Scratchgrass	*Muhlenbergia asperifolia*
Witchgrass	*Panicum capillare*
Timothy	*Phleum pratense*
Common reed	*Phragmites communis*
Annual rabbitsfoot grass	*Polypogon monospeliensis*
Kentucky bluegrass	*Poa pratensis*
Alkali grass	*Puccinellia pauciflora*
Rye	*Secale cereale*

Appendix B continued. Common and Scientific Names of Plants That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Green foxtail	*Setaria viridis*
Bottlebrush squirreltail	*Sitanion hystrix*
Alkali sacaton	*Sporobolus airoides*
Spike dropseed	*Sporobolus contractus*
Sand dropseed	*Sporobolus cryptandrus*
Wheat	*Triticum aestivum*
Cultivated corn	*Zea mays*
Knotgrass	*Polygonum aviculare*
Curly dock	*Rumex crispus*
Virgin's bower	*Clematis lingustifolia*
Alkali buttercup	*Ranunculus cymbalaria*
Mountain meadow rue	*Thalictrum fendleri*
Serviceberry	*Amelanchier alnifolia*
Western service berry	*Amelanchier utahensis*
River hawthorn	*Crataegus rivularis*
Silverweed	*Potentilla anserina*
Wildrose	*Rosa fendleri*
Narrow-leaf cottonwood	*Populus angustifolia*
Rio Grande cottonwood	*Populus wislizenii*
Peach-leaf willow	*Salix amygdaloides*
Coyote willow	*Salix exigua*
Pacific willow	*Salix lasiandra*
Indian paintbrush	*Castilleja linariaefolia*
Common monkeyflower	*Mimulus guttatus*
Common mullein	*Verbascum thapsus*
Water speedwell	*Veronica anagallis-aquatica*
Pale wolfberry	*Lycium pallidum*
Cutleaf nightshade	*Solanum triflorum*
Salt cedar	*Tamarix chinensis*
Common cattail	*Typha latifolia*
Netleaf hackberry	*Celtis reticulata*
Brewer nettle	*Urtica breweri*
Virginia creeper	*Parthenocissus inserta*
Puncturevine	*Tribulus terrestris*
Pinyon pine	*Pinus edulis*
Juniper	*Juniperus sp.*
Oak	*Quercus sp.*
Greasewood	*Sarcobatus vermiculatus*
Mountain-mahogany	*Cercocarpus montanus*

Appendix B continued. Common and Scientific Names of Plants That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Antelope bitterbrush	*Purshia tridentata*
Yucca	*Yucca sp.*
Cliffrose	*Cowania mexicana*
Broom snakeweed	*Gutierrezia sarothrae*
Barrel cactus	*Ferocactus wislizenii*
Pricklybear cactus	*Opuntia sp.*
Mesa Verde cactus	*Sclerocactus mesae-verdae*
Buckwheat	*Eriogonum sp.*
Brack's fishhook cactus	*Sclerocactus cloveriae var. brackii*
Threadleaf groundsel	*Senecio longilobus*
Bisti fleabane	*Erigeron bistiensis*
Little hogweed	*Portulaca oleracea*
Golden crownbeard	*Verbesina encelioides*
Colorado four-o'clock	*Mirabilis multiflora*
Nees	*Machaeranthera tanacetifolia*
Globemallow	*Sphaeralcea sp.*
Blue gramma	*Bouteloua gracilis*
Galleta	*Hilaria jamesii*
Indian ricegrass	*Oryzopsis hymenoides*
Alkaki sacaton	*Sporobolus airoides*
Wheatgrass	*Agropyron sp.*
Sandhill muhly	*Muhlenbergia pungens*
Western serviceberry	*Amelanchier utahensis*
Spiny hopsage	*Grayia spinosa*
Adonis blazingstar	*Mentzelia multiflora*
Mexican-fireweed	*Kochia scoparia*
Streambank wheatgrass	*Agropyron riparium*
Foxtail barley	*Hordeum jubatum*
Mormon tea	*Ephedra torreyana*
Green joint-fir	*Ephedra viridis*
Cholla	*Opuntia sp.*
Fringed sage	*Artemisia frigida*
Muhly	*Muhlenbergia torreyi*
Little leaf ratany	*Krameria sp.*
Flatspine burr ragweed	*Ambrosia acanthicarpa*
Three-awns	*Aristida sp.*

