APPENDIX J

Fish And Wildlife Coordination Act Report

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FISH AND WILDLIFE COORDINATION ACT REPORT

Final Fish and Wildlife Coordination Act Report
for the
City of Albuquerque's Drinking Water Project
Bernalillo County, New Mexico

Submitted to:
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INTRODUCTION

Municipalities and non-agricultural industries in the Albuquerque Basin presently depend entirely on groundwater drawn from the Santa Fe Group aquifer (aquifer). As the population of the City of Albuquerque (City) and surrounding communities has grown, groundwater pumping has increased to a degree that will make continued sole-source reliance on this aquifer unsustainable. Increases in population and changes in the socioeconomic and demographic characteristics in the region have resulted in increased water demands. As a result, the diminishing aquifer is not being recharged by the Rio Grande at the same rate of depletion. A U.S. Geological Survey (USGS) computer simulation showed that about half the water pumped from the City's aquifer is not being replenished (U.S. Geological Survey 1995). Even if conservation plans are met (*i.e.*, reduction of water use on a per-capita basis by 30 percent), groundwater pumping is expected to exceed natural replenishment. This imbalance between withdrawal and recharge rates has led to drops in groundwater levels around the City's pumping centers and could lead to future water shortages, water quality degradation, land subsidence, and permanent damage to the aquifer.

In an effort to address this water supply concern, the Albuquerque City Council appointed an oversight committee to help the Public Works Department water resources planning team address water supply issues. The product of this effort was the development and adoption of the Albuquerque Water Resources Management Strategy (AWRMS) in 1997. The strategy sets forth measures to ensure a sustainable water supply to the year 2060 by optimizing the City's use of existing resources while reducing their reliance on groundwater. The AWRMS generally consists of a conservation program, aquifer recharge, re-use, recycling, and renewable supply projects. To date, environmental assessments and Fish and Wildlife Coordination Act Reports (CARs) have been completed for the North I-25 Industrial Recycling Project, the Northside Non-potable Surface Water Reclamation Project, and the Southside Water Reclamation Plant (SWRP) Reuse Project.

Consistent with the AWRMS, the purpose of the proposed Drinking Water Project (DWP) is to: 1) provide a renewable water supply, 2) fully utilize the City's existing water resources, 3) protect the aquifer for use as a drought reserve, and 4) facilitate the conjunctive use of ground and surface water. Specifically, this project entails using treated surface water for the City's drinking water supply while allowing the groundwater to replenish and serve as an emergency water source during times of drought. The surface water required for this project is the City's San Juan-Chama (SJC) Project water allocations and native Rio Grande water. The DWP would comprise four major elements: 1) diversion and conveyance of water from the Rio Grande from the point of diversion to a new water treatment plant; 2) operation of the drinking water treatment plant (WTP); 3) transmission of treated (potable) water to residential and commercial customers throughout the Albuquerque metropolitan area; and 4) aquifer storage and recovery.

Currently, the City and the U.S. Bureau of Reclamation (Reclamation) have developed a draft environmental impact statement (EIS) for the DWP (U.S. Bureau of Reclamation 2002). Reclamation is the lead federal agency responsible for ensuring compliance with the National Environmental Policy Act of 1969 (NEPA), facility licensing, other environmental statutes and executive orders; coordination of the environmental review process, and signing the record of decision. The City is the project proponent and primary EIS preparer. The U.S. Army Corps of Engineers (Corps) is serving as a cooperating agency and the U.S. Fish and Wildlife Service (Service) and U.S. Environmental Protection Agency will provide consultation and review. Completion of the DWP will involve license agreements with the Middle Rio Grande Conservancy District (MRGCD), and a diversion permit from the New Mexico Office of the State Engineer (OSE). There are four alternatives: a no action alternative and three action alternatives. Unless otherwise indicated, the use of "project area" or "project vicinity" herein refers to all areas and/or river reaches affected by the range of alternatives.

This CAR provides information concerning: 1) project area description and fish and wildlife resources; 2) fish and wildlife resource conditions with and without the project; 3) a comparison of impacts among alternatives; and 4) a discussion and recommendations to avoid or minimize adverse effects and maximize benefits for those resources.

PROJECT AREA DESCRIPTION

Geomorphology and Hydrology

The Rio Grande flows 1,885 miles from its headwaters in southern Colorado, through New Mexico, where it empties into the Gulf of Mexico as it forms the border between Texas and Mexico. In New Mexico, the Rio Grande is divided into three sections: the Upper, Middle, and Lower Rio Grande.

The Upper Rio Grande includes the Rio Grande and the Rio Chama headwaters in southern Colorado, downstream to Cochiti Reservoir in New Mexico. The Rio Chama is the largest tributary to the Rio Grande in New Mexico, flowing 115 miles southeast to its confluence with the Rio Grande near Española. The Middle Rio Grande Region, discussed more specifically here (Sandoval, Bernalillo, Valencia, Socorro, and Sierra Counties, New Mexico), extends from Cochiti Dam downstream to Elephant Butte Reservoir, a distance of approximately 175 miles (Figure 1). The Lower Rio Grande section extends from Elephant Butte Dam to the New Mexico-Texas Border. The proposed action alternatives may involve construction in the Albuquerque reach (within the Middle Rio Grande Region) at Angostura and/or within the City, near River Mile 192 (preferred alternative). If the preferred alternative is implemented, the Rio Grande between River Mile 192 and River Mile 176 (SWRP location) would be directly affected by water diversion operations.

Major tributaries in the Upper Rio Grande segment include Costilla Creek, Red River, and Rio Hondo, and to the Rio Chama include Willow Creek, Horse Lake Creek, and Rio Ojo Caliente. Major tributaries in the Middle Rio Grande include the Santa Cruz River, Nambe River, Pojoaque River, Santa Fe River, Galisteo Creek, Jemez River, Rio Puerco, and the Rio Salado. Upstream of the proposed project area there are six reservoirs - Heron, El Vado, Abiquiu, Galisteo, Cochiti, and Jemez Canyon. There are several diversion dams including Angostura Diversion Dam downstream of Cochiti, Isleta Diversion Dam downstream of Albuquerque, and San Acacia Diversion Dam at San Acacia (Figures 1 and 2). Numerous other conveyances, drains, and laterals move water within the general area of the Rio Grande floodplain (U.S. Geological Survey 1996).

Reservoir and diversion dam operation have changed the hydrology and sediment supply of the Rio Grande, causing degradation of the channel and chronic erosion of the banks of the river in some areas, especially upstream of the Rio Puerco. The historical river in the Middle Rio Grande prior to dam construction was a wide, braided, shallow, sand-bed channel and wide floodplain (Crawford *et al.* 1993). The upstream dams were built, in part, to slow the aggradation occurring in the channel and to reverse the trend to degradation. Kellner jetty jacks were placed along the river to channelize and stabilize the banks. A river levee protects heavily developed valley areas. The resulting degradation and channelization has created a narrower and deeper channel, with no functional floodplain (U.S. Fish and Wildlife Service 2001a).

Water Management and Flood Control

The Rio Grande Basin is highly regulated for flood control and water delivery. Reclamation and the Corps manage water and facilities on the Rio Grande and the Rio Chama. Present water management on the six reservoirs upstream of the proposed project results in reduced peak releases and reduced volumes due to consumption, irrigation, flood control, timing of water releases, and water salvage efforts. The regulated flows in the Middle Rio Grande follow a pattern of high flows during the spring runoff and low flows during the fall and winter months, with occasional high flows from summer thunderstorms. Management of irrigation diversion structures through various irrigation districts, including the Middle Rio Grande Conservancy District, has also altered the hydrology and geomorphology by contributing to changes in flows, sediment distribution, and preventing upstream movement of aquatic organisms (U.S. Fish and Wildlife Service 2001b).

The City's SJC water (major source water for the DWP) is delivered to Heron Reservoir and stored in Abiquiu Reservoir. Through the SJC project, authorized by Congress in 1962, up to 110,000 ac-ft of project water from tributaries of the San Juan River in the Upper Colorado River Basin are diverted annually across the Continental Divide into the Rio Grande Basin in New Mexico. The collection and diversion facilities, located in the San Juan River Basin upstream of Navajo Reservoir, consist of three diversion dams, two siphons, and a tunnel system, which deliver water into Heron Reservoir (located on the Rio Chama). The SJC Project provides water for municipal, domestic, irrigation, industrial uses, and provides recreation and fish and wildlife benefits (U.S. Department of Interior 1992).

Water management along the Rio Grande is complex. Each reservoir and diversion dam and associated irrigation water conveyance system is operated at a multi-agency level that includes federal, state, and local regulations with the Rio Grande Compact as the main guidance. Water is managed for municipal and agricultural purposes, factoring in necessary flood control and mandatory deliveries to the New Mexico-Texas state line. To address overall water management issues between various involved agencies/entities in the Rio Grande Basin, the Upper Rio Grande Water Operations Review is jointly being conducted by the Corps, Reclamation, and the New Mexico Interstate Stream Commission. This review provides opportunities to explore alternative flow management scenarios to develop and maintain riverine and terrestrial habitats by mimicking the typical natural hydrograph. An integrated management of flows from Heron, El Vado, Abiquiu, Jemez, and Cochiti Reservoirs could be pursued for the purpose of protecting and enhancing the aquatic and terrestrial habitats along the Rio Grande.