Appendix C. Common and Scientific Names of Birds That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Turkey vulture	*Cathartes aura*
Horned grebe	*Podiceps auritus*
Eared grebe	*Podiceps nigricollis*
Western grebe	*Aechmorphorus occidentalis*
Pied-billed grebe	*Podilymbus podiceps*
White pelican	*Elecanus erythorhynchos*
Brown pelican	*Pelecanus occidentalis*
Double-crested cormorant	*Phalacrocorax auritus*
Great blue heron	*Ardea herodias*
Green heron	*Butorides virescens*
Great egret	*Ardea alba*
Snowy egret	*Egretta thula*
Black-crowned night heron	*Nycticorax nycticorax*
Least bittern	*Ixobrychus exilis*
American bittern	*Botarus lentiginosus*
White-faced ibis	*Plegadis chihi*
Whistling swan	*Olor columbianus*
Canada goose	*Branta canadensis*
White-fronted goose	*Anser albifrons*
Snow goose	*Chen caerulescens*
Mallard	*Anas platyrhynchos*
Gadwall	*Anas strepera*
Northern pintail	*Anas acuta*
Green-winged teal	*Anas crecca*
Blue-winged teal	*Anas discors*
Cinnamon teal	*Anas cyanoptera*
American wigeon	*Anas americana*
Northern shoveler	*Anas clypeata*
Wood duck	*Aix sponsa*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Canvasback	*Aythya valisineria*
Lesser scaup	*Aythya affinis*
Common goldeneye	*Bucephala clangula*
Barrow's goldeneye	*Bucephala islandica*
Bufflehead	*Bucephala albeola*
Surf scoter	*Melanitta perspicillata*
Ruddy duck	*Oxyura jamaicensis*
Hooded merganser	*Lophodytes cucullatus*

Appendix C continued. Common and Scientific Names of Birds That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Common merganser	*Mergus merganser*
Red-breasted merganser	*Mergus serrator*
Mississippi kite	*Ictinia mississippiensis*
Red-tailed hawk	*Buteo jamaicensis*
Ferruginous hawk	*Buteo regalis*
Northern goshawk	*Accipter gentilis*
Cooper's hawk	*Accipiter cooperii*
Sharp-shinned hawk	*Accipiter striatus*
Rough-legged hawk	*Buteo lagopus*
Swainson's hawk	*Buteo swainsoni*
Bald eagle	*Haliaeetus leucocephalus*
Golden eagle	*Aquila chrysaetos*
Norther harrier hawk	*Circus cyaneus*
Osprey	*Pandoin haliaetus*
American peregrine falcon	*Falco peregrinus anatum*
Arctic peregrine falcon	*Falco peregrinus tundrius*
Prairie falcon	*Falco mexicanus*
American kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Scaled quail	*Callipepla squamata*
Gambel's quail	*Callipepla gambelii*
Blue grouse	*Dendragapus obscurus*
Greater Sage grouse	*Centrocercus urophasianus*
Ring-necked pheasant	*Phasianus colchicus*
Chukar	*Alectoris chukar*
Turkey	*Meleagris gallopavo*
Virginia rail	*Rallus limicola*
Sora	*Porzana carolina*
Common gallinule	*Gallinula chloropus*
American coot	*Fulica americana*
Semi-palmated plover	*Charadrius semipalmatus*
Snowy plover	*Charadrius alexandrinus*
Killdeer	*Charadrius vociferus*
Mountain plover	*Charadrius montanus*
Black-bellied plover	*Pluvialis squatarola*
Upland plover	*Bartramia longicauda*
Common snipe	*Gallinago gallinago*
Long-billed curlew	*Numenius americanus*
Upland sandpiper	*Bartramia longicauda*