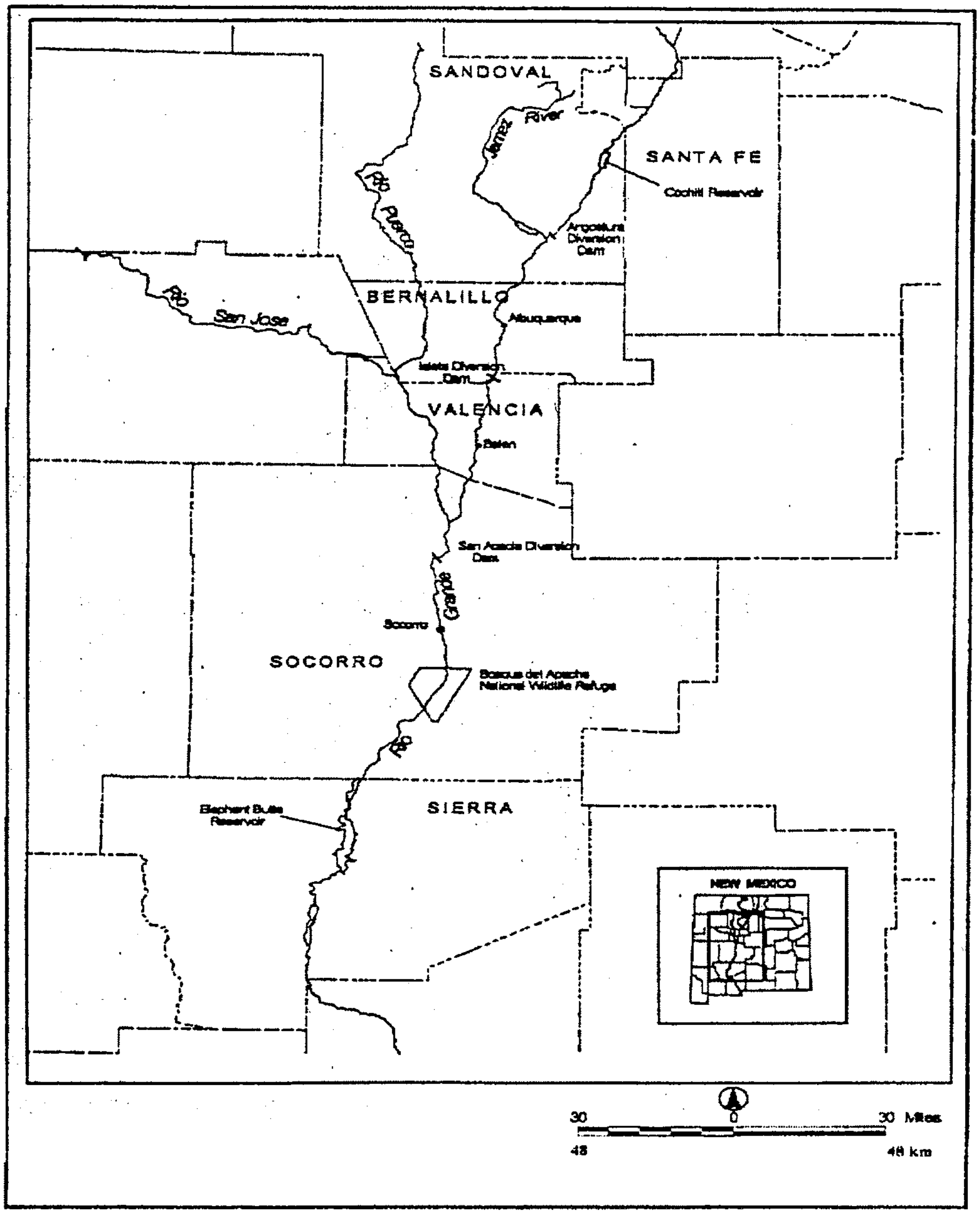

Figure 1. Middle Rio Grande Region of New Mexico, between Cochiti and Elephant Butte Reservoirs

Other recent water management efforts include fish and wildlife conservation. These efforts have included management for sensitive species such as the endangered Rio Grande silvery minnow (scientific names of fish species are provided in Appendix D). For example, the release of City-owned SJC water from upstream reservoirs was provided to supplement flows to Elephant Butte Reservoir. Since 1996, the City has provided over 150,000 ac-ft of SJC water for the silvery minnow through lease agreements and court ordered direction (Daves 1999; U.S. Bureau of Reclamation 2001). In 1996, the City entered into a no-cost lease agreement with the MRGCD that allowed MRGCD to use 28,792 ac-ft of the City's SJC water in exchange for leaving an equal amount of native Rio Grande water in the river to provide supplemental flows for the Rio Grande silvery minnow (Daves 1999). In 1997, Reclamation entered into a three-year lease agreement with the City that allowed for the purchase of 30,000 ac-ft of the City's SJC water annually from 1997-1999. Reclamation was allowed to carry-over the leased supplemental water that was unused in a given year (Daves 1999; U.S. Bureau of Reclamation 2001). After the supplemental water lease agreement ended in 1999, the City continued to lease SJC water to Reclamation and provided 86,600 ac-ft of SJC water to supplement flows for the silvery minnow in 2000.

Rio Grande Discharges

The lowest monthly flows at the Albuquerque gage (for water years 1974-1996) typically occurred in September and October (671 and 422 cfs, respectively). The highest flows typically occurred in April, May, and June (2,228, 3,332, and 3,030 cfs, respectively). Between 1974 and 1996, average daily flows measured at the Albuquerque gage for September and October were 597 and 439 cfs, respectively (U.S. Geological Survey 2001). However, since 1996, average daily flows at the Albuquerque gage have not dropped below 219 cfs during September and October. The seasonal peak discharge usually occurs in May and June, from snowmelt originating in Colorado. The average base flow of approximately 1,000 cfs usually persists from November to March (U.S. Geological Survey 1996).

Vegetational Changes

Wood was especially important as fuel for heating homes in the 1800s, resulting in little woody vegetation remaining near settlements (Abert 1962). Since then, plant species composition and abundance have changed in response to both natural and anthropogenic factors. Fragmentation of the native riparian forest, river manipulation, hunting, trapping, livestock grazing, and the introduction of exotic species (plants and animals) have impacted the vegetation and historic abundance and diversity of fish and wildlife (Crawford *et al.* 1993). Human development and encroachment in the floodplain have greatly restricted the active floodplain width. Within the Middle Rio Grande reach, there are 235 miles of levees. Analysis of aerial photography taken by Reclamation in February 1992 shows that of the 180 miles of river, only 1 mile, or 0.6 percent of the floodplain has remained undeveloped.

The most dramatic changes in vegetation composition along the Rio Grande resulted from the reduction of wetted areas such as marshes and wetlands and the increase in agricultural lands and exotic vegetation, primarily salt cedar and Russian olive (scientific plant names are provided in Appendix E). From 1918 to the present, wetland-associated habitats (*i.e.*, wet meadows) have undergone a 93% reduction (Crawford *et al.* 1993). Salt cedar and Russian olive were introduced into New Mexico (as ornamentals, shade trees, and for erosion control) in the early 1900s (Crawford *et al.* 1993). By 1935, both plants were common along the Middle Rio Grande (Hink and Ohmart 1984).

The incised channel, dam operations and/or river depletions prevent overbank flows and periodic scouring of floodplain areas in the Middle Rio Grande. This altered hydrology precludes natural regeneration of native cottonwoods and willows and promotes the growth of non-native salt cedar and Russian olive, which are replacing the native cottonwood/willow vegetative complex. As a result of these changes, the quality and quantity of fish and wildlife habitat have steadily decreased (U.S. Fish and Wildlife Service 2001b).

Fish and Wildlife Changes

Historically, 27 native fish species occupied the Rio Grande drainage (Sublette *et al.* 1990). Many native fish are extinct and/or extirpated from the Rio Grande in New Mexico, including the American eel, longnose gar, shovelnose sturgeon, gray redhorse, blue sucker, freshwater drum, speckled chub, Rio Grande shiner, phantom shiner, and Rio Grande bluntnose shiner (Sublette *et al.* 1990). The silvery minnow, a federally and state endangered species, now occupies only five percent of its former range (Bestgen and Platania 1991, U.S. Fish and Wildlife Service 1994). There are also about 31 introduced or non-native fish species within the Rio Grande drainage (Sublette *et al.* 1990). Terrestrial species that have been extirpated from the Rio Grande drainage include the gray wolf, jaguar, grizzly bear, river otter, and mink (Hink and Ohmart 1984). Approximately 46 mammalian species are currently noted to occur within the Middle Rio Grande Region (See Appendix A).

Surveys of the Middle Rio Grande in 1981 and 1982, documented 277 bird species (Hink and Ohmart 1984) and 259 species were documented in 1992 and 1993 (Thompson *et al.* 1994). Bird occurrence and abundance have changed with habitat changes. Swans and loons may have been plentiful, but are now absent or rare (Abert 1962). Twelve bird species are declining with 14 species increasing. The declining species are associated with decreasing native riparian areas, and the increasing species are associated with agricultural areas (Thompson *et al.* 1994). Therefore, changes to the natural fish and wildlife components of the Rio Grande are largely due to the direct and indirect effects of human settlements and/or development and manipulation of the Rio Grande and its associated watershed and riparian zones.

Aquatic Resources

The aquatic habitat in the Rio Grande has been altered by levees, dams, and reservoirs that store sediment and control water releases for agricultural use, flood control, recreation, and protection of development within the floodplain. Kellner jetty jack fields have straightened and channelized the river for more effective water transport. Reservoir operations reduce peaks in flows and discharge lower flows for a longer duration (Crawford *et al.* 1993). Downstream of Cochiti Dam, the altered sediment and flow regimes have resulted in the transformation from a wide, braided, sand bed system to a narrower and deeper channel with no active floodplain (U.S. Bureau of Reclamation 1999). Therefore, wetlands and slack water areas are scarce (Crawford *et* *al.* 1993). The cold, clear water releases from Cochiti Dam and the entrenched channel armored with a gravel bed have created an aquatic system that favors cool-water fishes and invertebrates, and limits warm water fisheries below the dam downstream to Albuquerque. Consequently, the existing aquatic resources in the project area differ from those that occurred historically due to human activities (Crawford *et al.* 1993).

The loss of native fish species in the Middle Rio Grande illustrates that the hydrologic and morphological changes in the channel have had a major impact on fishery resources. The historical or pre-development ichthyofauna of the Middle Rio Grande in New Mexico is thought to have included at least 16 species (Hatch 1985; Smith and Miller 1986; and Propst *et al.* 1987), four of which were endemic to the region. The Phantom shiner (*Notropis orca*) and Rio Grande bluntnose shiner (*Notropis simus*) are extinct. The Rio Grande shiner (*Notropis jemezanus*) and Rio Grande speckled chub (*Extrarius aestivalis*) are extirpated from the New Mexico portion of the Rio Grande. The silvery minnow is the only native pelagic, broadcast spawning minnow surviving in the Middle Rio Grande (Bestgen and Platania 1991). A considerable number of non-native fishes have been introduced into the Middle Rio Grande, either accidentally or as gamefish by the New Mexico Department of Game and Fish. Today, the Middle Rio Grande Region contains at least 27 fish species, of which 12 are native and 15 introduced or non-native (See Appendix D).

Fish surveys have been conducted monthly in the project area by the Service's New Mexico Fishery Resources Office since October 1999. These surveys target the silvery minnow, but provide information on other species as well. Silvery minnows are caught consistently but in very low numbers. Other species in the project reach are western mosquitofish, white sucker, flathead chub, fathead minnow, red shiner, gizzard shad, and longnose dace, with the red shiner being the most abundant fish captured (J. Brooks, U.S. Fish and Wildlife Service 2001, *pers. comm.*).

Terrestrial Resources

Vegetation

The Middle Rio Grande corridor winds its way through a mosaic of Plains-Mesa Sand Scrub and Desert Grasslands in the north to Chihuahuan scrub in the south (Dick-Peddie 1993). Vegetative communities within the riparian corridor of the Middle Rio Grande were historically characterized by a cottonwood overstory with a willow and saltgrass-dominated understory. Other riparian species included New Mexico olive, baccharis, false indigo bush, and wolfberry. Wetlands were common, vegetated with cattails, sedges, spikerush, rushes, yerba mansa, and other wetland plants (Scurlock 1998).

The existing vegetation community along the river corridor and in the project area is a result of the altered flow regime, drainage for agriculture and development, levees, channelization, livestock grazing, and the explosive growth of exotic salt cedar, Siberian elm, and Russian olive. Overbank flooding and in-channel scouring rarely occurs, reducing the opportunity for natural recruitment of native vegetation, *i.e.*, cottonwood regeneration. As a result, rapid colonizers such as salt cedar, Russian olive, and other exotics that thrive in the altered hydrologic regime have significantly degraded the native riparian plant community (Crawford *et al.* 1993). In addition, salt cedar thickets contribute to the loss and maintenance of wetlands (a habitat type that is now very limited in the Middle Rio Grande) by stabilizing channels and through high evapotranspiration rates. Vegetation in the area of the preferred alternative (near Paseo del Norte Bridge) consists mostly of young, recently established pole plantings of willows and cottonwoods, with a few large established cottonwood and elm trees. Russian olive and salt cedar stands are also present along the shoreline.

Mammals

Existing mammal populations are also a result of the existing water operations and land uses in the Middle Rio Grande. Hink and Ohmart (1984) performed systematic floral and faunal surveys throughout the Middle Rio Grande. Residential development, agricultural conversion and subsequent irrigation systems, and construction of bridges/roads resulted in the permanent loss of all habitats within developed areas; disruption of animal movement and dispersal patterns, and creation of a continual disturbance affects animal communities in the adjacent, fragmented portions of the bosque (Crawford *et al.* 1993). The largest mammal likely to occur in the area is the mule deer. Other mammals such as coyote, raccoon, beaver, muskrat, long-tailed weasel, bobcat, swift fox, and striped skunk are found in the project vicinity. Desert cottontail rabbit, black-tailed jackrabbit, rock squirrel, pocket gopher, deer mouse, western harvest mouse, and American porcupine are also likely to occur in the project area. Seven small mammal species were captured along the Rio Grande during a 1995 study (Stuart and Bogan 1996). Surveyed areas included fragmented patches of Rio Grande bosque at six locations from as far north as Bernalillo to as far south as Caballo Reservoir. The most common species were the white-footed mouse and house mouse. Eleven species of bats are found along the Rio Grande (Findley *et al.* 1975). Two bat species are restricted to riparian areas, the Yuma myotis and little brown bat. Other species that may occur in the Middle Rio Grande are pallid bat, Brazilian free-tailed bat, big free-tailed bat, Townsend's big-eared bat, long-legged myotis, silver-haired bat, big brown bat, hoary bat, and spotted bat.

A listing of common and scientific names of mammals that may occur in the Rio Grande floodplain within the project area is provided in Appendix A.

Birds

Hink and Ohmart (1984), found that riparian areas are used heavily by most bird species in New Mexico. Cottonwood-dominated community types are highly used and are preferred habitat for many species, especially during the nesting season. Marshes, drains, and areas of open water contribute to the bird diversity of the riparian ecosystem as a whole because of the strong attraction by water-loving birds. At various times of the year, such as during migration, riparian areas support the highest bird densities and species richness in the Middle Rio Grande.
Since wetlands are scarce within the project vicinity, reservoirs and the river in and near the proposed project provide habitat on a seasonal basis for a variety of waterfowl including Canada geese, mallard, gadwall, green-winged teal, American widgeon, northern pintail, northern shoveler, ruddy duck, and common merganser. Shorebirds such as the spotted sandpiper and killdeer are likely to occur in the project area. Raptors that may occur in the project area include

the bald eagle, turkey vulture, northern harrier, sharp-shinned hawk, Cooper's hawk, red-tailed hawk, American kestrel, common barn owl, and great-horned owl. Birds from a variety of habitats that may be in the project area at any given time include the common nighthawk, belted kingfisher, great blue heron, northern flicker, downy woodpecker, hairy woodpecker, violet-green swallow, northern rough-winged swallow, cliff swallow, barn swallow, black-billed magpie, common raven, plain titmouse, white-breasted nuthatch, canyon wren, western bluebird, mountain bluebird, American robin, northern mockingbird, American pipit, American dipper, European starling, yellow warbler, spotted towhee, white-crowned sparrow, red-winged blackbird, Brewer's blackbird, northern oriole and evening grosbeak (Udvardy 1977; Scott 1987). Game species include the mourning dove, Merriam's turkey, and scaled quail.

A listing of common and scientific names of birds that may occur in the Rio Grande floodplain within the project area is provided in Appendix C.

Reptiles and Amphibians

Hink and Ohmart (1984) documented 3 turtle species, 17 species of lizards, and 18 snake species in the Middle Rio Grande Ecosystem. According to Degenhardt *et al.* (1996), up to 57 species of reptiles may occur in the Middle Rio Grande Region of New Mexico. Reptiles typically found in the habitat types within the project area include the western collared lizard, southern prairie lizard, Great Plains skink, regal ringneck snake, desert striped whipsnake, smooth green snake, and western garter snake. The most common reptiles observed during 1982 and 1983 studies were the plateau striped whiptail lizard and New Mexico whiptail. Thirteen amphibian species may be found in the Middle Rio Grande Valley (Degendardt *et al.* 1996). Amphibians associated with the riparian areas such as wet meadows and marshes include chorus frogs, leopard frogs, and bullfrogs (Crawford *et al.* 1993). Amphibians common to all the habitat types (wetland, riparian, and upland) include the tiger salamander, Woodhouse's toad, red-spotted toad, and northern leopard frog. The most often captured or perhaps the most abundant amphibians along the Rio Grande were the bullfrog and Woodhouse's toad (Hink and Ohmart 1984). Other species documented along the Rio Grande include Couch's spadefoot toad, New Mexico spadefoot, red-spotted toad, and northern leopard frog (Hink and Ohmart 1984). Applegarth (1983) suggests the northern leopard frog and painted turtle were more abundant when wetlands were more numerous.

A listing of common and scientific names of reptiles and amphibians that may occur in the Rio Grande floodplain within the project area is provided in Appendix B.

Threatened and Endangered Species

As the quality and quantity of the fish and wildlife habitat within the Rio Grande corridor has decreased over time, so has its ability to sustain certain native flora and fauna. Several species endemic to the Middle Rio Grande are extinct, extirpated, or have been federally listed as threatened or endangered under the Endangered Species Act (ESA). This CAR provides information concerning listed species (Rio Grande silvery minnow, southwestern willow flycatcher, bald eagle) that may be affected by the proposed project.

Rio Grande Silvery Minnow

The silvery minnow was formerly one of the most widespread and abundant species in the Rio Grande Basin occurring from Española, New Mexico to the Gulf of Mexico (Bestgen and Platania 1991). Currently, the silvery minnow is restricted to the Middle Rio Grande in New Mexico, occurring only from Cochiti Dam downstream to the headwaters of Elephant Butte Reservoir (Platania 1991). The species was federally listed as endangered in July 1994 (U.S. Fish and Wildlife Service 1994) and is likewise state listed as endangered. The Service (1993a) cited the de-watering of portions of the Rio Grande below Cochiti Dam through water regulation activities, the construction of main-stream dams, the introduction of non-native competitor/predator species, and the degradation of water quality as factors responsible for declines in the silvery minnow population. On June 6, 2002, the Service published a proposed rule establishing critical habitat for the minnow within the last remaining portion of their historical range in the Middle Rio Grande, from Cochiti Dam to Elephant Butte Dam (U.S. Fish and Wildlife Service 2002). The proposed DWP occurs within proposed critical habitat.