Appendix C continued. Common and Scientific Names of Birds That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Spotted sandpiper	*Actitis macularia*
Solitary sandpiper	*Tringa solitaria*
Willet	*Catoptrophorus semipalmatus*
Greater yellowlegs	*Tringa melanoleuca*
Lesser yellowlegs	*Tringa flavipes*
Pectoral sandpiper	*Calidris melanotos*
Baird's sandpiper	*Calidris bairdii*
Least sandpiper	*Calidris minutilla*
Long-billed dowithcher	*Limnodromus scolopaceus*
Western sandpiper	*Calidris mauri*
Marbled godwit	*Limosa fedoa*
Sanderling	*Calidris alba*
American avocet	*Recurvirostra americana*
Black-necked stilt	*Himantopus mexicanus*
Wilson's phalarope	*Phalaropus tricolor*
Red-necked phalarope	*Phalaropus lobatus*
Herring gull	*Larus argentatus*
California gull	*Larus californicus*
Ring-billed gull	*Larus delawarensis*
Laughing gull	*Larus atricilla*
Franklin's gull	*Larus pipixcan*
Bonaparte's gull	*Larus philidelphia*
Sabine's gull	*Xema sabini*
Forster's tern	*Sterna forsteri*
Common tern	*Sterna hirundo*
Caspian tern	*Sterna caspia*
Black tern	*Chlidonias niger*
Band-tailed pigeon	*Columba fasciata*
Rock dove	*Columba livia*
Mourning dove	*Zenaida macroura*
Inca dove	*Columbina inca*
Yellow-billed cuckoo	*Coccyzus americanus*
Greater roadrunner	*Geococcyx californianus*
Mexican spotted owl	*Strix occidentalis lucida*
Western burrowing owl	*Speotyto cunicularia hypugea*
Northern sah-whet owl	*Aeogolius acadicus*
Pygmy owl	*Glaucidium californicum*
Common barn-owl	*Tyto alba*
Screech owl	*Otus asio*
Great-horned owl	*Bubo virginiansus*

Appendix C continued. Common and Scientific Names of Birds That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Long-eared owl	*Asio otus*
Short-eared owl	*Asio flammeus*
Flammulated owl	*Otus flammeolus*
Common poorwill	*Phalaenoptilus nuttallii*
Common nighthawk	*Chordeiles minor*
Black swift	*Cypseloides niger*
White-throated swift	*Aeronautes saxatalis*
Black-chinned hummingbird	*Archilochus alexandri*
Broad-tailed hummingbird	*Selasphorus platycercus*
Rufous hummingbird	*Selasphorus rufus*
Calliope hummingbird	*Stellula calliope*
Belted kingfisher	*Ceryle alcyon*
Northern flicker	*Colaptes auratus*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Acorn woodpecker	*Melanerpes formicivorus*
Lewis woodpecker	*Melanerpes lewis*
Yellow-billed sapsucker	*Sphyrapicus varius*
Williamson's sapsucker	*Sphyrapicus thyroideus*
Hairy woodpecker	*Picoides villosus*
Downy woodpecker	*Picoides pubescens*
Northern three-toed woodpecker	*Picoides tridactylus*
Western kingbird	*Tyrannus verticalis*
Eastern kingbird	*Tyrannus tyrannus*
Cassin's kingbird	*Tyrannus vociferans*
Eastern phoebe	*Sayornis phoebe*
Black phoebe	*Sayornis nigricans*
Say's phoebe	*Sayornis saya*
Southwestern willow flycatcher	*Empidonax traillii extimus*
Hammond's flycatcher	*Empidonax hammondii*
Western flycatcher	*Empidonax difficilis*
Ash-throated flycatcher	*Myiarchus cinerascens*
Western wood-pewee	*Contopus sordidulus*
Greater pewee	*Contopus pertinax*
Olive-sided flycatcher	*Contopus cooperi*
Dusky flycatcher	*Empidonax oberholseri*
Gray flycatcher	*Empidonax wrightii*
Tree swallow	*Tachycineta bicolor*
Bank swallow	*Riparia riparia*
Violet-green swallow	*Trachycineta thalassina*
Barn swallow	*Hirundo rustica*

Appendix C continued. Common and Scientific Names of Birds That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Purple martin	*Progne subis*
Blue jay	*Cyanocitta crystata*
Gray jay	*Perisoreus canadensis*
Steller's jay	*Cyanocitta stelleri*
PiZon jay	*Gymnorhinus cyanocephalus*
Western scrub jay	*Aphelocoma californica*
Black-billed magpie	*Pica hudsonia*
American crow	*Corvus brachyrhynchos*
Common raven	*Corvus corax*
Plain titmouse	*Parus inornatus*
Clark's nutcracker	*Nucifraga columbiana*
Black-capped chickadee	*Poecile atricapilla*
Mountain chickadee	*Poecile gambeli*
Common bushtit	*Psaltriparus minimus*
White-breasted nuthatch	*Sitta carolinensis*
Red-breasted nuthatch	*Sitta canadensis*
Pygmy nuthatch	*Sitta pygmaea*
Brown creeper	*Certhia americana*
American Dipper	*Cinclus mexicanus*
House wren	*Troglodytes aedon*
Bewick's wren	*Thryomanes bewickii*
Long-billed marsh wren	*Telmatodytes palustris*
Canon wren	*Catherpes mexicanus*
Rock wren	*Salpinctes obsoletus*
Gray catbird	*Dumetella carolinensis*
Northern mockingbird	*Mimus polyglottos*
Brown thrasher	*Toxostoma rufum*
Bendire's thrasher	*Toxostoma bendirei*
Sage thrasher	*Oreoscoptes montanus*
American robin	*Turdus migratorius*
Hermit thrush	*Catharus guttatus*
Swainson's thrush	*Catharus ustulatus*
Western bluebird	*Sialia mexicana*
Eastern bluebird	*Sialia sialis*
Mountain bluebird	*Sialia currucoides*
Townsend's solitaire	*Myadestes townsendi*
Blue-gray gnatcatcher	*Polioptila caerulea*
Golden-crowned kinglet	*Regulus satrapa*
Ruby-crowned kinglet	*Regulus calendula*

Appendix C continued. Common and Scientific Names of Birds That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Water pipit	*Anthus rebescens*
European starling	*Sturnus vulgaris*
Bohemian waxwing	*Bombycilla garrulus*
Cedar waxwing	*Bombycilla cedrorum*
Northern shrike	*Lanius exubitor*
Loggerhead shrike	*Lanius ludovicianus*
Gray vireo	*Vireo vicinior*
Solitary vireo	*Vireo solitarius*
Warbling vireo	*Vireo gilvus*
Red-eyed vireo	*Vireo olivaceus*
Black and white warbler	*Mniotilta varia*
Orange-crowned warbler	*Vermivora celata*
Nashville warbler	*Vermivora ruficapilla*
Black-throated blue warbler	*Dendroica caerulescens*
Black-throated gray warbler	*Dendroica nigrescens*
Black-throated green warbler	*Dendroica virens*
Yellow-rumped warbler	*Dendroica coronata*
Hermit warbler	*Dendroica occidentalis*
Grace's warbler	*Dendroica graciae*
Palm warbler	*Dendroica palmarum*
Ovenbird	*Seiurus aurocapillus*
Virginia's warbler	*Vermivora virginiae*
Lucy's warbler	*Vermivora luciae*
Yellow warbler	*Dendroica petechia*
Townsend's warbler	*Dendroica townsendi*
Northern waterthrush	*Seiurus noveboracensis*
MacGillivray's warbler	*Oporornsis tolmiei*
Common yellowthroat	*Geothlypis trichas*
Yellow-brested chat	*Icteria virens*
Wilson's warbler	*Wilsonia pusilla*
American redstart	*Setophaga ruticilla*
Horned lark	*Eremophila alpestris*
Eastern meadowlark	*Sturnella magna*
Western meadowlark	*Sturnella neglecta*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Red-winged blackbird	*Agelaius phoeniceus*
Northern oriole	*Icterus galbula*
Scott's oriole	*Icterus parisorum*
Brewer's blackbird	*Euphagus cyanocephalus*
Great-tailed grackle	*Quiscalus mexicanus*