The silvery minnow is a moderately sized, stout minnow, approximately 3.5 inches in length that spawns in the late spring and early summer, coinciding with high spring flows (Sublette *et al.* 1990). This species is a pelagic spawner producing neutrally buoyant eggs that drift downstream with the current (Platania 1995). Spawning may also be triggered by other high flow events such as spring and summer thunderstorms. Natural habitat for the silvery minnow includes stream margins, side channels, and off-channel pools where water velocities are low or reduced from main-channel velocities. Appropriate stream characteristics includes sufficient flowing water to provide food and cover needs for all life stages of the species; water quality to prevent water stagnation (elevated temperatures, decreased oxygen, *etc.*); and water quantity to prevent formation of isolated pools that restrict fish movement, foster increased predation by birds and aquatic predators, and congregate disease-causing pathogens (U.S. Fish and Wildlife Service 1993a; and 1994). Stream reaches dominated by straight, narrow, incised channels with rapid flows are not typically occupied by silvery minnows (Sublette *et al.* 1990, Bestgen and Platania 1991).

Within the project area, past actions have eliminated and severely altered habitat conditions for the silvery minnow. Narrowing and deepening of the channel, restraints to channel migration through jetty jacks, the invasion of non-native vegetation species, and changes in natural flow regimes have all adversely affected the silvery minnow and its habitat. Isleta Diversion Dam downstream and the Angostura diversion dam upstream of the project area block upstream migration, create thermal barriers, and restrict species redistribution. The majority of the population, below San Acacia Dam, are believed to be moved by high velocities in the narrow and deep channel into Elephant Butte Reservoir where none survive. These environmental changes have degraded and eliminated spawning, nursery, feeding, resting, and refugia areas required for species survival and recovery (U.S. Fish and Wildlife Service 1993a, 1999).

Southwestern Willow Flycatcher

The Service listed the southwestern willow flycatcher (flycatcher) as endangered on February 27, 1995 (U.S. Fish and Wildlife Service 1995a). 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, 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, and U.S. Fish and Wildlife Service 1993b). 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 growth 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, widely separated by vast expanses of arid lands, small and/or linear patches. Flycatchers begin arriving in New Mexico in late April and May. Nesting begins in late spring and the young fledge in early summer. Late nests and re-nests may not fledge young until late summer (Sogge and Tibbitts 1992, Sogge *et al.* 1993). 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 either 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 Rio Grande. This habitat is primarily composed of riparian shrubs and trees, chiefly Goodding's, peachleaf, and coyote willow, Rio Grande cottonwood, and salt cedar. The habitat within the City's project construction area may be used by flycatchers during migration, and could be potential nesting habitat for the flycatcher. The habitat at the site of the preferred alternative has only a few mature cottonwoods and elms with young cottonwood and willow plantings. Wetlands and backwater habitat are currently lacking in the project area.

Bald Eagle

The project 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 (U.S. Fish and Wildlife Service 1995b). 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 Rio Grande. Bald eagle prey includes fish, waterfowl, and small mammals. Bald eagles prefer to roost and perch in large trees near water. Suitable perch sites occur within the project area, typically where large cottonwoods occur at the river's edge.

At present and in the foreseeable future, major threats to the eagle are destruction and degradation of its habitat and environmental contamination of its food supply. The main threats to New Mexico's wintering population are impacts to their prey base and availability of roost-sites. Eagles may also occur around ponds outside the riparian zone but cottonwood trees within the riparian zone are used for perches and night roosts. Short-term, bald eagles may utilize a variety of river flow conditions, depending on their foraging habits. However, extremely low flows over the long-term may affect maintenance and regeneration of adequate riparian wintering habitat (*i.e.*, cottonwoods or other riparian vegetation used for roosting).

Winter bald eagle surveys were conducted annually for eight years from Albuquerque upstream to the confluence of the Rio Chama and the Rio Grande. The mean annual sightings from 1988-1996 is 64, with the largest number sighted in 1993 (88). The survey data show that wintering bald eagles use the habitat within the project area for feeding and perching (U.S. Bureau of Reclamation 1999).

PROJECT DESCRIPTION

Project construction of the diversion and conveyance facilities would occur in Sandoval County (Angostura) and/or within the City (Figure 2). All other construction elements would occur within the City. The City proposes the diversion of 47,000 acre-feet/year (ac-ft/yr) of SJC water and 47,000 ac-ft/yr of "native" Rio Grande water for a total diversion of 94,000 ac-ft/yr for the DWP. The diverted river water would be conveyed to a new WTP with a normal operating rate of 84 million gallons per day (mgd) and a peaking capacity of about 92 mgd or 142 cubic ft per second (cfs). However, diversion and conveyance facilities would be sized for a peak hydraulic capacity of up to 120 mgd or 186 cfs. Although this would provide flexibility in operation and the ability to respond to unusual, short demands, it may also allow for continuous operation in the future at 120 mgd. Normally, the City will reclaim half of this water (47,000 ac-ft/yr) and release it back into the Rio Grande from the SWRP; therefore, only the 47,000 ac-ft/yr of SJC water will be used consumptively.

The DWP will include an aquifer storage and recovery program intended to supplement the aquifer for peak demands and drought reserve and to improve the possibilities for conjunctive use of surface and groundwater resources. During low demand periods (October through March), the aquifer would be recharged using treated City water for injection into existing and possibly new wells. Preliminary water budget calculations (based on projected populations,

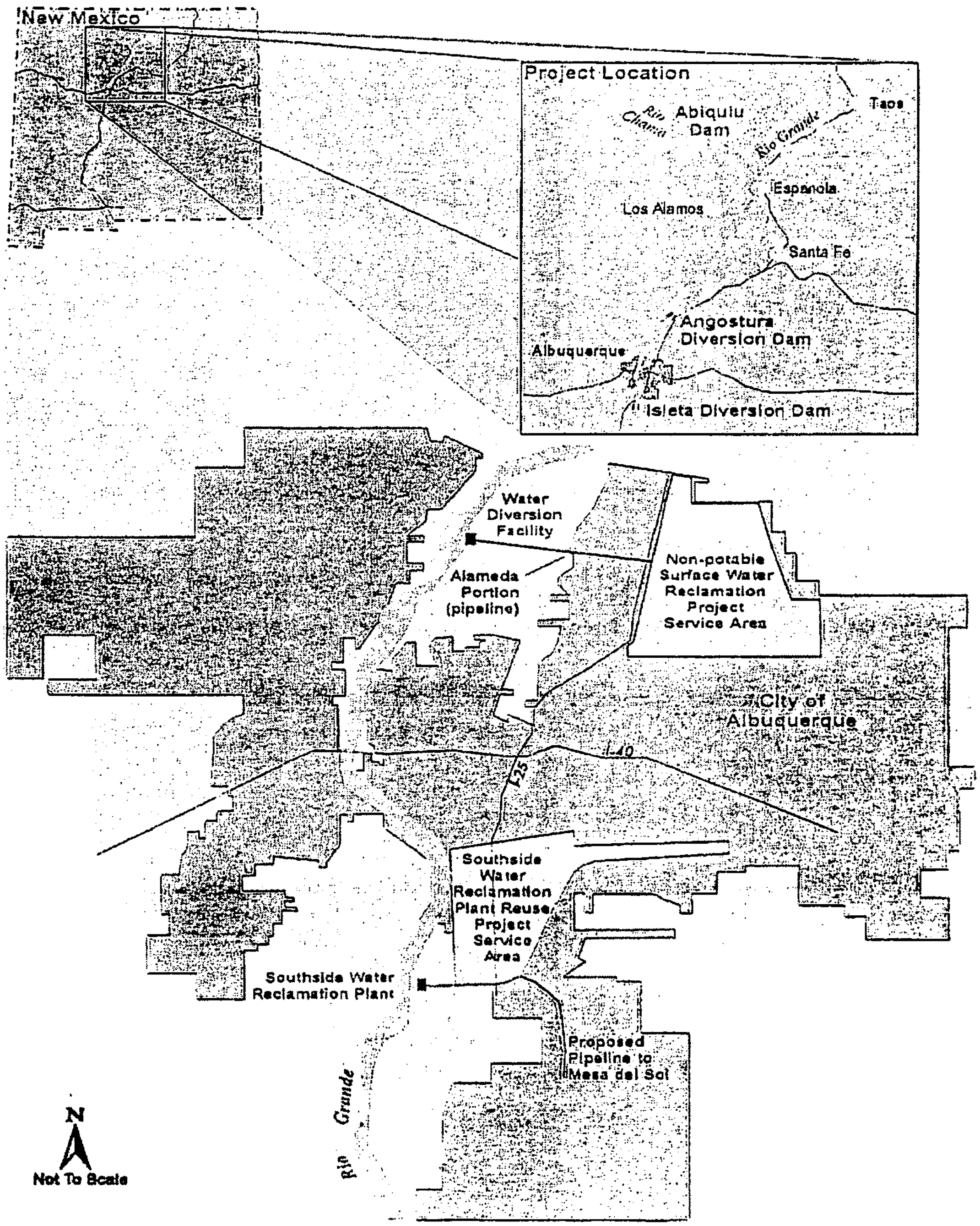

Figure 2. Project Location

water demand, and supply assumptions) suggest that the quantities of water available for aquifer storage would be about 10,000 to 15,000 ac-ft/yr in early project years and gradually decline thereafter. With project implementation, aquifer demand will decrease from 3.1 million ac-ft to approximately 1.2 million ac-ft and; aquifer drawdown from more than 250 ft to about 100-150 ft over the life of the project (2006-2060). Plans call for operating the new WTP at a near constant rate capable of: 1) meeting a "base load" demand sufficient to satisfy all municipal and industrial needs except those occurring during peak-demand summer periods; and 2) providing water at the same "base load" rate during the lower demand months (typically October through March) so as to supply treated water for recharge of the aquifer. During summer, recharge would cease and the wells would be "turned back to production" to help meet the peak-period municipal and industrial demands.

The City has proposed three action alternatives for the DWP:

- Angostura Diversion with Dual Conveyance alternative
- New Surface Diversion North of Paseo del Norte Bridge alternative (preferred)
- Subsurface Diversion at the Paseo del Norte Bridge alternative

Brief descriptions of these alternatives, and a no action alternative are provided below. The timing and amounts of water diverted are similar for each action alternative. Each action alternative includes the construction of a WTP near the southwest corner of Osuna Road and Chappell Drive and associated delivery pipelines from the WTP to the potable water distribution system.

Alternative A: Angostura Diversion

Alternative A proposes to use the existing Angostura Dam for the City's diversion and the Albuquerque Riverside Drain (also known as the Atrisco Feeder) as the primary conveyance channel and the Albuquerque Main Canal as an alternate emergency channel for the transport of surface water to the proposed WTP. Implementation of this alternative would require modifications to Angostura Dam, and if necessary, replace concrete on the main dam, sluiceway, and the canal below the sluiceway. This alternative also calls for the replacement and upgrade of all radial gates and installation of electrically driven operators. Reconstruction and improvements of access roads and the removal of sediment and debris from the canals would also be required. Additional renovations would include the enlargement of the Atrisco Feeder to assure a safe capacity of 450 to 500 cfs, widening and concrete lining of the channel just below the diversion dam, and the construction of a pump station near the North Diversion Channel. A 5-mile, 72-inch diameter pipe would be installed within the North Diversion Channel right-of-way to carry the City's water from the pump station to the new WTP. This alternative incorporates the construction of a 50-ft-wide, 1,500-ft-long rock-lined fishway on the western side of the dam, construction of a V-shaped 250-ft-long fish screen within the existing concrete-lined channel immediately below the diversion dam and the construction of a 36-inch fish bypass extending from the diversion channel to the river.

Alternative B: New Surface Diversion north of the Paseo del Norte Bridge (Preferred)

Alternative B proposes the construction of a low-head, adjustable height diversion dam (bladder dam) and pump station approximately 0.7 miles north of the Paseo del Norte Bridge. The bladder dam, approximately 600 ft long and between 2.5 to 3.5 ft in height (when in operation), would be mounted on the top of a fixed concrete sill constructed across the active river channel. A retaining wall, sluice channel, raw water intake, and fish screens would be located on the east side of the river, along the bank. The sluice channel would be constructed of reinforced concrete and would be 36 ft wide at the upstream end, 5 ft wide at the downstream end, and about 6.5 ft deep. The surface water intake would be constructed along the east side of the sluice channel and would consist of 10 reinforced concrete intake compartments. A fish-screen would be located across the entrance of each compartment. A 30-inch-diameter intake pipeline, located at the back of each compartment, would convey the water to the pump station, to be located on top of a widened section of the levee. A 72-inch diameter conveyance pipeline would extend from the pump station to approximately one-half mile south along the levee road to Paseo del Norte, then east along the north side of the Paseo del Norte right-of-way, then south along the North Diversion Channel right-of-way to the WTP site. A 50 ft-wide, low gradient, V-shaped fishway would be constructed on the west side of the river to provide for fish passage. The dam will normally divert 130 cfs but will be designed to handle up to 186 cfs.

Alternative C: Subsurface Diversion near the Paseo del Norte Bridge

The specific elements of this alternative consist of the construction of three subsurface horizontal collector systems and associated pump stations north and south of the Paseo del Norte Bridge. Each collector system will use perforated pipes buried 20 ft beneath the riverbed perpendicular to the riverbank. The pipe trenches would be backfilled with gravel and would extend about 400 ft along the active river channel. Each of the three collectors would have 11 arms of 20-inch diameter perforated pipes connected to a common header, which would be connected to its pump station. From the pump station, water will be transported to the proposed WTP by a 60-inch diameter pipeline. The pipeline, approximately 28,500 ft in total length, would be located along the Albuquerque Riverside Drain access road to Paseo del Norte, then east along the north side of the Paseo del Norte right-of-way to the North diversion Channel, then south along the North Diversion Channel right-of-way to the WTP site.

No Action Alternative: No Diversions

Under the No Action Alternative, none of the project features would be implemented. Diversion of surface water for use as potable water would not occur and the City would continue extracting water solely from the aquifer. Groundwater pumping is currently around 110,000 ac-ft/yr and continued sole reliance under this alternative, with conservation planning, is estimated to rise to 195,000 ac-ft/yr by 2060. Aquifer drawdown from the City's 92 production wells is estimated at 150 ft and by 2060 may exceed 250 ft.

EVALUATION METHODOLOGY

Since project planning began in 1998, the Service has attended many meetings with the City, project consultants, and Reclamation to discuss project features, design, and construction methods. Field trips to the project area have taken place in conjunction with all AWRMS activities, including the DWP. Additional biological data and background information were derived through review of relevant literature and personal communications. Reclamation, project consultants, and the City have provided a majority of the technical and background information. Hydrological reports used in our evaluations were provided by the City's project consultants and USGS data. Surveys for the southwestern willow flycatcher within the project construction area in 2001 by Eco-Systems Management found no birds present. However, if potential habitat is identified within the entire affected area, then additional surveys may be warranted. Surveys for bald eagles in the project area were conducted by the Corps between 1988 and 1996. Monthly silvery minnow surveys were conducted in the project area during the winter of 1999-2000, and during previous years.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

The river, floodplain, and the associated fish and wildlife would continue to experience adverse effects from federal, state, and private actions, including new and ongoing activities. Urbanization/development within the historic floodplain would continue to eliminate remnant riparian areas located outside the levees, while putting increased pressure on the habitat and wildlife in the riparian zone. Changes to the river channel and the floodplain that affect how base flow and flood currents move downstream and across the floodplain (dams, levees, channelization, *etc.*) would continue to affect patterns of erosion, aggradation, and maintenance or regeneration of riparian vegetation (Crawford *et al.* 1993). Other water diversion projects, such as the City of Santa Fe's Buckman Diversion are planned that may result in additional river depletions.

Generally, channel degradation caused by current hydrological and sediment management would continue. The river downstream of Cochiti Dam would become narrower and deeper, negatively affecting warmwater fishes and reducing the availability of native aquatic habitat, while the river in the lower end of the Middle Rio Grande near Elephant Butte Reservoir would continue to aggrade. The quality of river and groundwater would be increasingly affected by urban discharges and agricultural runoff, locally affecting fish abundance. A lack of overbank flooding and a lowered water table would continue to restrict opportunities for wetland formation and would cause the remaining cottonwoods to die off while the growth of non-native vegetation, such as salt cedar and Russian olive, would continue to increase. The native cottonwood/willow vegetative complex would be gradually replaced with non-native species. However, the City's Open Space Division is actively planting native vegetation throughout the riparian corridor within the city (including the project area) which may help to reduce this trend. The OSE Interim Ground-Water Model for the Albuquerque Basin (*in* U.S. Bureau of Reclamation 2002) predicts a reduction in water table elevation of around 0.75 ft for the No Action Alternative when compared to the action alternatives. Although there is no construction-related loss of riparian habitat under the No Action alternative, riparian habitat estimated at 583 ac between the riverside drains is expected to experience a reduction of 3 ft or greater in the water table from continued sole-source aquifer pumping. The overall quality and quantity of fish and wildlife habitat would continue to steadily degrade, and species that do not adapt to the changes would be stressed and eventually disappear from the system (Crawford *et al.* 1993).

Threatened and Endangered Species

Without identification and effective implementation of recovery measures for the endangered silvery minnow and flycatcher, these species may become extinct in the foreseeable future. The wetted channel would continue to decrease in width and increase in depth, a situation that is directly detrimental to Rio Grande silvery minnow habitat. Potential flycatcher habitat would continue to degrade. Mature cottonwood trees would die naturally of senescence, with no recruitment of native riparian habitat. Without adequate cottonwood regeneration, bald eagle perch habitat would decline, thus impacting the bald eagle (Crawford *et al.* 1993).

FISH AND WILDLIFE RESOURCES WITH THE PROJECT

Impacts to fish and wildlife will be described for each alternative, followed by a brief description of possible impacts to federally listed species. Measures to offset anticipated fish and wildlife losses described in this section are provided in the Recommendations section.

Angostura and Paseo del Norte Diversion

Although these action alternatives would divert 130 cfs, 65 cfs would be added to current base flows from Abiquiu Reservoir upstream, this results in a net depletion past the point of diversion by 65 cfs. Long-term project impacts would likely occur with the net depletion of 65 cfs in the Rio Grande between the point of diversion and the point of return by 47,000 ac-ft/yr, affecting 33 river miles for the Angostura Alternative or 15 river miles for the Paseo del Norte Alternative. These alternatives, when added to the cumulative effects of river de-watering from other projects, further depletes available water for fish and wildlife species in the ecosystem along the affected reaches. However, fish and wildlife resources may benefit from the additional 65 cfs added to base flows within river reaches above the point of diversion.

Although the operational scenario predicts only a 7 percent reduction in the mean annual flow for a typical year midway through the project at the Albuquerque gage, the months of greatest adverse impact of a net 65 cfs depletion would likely occur in September and October (typical low-flow period). According to the City's project consultants (CH2M Hill), analysis of the wetted channel characteristics during a severe low flow (170 cfs at the Albuquerque gage) below the diversion point to the SWRP could include a 20 to 30-ft reduction in river channel width in the narrowest river sections (70 to 130 ft wide, respectively). During these conditions, water levels could be reduced by up to 0.3 ft in the narrowest sections of the river under a constant net diversion of 65 cfs. In wider parts of the river (>130 ft wide), CH2M Hill predicts no difference in water level depths under severe low flow conditions. When in operation, the Paseo del Norte diversion would add another barrier to fish movement on the Rio Grande. The proposed Paseo del Norte bladder dam will span most of the river, year-round, and the City states that use of the proposed fishway by aquatic species "is an area of uncertainty"(U.S. Bureau of Reclamation 2000). However, both alternatives will involve the construction of a fishway, to address potential barriers to fish movement. The feature, located on the west shore, will provide flows of 50 cfs during all operational periods of the diversion structure. A direct loss of riparian habitat amounting to 1.8 ac (Angostura) or 6.6 ac (Paseo del Norte) would also result from facility construction.