Appendix C continued. Common and Scientific Names of Birds That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Common grackle	*Quiscalus quiscula*
Brown-headed cowbird	*Molothrus ater*
Western tanager	*Piranga ludoviciana*
Scarlet tanager	*Piranga olivacea*
Hepatic tanager	*Piranga flava*
Rose-breasted grosbeak	*Pheuticus ludovicianus*
Black-headed grosbeak	*Pheuticus melanocephalus*
Blue grosbeak	*Guiraca caerulea*
Evening grosbeak	*Coccothraustes vespertinus*
Indigo bunting	*Passerina cyanea*
Lazuli bunting	*Passerina amoena*
Dickcissel	*Spiza americana*
House finch	*Carpodacus mexicanus*
Cassin's finch	*Carpodacus cassinii*
Gray-crowned rosy finch	*Leucosticte tephrocotis*
Black rosy finch	*Leucosticte atrata*
Brown-capped rosy finch	*Leucosticte australis*
Pine siskin	*Carduelis pinus*
American goldfinch	*Carduelis tristis*
Lesser goldfinch	*Carduelis psaltria*
Lawrence's goldfinch	*Carduelis lawrencei*
Red crossbill	*Loxia curvirostra*
Green-tailed towhee	*Pipilo chlorurus*
Rufous-sided towhee	*Pipilo erythrophthalmus*
Brown towhee	*Pipilo fuscus*
Lark bunting	*Calamospiza melanocorys*
Vesper sparrow	*Pooecetes gramineus*
Lark sparrow	*Chondestes grammacus*
Cassin's sparrow	*Aimophila cassinii*
Black-throated sparrow	Amphispiza bilineata
Sage sparrow	*Amphispiza belli*
Dark-eyed junco	*Junco hyemalis*
Gray-headed junco	*Junco caniceps*
Brewer's sparrow	*Spizella breweri*
Harris' sparrow	*Zonotrichia querula*
House sparrow	*Passer domesticus*
American tree sparrow	*Spizella arborea*
Baird's sparrow	*Ammodramus bairdii*
Savannah sparrow	*Passerculus sandwichensis*
Chipping sparrow	*Spizella passerina*

Appendix C continued. Common and Scientific Names of Birds That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
White-crowned sparrow	*Zonotrichia leucophrys*
Fox sparrow	*Passerella iliaca*
Lincoln's sparrow	*Melospiza lincolnii*
Song sparrow	*Melospiza melodia*

Appendix D. Common and Scientific Names of Mammals That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	**Scientific Name**
Merriam shrew	*Sorex merriami*
Dwarf shrew	*Sorex nanus*
Vagrant shrew	*Sorex vagrans*
Desert shrew	*Notiosorex crawfordi*
Pallid bat	*Antrozous pallidus*
Big brown bat	*Eptesicus fuscus*
Spotted bat	*Euderma maculata*
Red bat	*Lasiurus borealis*
Silver-haired bat	*Lasionycteris noctivagans*
Hoary bat	*Lasiurus cinereus*
California myotis	*Myotis californicus*
Long-eared myotis	*Myotis evotis*
Western small-footed myotis	*Myotis ciliolabrum*
Little brown myotis	*Myotis lucifugus*
Fringed myotis	*Myotis thysanodes*
Cave myotis	*Myotis velifer*
Long-legged myotis	*Myotis volans*
Yuma myotis	*Myotis yumanensis*
Western pipistrel	*Pipistrellus hesperus*
Townsend's big-eared bat	*Plecotus tounsendii*
Mexican free-tailed bat	*Tadarida brasiliensis*
Big free-tailed bat	*Nyctinimops macrotis*
Desert cottontail rabbit	*Sylvilagus audobonii*
Eastern cottontail rabbit	*Sylvilagus floridanus*
Nuttall's cottontail rabbit	*Sylvilagus nuttalii*
Blacktail jackrabbit	*Lepus californicus*
Ring-tailed cat	*Bassariscus astutus*
Coyote	*Canis latrans*
Mountain lion	*Felis concolor*
Bobcat	*Lynx rufus*
River otter	*Lutra canadensis*
Marten	*Martes americana*
Striped skunk	*Mephitis mephitis*
Western spotted skunk	*Spilogale gracilis*
Long-tailed weasel	*Mustela frenata*
Black-footed ferret	*Mustela nigripes*
Mink	*Mustela vison*
Raccoon	*Procyon lotor*
Badger	*Taxidea taxus*
Gray fox	*Urocyon cinereoargenteus*

Appendix D continued. Common and Scientific Names of Mammals That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Kit fox	*Vulpes macrotis*
Red fox	*Vulpes vulpes*
Swift fox	*Vulpes velox*
Black bear	*Ursus americanus*
Pronghorn antelope	*Antilocapra americana*
Elk	*Cervus canadensis*
Mule deer	*Odocoileus hemionus*
White-tailed antelope ground squirrel	*Ammospermophilus leucurus*
Beaver	*Castor canadensis*
Spotted ground squirrel	*Spermophilus spilosoma*
Rock squirrel	*Spermophilus variegatus*
Gunnison's prairie dog	*Cynomys gunnisoni*
Ord's kangaroo rat	*Dipodomys ordi*
Banner-tailed kangaroo rat	*Dipodomys spectabilis*
Porcupine	*Erethizon dorsatum*
Cliff chipmunk	*Tamias dorsalis*
Least chipmunk	*Tamias minimus*
Colorado chipmunk	*Tamias quadrivittatus*
Meadow vole	*Microtus pennsylvanicus*
Montane vole	*Microtus montanus*
Mexican vole	*Microtus mexicanus*
Long-tailed vole	*Microtus longicaudus*
House mouse	*Mus musculus*
White-throated woodrat	*Neotoma albigula*
Bushy-tailed woodrat	*Neotoma cinerea*
Mexican woodrat	*Neotoma mexicana*
Stephen's woodrat	*Neotoma stephensi*
Muskrat	*Ondatra zibethica*
Northern grasshopper mouse	*Onychomys leucogaster*
Silky pocket mouse	*Perognathus flavus*
Plains pocket mouse	*Perognathus flavescens*
Brush mouse	*Peromyscus boylii*
Canyon mouse	*Peromyscus crinitus*
Rock mouse	*Peromyscus difficilis*
White-footed mouse	*Peromyscus leucopus*
Deer mouse	*Peromyscus maniculatus*
PiZon mouse	*Peromyscus truei*
Western harvest mouse	*Reithrodontomys megalotis*
Abert's squirrel	*Sciurus aberti*
Spotted ground squirrel	*Spermophilus spilosoma*

Appendix D continued. Common and Scientific Names of Mammals That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Rock squirrel	*Spermophilus variegatus*
American red squirrel	*Tamiasciurus hudsonicus*
Botta's pocket gopher	*Thomomys bottae*
Northern pocket gopher	*Thomomys talpoides*

Appendix E. Common and Scientific Names of Amphibians and Reptiles That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Amphibians	
Tiger salamander	*Ambystoma tigrinum*
Western spadefoot	*Spea hammondii*
Plains spadefoot	*Scaphiopus bombifrons*
Great Plains toad	*Bufo cognatus*
Red-spotted toad	*Bufo punctatus*
Woodhouse's toad	*Bufo woodhousii*
Canyon treefrog	*Hyla arenicolor*
Western chorus frog	*Pseudacris triseriata*
Bullfrog	*Rana catesbeiana*
Northern leopard frog	*Rana pipiens*
Reptiles	
Chuckwalla	*Sauromalus obesus*
Collard lizard	*Crotophytus collaris*
Longnose leopard lizard	*Crotophytus wislezenii*
Lesser earless lizard	*Holbrookia maculata*
Eastern fence lizard	*Sceloporus undulatus*
Desert spiny lizard	*Sceloporus magister*
Common sagebrush lizard	*Sceloporus graciosus*
Ornate tree lizard	*Urosaurus ornatus*
Common side-blotched lizard	*Uta stansburiana*
Short-horned lizard	*Phrynosoma douglassi*
Little striped whiptail	*Cnemidophorus inornatus*
Western whiptail	*Cnemidophorus tigris*
Plateau striped whiptail	*Cnemidophorus velox*
Desert night lizard	*Xantusia vigilis*
Many-lined skink	*Eumeces multivirgatus*
Smooth green snake	*Ophedrys vernalis*
Ring-neck snake	*Diadophis punctatus*
Striped whipsnake	*Masticophis taeniatus*
Coachwhip	*Masticophis flagellum*
Racer	*Coluber constrictor*
Corn snake	*Elaphe guttata*
Gopher snake	*Pituophis melanoleucus*
Milk snake	*Lampropeltis triangulum*
Common king snake	*Lampropeltis getulus*
Longnose snake	*Rhinocheilus lecontei*
Western terrestrial garter snake	*Thamnophis elegans*

Appendix E. Common and Scientific Names of Amphibians and Reptiles That May Occur in the Navajo - Gallup Water Supply Project Area.

Common Name	Scientific Name
Common garter snake	*Thamnophis sirtalis*
Blackneck garter snake	*Thamnophis cyrtopsis*
Western blackhead snake	*Tantilla planiceps*
Night snake	*Hypsiglena torquata*
Glossy snake	*Arizona elegans*
Western rattlesnake	*Crotalus viridis*
Western diamondback rattlesnake	*Crotalus atrox*
Mountain patch-nosed snake	*Salvadora grahamiae*