Temporary, short-term impacts to fish and wildlife may occur from noise, dust, and the presence of workers and machinery during project construction. Placement and removal of temporary cofferdams, construction forms, and backfill could increase turbidity. Runoff from construction work sites, access routes, staging areas, and unprotected fills could degrade water quality in the river. Uncured concrete could increase alkalinity and conductivity, water quality factors to which aquatic biota are highly sensitive. Accidental spills of fuels, lubricants, hydraulic fluids and other petrochemicals, although unlikely, would be harmful to aquatic life. De-watering or changes in flow at the construction site could cause direct mortality to fish and aquatic invertebrates, and could disrupt fish spawning.

Subsurface Diversion

Under this alternative, 47,000 ac-ft/yr of water would be taken up by the collectors, effectively depleting flows by 65 cfs within a 15-mile reach. When added to the cumulative effects of river de-watering from other projects, this further depletes available water for fish and wildlife species in the ecosystem along the affected reaches. The months of greatest adverse impact of this depletion on fish and wildlife resources would typically occur in September and October. However, fish and wildlife resources may benefit from the additional 65 cfs added to base flows within the river reaches upstream of the uptake point. Unlike the surface diversion alternatives, this alternative is estimated to have a similar depletion effect on groundwater as the No Action Alternative. Riparian area that would experience substantial changes in overall plant-community structural composition due to a groundwater decline of 1 to 3 ft for at least 1 month per year is estimated to affect 552 ac (near Paseo del Norte Bridge). A direct loss of 10.6 ac of riparian habitat would result from facility construction.

Temporary, short-term impacts to fish and wildlife may occur from noise, dust, and the presence of workers and machinery during project construction. Placement and removal of temporary cofferdams, construction forms, and backfill could increase turbidity. Runoff from construction work sites, access routes, staging areas, and unprotected fills could degrade water quality in the river. Uncured concrete could increase alkalinity and conductivity that could adversely affect highly sensitive aquatic biota. Accidental spills of fuels, lubricants, hydraulic fluids and other petrochemicals, although unlikely, would be harmful to aquatic life. De-watering or changes in flow at the construction site could cause direct mortality to fish and aquatic invertebrates, and could disrupt fish spawning.

Summary and Comparison of Impacts Among Alternatives

The following statements compare the impacts of each alternative:

The most obvious differences between the action alternatives are the lengths of depleted river reaches and effects on groundwater by the proposed DWP. With respect to lengths of affected reaches, the Angostura Alternative is the least desirable since it will affect approximately 33 miles, as opposed to 15 miles for the Paseo del Norte and Subsurface Diversion alternatives. With respect to groundwater, the Subsurface Diversion and No Action alternatives would create more significant drawdown impacts to the shallow alluvial aquifer and the aquifer, respectively. For example, based on modeling efforts and hydrogeologic data, the City's consultants predict that during operation, the Subsurface Diversion Alternative would create maximum drawdowns of the shallow alluvial aquifer of between 3 to 3.5 ft. The concern here would be direct adverse effects to bosque trees (*i.e.*, cottonwoods) within the area of the drawdown (552 ac). Similarly, under the No Action Alternative, pumping is expected to indirectly cause water table drawdowns that would affect 583 ac of riparian vegetation within the Albuquerque reach. These affected areas would likely continue to support riparian vegetation but there may be a shift to woody vegetation that is adapted to a deeper water table (U.S. Bureau of Reclamation 2000).

Hydrologic modeling predicts that, over the 54-year life of the project (2006-2060), the No Action Alternative would result in about 3.1 million ac-ft of aquifer pumpage and drawdowns of more than 250 ft are expected throughout most of northeast and parts of southeast Albuquerque. Comparatively, aquifer drawdowns in the same area for the action alternatives are estimated at less than 200 ft and water removed is estimated at about 1.2 million ac-ft over the life of the project. This savings is expected to show up in a higher riverfront groundwater table. According to the Appendix L in the EIS, river flows in the reach between Paseo del Norte and Rio Bravo streets would experience 27 cfs less, on average, than No Action flows over the life of the project. Appendix L also calculates that the DWP, when compared to the No Action Alternative, will result in 0.1 to 0.3 feet less water depth in the Albuquerque reach, a velocity reduction of 0.1 to 0.2 ft/s, and a 20 to 30 foot reduction of wetted stream width in narrow sections of the river. Between Abiquiu Dam and the proposed diversions, implementation of the action alternatives would result in additional flows (65 cfs or 48,200 ac-ft/yr) when compared to the No Action Alternative. These flows may beneficially affect fish and wildlife resources within those reaches.

Impacts to Threatened and Endangered Species

Analysis of effects to affected listed species will be addressed in detail during ESA section 7 consultation between Reclamation and the Service. Only general observations and suggestions will be addressed in this report. Actions that could prevent listed species impacts such as those described below are provided in the Recommendations section.

Rio Grande Silvery Minnow

Temporary construction impacts: The silvery minnow has been collected within the proposed project area, but few have been captured recently with decreasing numbers over time. Construction within the river channel would have a direct effect on any individuals present in the area. The silvery minnow, as well as other fish, have the ability to move downstream to safer and less stressful areas. In addition, the project would modify a small portion of channel thereby affecting proposed critical habitat and possibly could disrupt spawning if construction within the Rio Grande channel is conducted from April through June.

General long-term impacts: Channel-wide diversions fragment the ranges of fish species, entrain drifting eggs/larvae, and prevent upstream movement necessary to maintain populations which appears to be especially detrimental to their continued survival (Platania and Altenbach 1998). Although the preferred alternative includes a fish passageway, "use...by aquatic species is an area of uncertainty." Depletion of river flows through operation of the proposed DWP may contribute to cumulative impacts on the silvery minnow, since this depletion adds to all other de-watering activities on the Rio Grande. Lesser flows may adversely affect the minnow by lessening the quality and availability of minnow habitat and degradation of water quality by magnifying concentrations of urban and agricultural contaminants.

Southwestern Willow Flycatcher

Temporary construction impacts: To date, no flycatchers have been located within the proposed project area based on previous survey data. Potential habitat exists along the Rio Grande corridor within Albuquerque. It is possible, but unlikely, that individual flycatchers could be displaced up or downstream from the construction area, if construction occurs during the migrating or nesting season (April-August).

General long-term impacts: Southwestern willow flycatcher habitat has been greatly reduced by the lack of overbank flooding, de-watering, habitat development and fragmentation, and the lack of sediment deposition. Nonetheless, flycatchers do nest in native, exotic or mixed riparian habitat such as that which occurs along the proposed depletion zone. Absent any other riparian management (*i.e.*, bank lowering, exotic plant removal, periodic high flows, *etc.*), the proposed DWP may further degrade potential or suitable flycatcher habitat within the project area.

Bald Eagle

Temporary construction impacts: The proposed construction period may overlap with the bald eagle winter use season (November through March) in New Mexico. Bald eagles are sensitive to human disturbance but nonetheless reside along the river during winter. The proximity of the project area to bald eagle habitat may cause them to move and concentrate at other sites or use less than optimal habitat.

General long-term impacts: Some large trees will be removed at the construction site, which will result in the loss of potential perching sites for the bald eagle. However, there are many localized sites up and downstream of the project area that provide that same type of habitat, so the effect is anticipated to be minimal.

DISCUSSION

Although implementation of the AWRMS is moving the City toward relieving aquifer dependency and over-use, the Service is concerned over the effects of depleted Rio Grande surface flows on fish and wildlife habitat over the life of the project.

Common to all alternatives, key assumptions during the modeling runs was "the City's adopted scenario of continued growth trends with conservation, which includes future growth rates of between 1.1 and 1.7 percent and a substantial reduction in per capita water demands from 250 to 175 gallons per capita per day by 2005." Assuming that the key assumptions and model predictions are accurate, DWP flows for the preferred alternative between Paseo del Norte and Rio Bravo (depletion zone) would be on average, 27 cfs less than No Action flows. Additionally, the DWP, when compared to the No Action Alternative, will result in 0.1 to 0.3 feet less water depth in the Albuquerque reach, a velocity reduction of 0.1 to 0.2 ft/s, and a 20 to 30 foot reduction of wetted stream width in narrower sections of the river. However, if these assumptions are not met, water demand, aquifer drawdown, and river depletions may be higher than expected. In that event, the result is that all of the effects analysis, which the City concludes will have minimal adverse effects on fish and wildlife resources, may be compromised. Furthermore, although current diversion proposals are 130 cfs, DWP facilities will be sized to handle a continuous diversion up to 186 cfs to respond to higher demands. The increased capability may also be needed to recharge the aquifer during low demand months of October through March. Therefore, operation of the DWP may result in more significant impacts to fish and wildlife resources than was analyzed or anticipated from the point of diversion to the SWRP and potentially from the SWRP downstream. These effects will be particularly apparent during the typical low flow months of September and October.

Hydrologic data associated with the connectivity of the aquifer to the Rio Grande are included in the modeling shown in Figures 4-3a, 5-2, 5-3(a-e), 5-4(a-e), 5-5(a-e), and 5-7 in sections 4 and 5 of Appendix L in the EIS. These figures depict predicted future conditions regarding the effect of the DWP on flows in the Rio Grande versus the No Action Alternative. The predictions used to model the connection between the aquifer and the Rio Grande are based on the best available information to date. However, the accuracy of these data could improve in the future relating to the characterization of; a) the response of groundwater levels in the aquifer as groundwater pumping is reduced, b) the conductivity of the portion of the shallow alluvial aquifer (along the Rio Grande) in a spatially comprehensive framework, c) the vertical gradient of the alluvial aquifer in a spatially comprehensive framework, d) the vertical gradient of the alluvial aquifer as the aquifer rebounds, e) the flows in the Rio Grande as the aquifer rebounds, and f) the seepage characteristics of the Rio Grande as the aquifer rebounds. If the City adopts an adaptive management plan that will actively collect and incorporate these new data into the State's Middle Rio Grande Administrative Model and mitigate for impacts to the Rio Grande based on the most current data available, then impacts to the Rio Grande are more likely to be accurately identified and mitigated. The Service assumes that the City will comply with the conditions set forth in the existing groundwater diversion permit RG-906 and any subsequent revisions, modifications and additions. The Service also assumes that the City will comply with the conditions set forth in the surface water diversion permit, RG-4830 and RG-4819, and any subsequent revisions, modifications and additions.

Construction projects that result in unavoidable 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 determining resource categories and recommending mitigation (U.S. Fish and Wildlife Service 1981). The river, riparian bosque, and associated wetland resources within the project area below Cochiti Dam that may be affected by implementation of the DWP are consistent with "Resource Category No. 2"; that is, habitats of high value that are relatively scarce or becoming scarce on a national basis or in the eco-region section. These riparian and wetland habitats are classified in Category 2 because they are scarce. According to Johnson and Jones (1977), about 90 percent of the historic wetland and riparian habitat in the Southwest has been eliminated. Hink and Ohmart (1984) found a wetland decrease of 87 percent along the Rio Grande from 1918 to 1982. Our mitigation policy states that the degree of mitigation should correspond to the value and scarcity of the fish and wildlife habitat at risk. Consequently, no net loss of in-kind habitat value should be the mitigation goal for this resource category.

Notwithstanding the above, implementation of the DWP with appropriate management and contingency planning may provide opportunities that can benefit important fish and wildlife resources within the project area. Appendix O in the EIS provides the City's mitigation plan with respect to the proposed DWP. The plan's objective is to provide the City's existing and proposed measures that would offset long-term and/or cumulative effects of project construction and operations.

The Aquatic Life section of Appendix O provides for appropriate "best management practices" to contain the discharge of sediments during project construction; provides for coordination with this office regarding fish salvage efforts; allows for a clear fish channel passage during construction phases; provides for coordination of SJC water release schedules with various agencies, including the Service; and provides for fishway and fish screen features to be incorporated into project design.

The Hydrology section of Appendix O provides for the release of SJC water for the DWP; the installation of a gaging system; the implementation of a curtailment strategy; a sediment management protocol; additional native water storage in Abiquiu Reservoir; and an accounting system to track water removal and replacement to the river.

The Riparian section of Appendix O provides for project facilities to be sized and located to minimize unnecessary loss of riparian vegetation such as cottonwoods; a revegetation plan to replace vegetation impacted during the construction phases; channel restoration planning will consider providing some potential habitat for the silvery minnow and flycatcher; funding would be provided to monitor and improve the AWRMS environmental enhancement program; continue a fuel reduction program; conduct studies for bosque improvements; complete the Albuquerque Overbank Project; removal of exotic riparian species; removal of dumped construction debris; and replanting with native species.

The Threatened and Endangered Species section of Appendix O provides for similar efforts as stated in Aquatic Life above, but will provide funding to develop projects that enhance habitat for the silvery minnow; provide funds for the minnow captive breeding program at the Albuquerque Aquarium for a 10-year period; provide funding to develop projects that provide for the continued enhancement and health of the bosque; proposes to remove exotic vegetation, jetty jacks, and root structures along the banks to facilitate overbank flooding; channel cutting to allow for flow through or backwater flows to occur; provide sediment from various sources; woody debris placement within the river to create additional habitat for juvenile fish; wetland restoration in recently acquired properties in the Oxbow; a protocol to avoid disturbing bald eagles during construction; construction of a diversion fishway and fish screens; and a flow curtailment strategy (as stated in the Hydrology section).

It is reasonable to conclude that, given the current condition of the river and bosque within the affected area, higher flows would be necessary to facilitate important ecological processes. However, bank lowering, jetty-jack removal, replacement of exotic with native vegetation, and other restorative measures could help alleviate the need for higher flows necessary to compensate for current and future conditions. And, such restorative measures could help offset the effects of the DWP on flows in the Rio Grande. The Bosque Biological Management Plan (Crawford *et al.* 1993) provides a foundation for enhancing the biological quality and ecosystem integrity within the project area.

RECOMMENDATIONS

The Service offers the following recommendations concerning fish and wildlife habitat within the proposed depleted portions of the project area. The Discussion contains a more detailed explanation for each recommendation.

1. To help offset predicted reductions in wetted stream width, flow velocities, and water depths, we recommend that the city adopt, without duplication of effort, the proposed measures described in Aquatic Life, Hydrology, Riparian Zone, and Threatened and Endangered Species sections in Appendix O.

In addition to the mitigation plan outlined in Appendix O, we provide these additional recommendations for the DWP to ensure no-net loss of in-kind habitat:

2. In general, applicable protective measures presented in Appendix O are adequate to address temporary project construction impacts provided that they are incorporated as stipulations into contractor plans. However, with respect to proposed mitigation measure no. TE-15, we recommend a qualified biologist be present during construction phases to ensure this measure is adequately addressed.

3. With reference to the fishway design or other fishery-related issues for the DWP, we recommend continued collaboration with the New Mexico Ecological Services Field Office and Fishery Resources Office. As part of this process, the City should ensure that fish passage structures and fish exclusion devices are successful.

4. In addition to the pump station meters, we recommend the City install gages just above and below the diversion structure, and at the SWRP outfall (*if* existing gages do not accurately reflect flows as a result of the DWP). Consistent with our September 10, 2001, memorandum, flow data for management/monitoring should be provided on a real-time basis.

5. The City, in cooperation with the Office of the State Engineer and the United States Geological Survey, should monitor the connectivity between groundwater levels in the aquifer and the shallow alluvial aquifer of the Rio Grande and monitor surface flows within the Rio Grande and associated drains and ditches. Data from monitoring efforts should be used to periodically update the Middle Rio Grande Administrative Model through a cooperative effort between the City, Office of the State Engineer, and the USGS. In addition, this should allow for more accurate assessments of the effects of the DWP on river flows and its effects on fish and wildlife resources.

6. The City will report the total combined diversions from ground and surface water sources to the State Engineer which will be entered into the most current version of the Middle Rio Grande Administrative Model to determine the City's total effects on the Rio Grande. If the total effects

on Rio Grande flows from the DWP (within the depletion zone) result in reductions in flow velocities, wetted stream widths, and reduced water depths that are more than those shown in "Effects of River Flow Depths and Velocities" on page ES-6 and 7, and in Table 5-3 of Appendix L; then those flow-related reductions should be offset through native Rio Grande water rights, City San Juan-Chama water or by leasing or acquiring water rights.

7. The Service recommends the City support the recommendations found in the Bosque Biological Management Plan (Crawford *et al.* 1993) for DWP mitigation and/or enhancement activities.

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Appendix A. Common and Scientific Names of Mammals That May Occur in the Middle Rio Grande (NM) Floodplain.

Common Name	**Scientific Name**
Opossum	*Didelphis virginiana*
Desert shrew	*Notiosorex crawfordi*
Yuma myotis	*Myotis yumanensis*
Little brown bat	*Myotis lucifugus*
Long-legged myotis	*Myotis volans*
Silver-haired bat	*Lasionycteris noctivagans*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasiurus cinereus*
Spotted bat	*Euderma maculatum*
Townsend's big-eared bat	*Plecotis townsendii*
Pallid bat	*Antrozous pallidus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Desert cottontail	*Sylvilagus auduboni*
Black-tailed jackrabbit	*Lepus californicus*
Beaver	*Castor canadensis*
Gunnison's prairie dog	*Cynomys gunnisoni*
Colorado chipmunk	*Eutamias quadrivittatus*
Spotted ground squirrel	*Spermophilus spilosoma*
Rock squirrel	*Spermophilus variegatus*
Red squirrel	*Tamiasciurus hudsonicus*
Northern grasshopper mouse	*Onychomys leucogaster*
Deer mouse	*Peromyscus maniculatus*
White-footed mouse	*Peromyscus leucopus*
Piñon mouse	*Peromyscus truei*
Western harvest mouse	*Reithrodontomys megalotis*
Hispid cotton rat	*Sigmodon hispidus*
Norway rat	*Rattus norvegicus*
Muskrat	*Ondatra zibethicus*
New Mexican jumping mouse	*Zapus hudsonius luteus*
Ord kangaroo rat	*Dipodomys ordii*
Merriam kangaroo rat	*Dipodomys merriami*
Silky pocket mouse	*Perognathus flavus*
Plains pocket mouse	*Perognathus flavescens*
Yellow-faced pocket gopher	*Pappogeomys castanops*
Botta pocket gopher	*Thomomys bottae*
American porcupine	*Erethizon dorsatum*
Coyote	*Canis latrans*
Gray fox	*Urocyon cinereoargenteus scottii*
Raccoon	*Procyon lotor*
Striped skunk	*Mephitis mephitis*
Long-tailed weasel	*Mustela frenata*
Mink	*Mustela vison*
Badger	*Taxidea taxus*
Bobcat	*Lynx rufus*
Mountain lion	*Felis concolor*
Mule deer	*Odocoileus hemionus*

Appendix B. Common and Scientific Names of Reptiles and Amphibians That May Occur in the Middle Rio Grande (NM) Floodplain.

Common Name	**Scientific Name**
Tiger salamander	*Ambystoma tigrinum*
Couch's spadefoot	*Scaphiopus couchii*
Plains spadefoot	*Spea bombifrons*
New Mexico spadefoot	*Spea multiplicata*
Great Plains toad	*Bufo cognatus*
Green toad	*Bufo dibilis*
Red-spotted toad	*Bufo punctatus*
Woodhouse's toad	*Bufo woodhousii*
Canyon treefrog	*Hyla arenicolor*
Western chorus frog	*Pseudacris triseriata*
Plains leopard frog	*Rana blairi*
Bullfrog (introduced)	*Rana catesbeiana*
Northern leopard frog	*Rana pipiens*
Yellow mud turtle	*Kinosternon flavescens*
Snapping turtle	*Chelydra serpentina*
Painted turtle	*Chrysemys picta*
Ornate box turtle	*Terrapene ornata*
Big Bend slider	*Trachemys gaigeae*
Red-eared slider (introduced)	*Trachemys scripta*
Spiny softshell	*Trionyx spiniferus*
Collared lizard	*Crotaphytus collaris*
Leopard lizard	*Gambelia wislizenii*
Greater earless lizard	*Cophosaurus texanus*
Lesser earless lizard	*Holbrookia maculata*
Texas horned lizard	*Phrynosoma cornutum*
Roundtail horned lizard	*Phrynosoma modestum*
Desert spiny lizard	*Sceloporus magister*
Crevice spiny lizard	*Sceloporus poinsettii*
Eastern fence lizard	*Sceloporus undulatus*
Tree lizard	*Urosaurus ornatus*
Side-blotched lizard	*Uta stansburiana*
Chihuahuan whiptail	*Cnemidophorus exsanguis*
Checkered whiptail	*Cnemidophorus grahamii*
Little striped whiptail	*Cnemidophorus inornatus*
New Mexico whiptail	*Cnemidophorus neomexicanus*
Western whiptail	*Cnemidophorus tigris*
Desert grassland whiptail	*Cnemidophorus uniparens*
Plateau striped whiptail	*Cnemidophorus velox*
Many-lined skink	*Eumeces multivirgatus*
Great Plains skink	*Eumeces obsoletus*
Texas blind snake	*Leptotypholps dulcis*
Western blind snake	*Leptotypholps humilis*
Glossy snake	*Arizona elegans*
Trans-pecos rat snake	*Bogertophis subocularis*
Racer	*Coluber constrictor*
Ringneck snake	*Diadophis punctatus*
Great Plains rat snake	*Elaphe guttata*
Western hooknose snake	*Gyalopion canum*
Western hognose snake	*Heterodon nasicus*
Night snake	*Hypsiglena torquata*

Appendix B continued. Common and Scientific Names of Reptiles and Amphibians That May Occur in the Middle Rio Grande (NM) Floodplain.

Common Name	**Scientific Name**
Common kingsnake	*Lampropeltis getula*
Milk snake	*Lampropeltis triangulum*
Coachwhip	*Masticophis flagellum*
Striped whipsnake	*Masticophis taeniatus*
Bullsnake or gopher snake	*Pituophis melanoleucus*
Longnose snake	*Rhinocheilus lecontei*
Big Bend patchnose snake	*Salvadora deserticola*
Mountain patchnose snake	*Salvadora grahamiae*
Ground snake	*Sonora semiannulata*
Plains blackhead snake	*Tantilla nigriceps*
Blackneck garter snake	*Thamnophis cyrtopsis*
Wandering garter snake	*Thamnophis elegans*
Checkered garter snake	*Thamnophis marcianus*
Common garter snake	*Thamnophis sirtalis*
Lyre snake	*Trimorphodon biscutatus*
Western diamondback rattlesnake	*Crotalus atrox*
Blacktail rattlesnake	*Crotalus molossus*
Western rattlesnake	*Crotalus viridis*
Massasauga	*Sistrurus catenatus*

Appendix C. Common and Scientific Names of Birds That May Occur in the Middle Rio Grande (NM) Floodplain.

Common Name	**Scientific Name**
Pied-billed grebe	*Podilymbus podiceps*
Common loon	*Gavia immer*
American white pelican	*Pelecanus erythrorhynchos*
Double-crested cormorant	*Phalacrocorax auritus*
Olivaceous cormorant	*Phalacrocorax olivaceus*
American bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Great blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Snowy egret	*Egretta thula*
Little blue heron	*Egretta caerulea*
Cattle egret	*Bubulcus ibis*
Green-backed heron	*Butorides striatus*
Black-crowned night heron	*Nycticorax nycticorax*
White-faced ibis	*Plegadis chihi*
Snow goose	*Chen caerulescens*
Canada goose	*Branta canadensis*
Wood duck	*Aix sponsa*
Green-winged teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
Northern pintail	*Anas acuta*
Cinnamon teal	*Anas cyanoptera*
Northern shoveler	*Anas clypeata*
Gadwall	*Anas strepera*
Hooded merganser	*Mergus cuculatus*
Red-breasted merganser	*Mergus serrator*
Ruddy duck	*Oxyura jamaicensis*
Virginia rail	*Rallus limicola*
Sora	*Porzana carolina*
Common moorhen	*Gallinula chloropus*
American coot	*Fulica americana*
Sandhill crane	*Grus canadensis*
Whooping crane	*Grus americana*
Killdeer	*Charadrius vociferus*
Black-necked stilt	*Himantopus mexicanus*
American avocet	*Recurvirostra americana*
Solitary sandpiper	*Tringa solitaria*
Spotted sandpiper	*Actitis macularia*
Long-billed curlew	*Numenius americanus*
Forster's tern	*Sterna forsteri*
Black tern	*Chlidonias niger*
Turkey vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
Black-shouldered kite	*Elanus caeruleus*
Mississippi kite	*Ictinia mississippiensis*
Bald eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
Cooper's hawk	*Accipiter cooperii*
Common black-hawk	*Buteogallus anthracinus*
Swainson's hawk	*Buteo swainsoni*
Red-tailed hawk	*Buteo jamaicensis*
American kestrel	*Falco sparverius*

Appendix C continued. Common and Scientific Names of Birds That May Occur in the Middle Rio Grande (NM) Floodplain.

Common Name	Scientific Name
American peregrine falcon	*Falco peregrinus anatum*
Ring-necked pheasant	*Phasianus colchicus*
Northern bobwhite	*Colinus virginianus*
Scaled quail	*Callipepla squamata*
Gambel's quail	*Callipepla gambelii*
Rock dove	*Columba livia*
White-winged dove	*Zenaida asiatica*
Morning dove	*Zenaida macroura*
Common ground-dove	*Columbina passerina*
Yellow-billed cuckoo	*Coccyzus erythropthalmus*
Greater roadrunner	*Geococcyx californianus*
Common barn-owl	*Tyto alba*
Great horned owl	*Bubo virginianus*
Burrowing owl	*Athene cunicularia*
Lesser nighthawk	*Chordeiles acutipennis*
Common nighthawk	*Chordeiles minor*
White-throated swift	*Aeronautes saxatalis*
Black-chinned hummingbird	*Archilochus alexandri*
Rufous hummingbird	*Selasphorus rufus*
Belted kingfisher	*Ceryle alcyon*
Northern flicker	*Colaptes auratus*
Olive-sided flycatcher	*Contopus borealis*
Western wood-pewee	*Contopus sordidulus*
Southwestern willow flycatcher	*Empidonax traillii extimus*
Black phoebe	*Sayornis nigricans*
Say's phoebe	*Sayornis saya*
Ash-throated flycatcher	*Myiarchus cinerascens*
Cassin's kingbird	*Tyrannus vociferans*
Western kingbird	*Tyrannus verticalis*
Eastern kingbird	*Tyrannus tyrannus*
Violet-green swallow	*Tachycineta thalassina*
Bank swallow	*Riparian riparia*
Cliff swallow	*Hirundo pyrrhonota*
Barn swallow	*Hirundo rustica*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Black-billed magpie	*Pica pica*
American crow	*Corvus caurinus*
Chihuahuan raven	*Corvus cryptoleucus*
Black-capped chickadee	*Parus atricapillus*
Verdin	*Auriparus flaviceps*
White-breasted nuthatch	*Sitta carolinensis*
Cactus wren	*Campylorhynchus brunneicapillus*
Black-tailed gnatcatcher	*Polioptila melanura*
Eastern bluebird	*Sialia sialis*
Western bluebird	*Sialia mexicana*
Hermit thrush	*Catharus guttatus*
American robin	*Turdus migratorius*
Gray catbird	*Dumetella carolinensis*
Northern mockingbird	*Mimus polyglottos*
Curved-billed thrasher	*Toxostoma curvirostre*
Crissal thrasher	*Toxostoma dorsale*
European starling	*Sturnus vulgaris*

Appendix C continued. Common and Scientific Names of Birds That May Occur in the Middle Rio Grande (NM) Floodplain.

Common Name	Scientific Name
Bell's vireo	*Vireo bellii*
Warbling vireo	*Vireo gilvus*
Orange-crowned warbler	*Vermivora celata*
Virginia's warbler	*Vermivora virginiae*
Lucy's warbler	*Vermivora luciae*
Yellow warbler	*Dendroica petechia*
Yellow-rumped warbler	*Dendroica coronata*
Common yellowthroat	*Geothlypis trichas*
Wilson's warbler	*Wilsonia pusilla*
Yellow-breasted chat	*Icteria virens*
Summer tanager	*Piranga rubra*
Western tanager	*Piranga ludoviciana*
Northern cardinal	*Cardinalis cardinalis*
Pyrrhuloxia	*Cardinalis sinuatus*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
Black-headed grosbeak	*Pheucticus melanocephalus*
Blue grosbeak	*Guiraca caerulea*
Lazuli bunting	*Passerina amoena*
Indigo bunting	*Passerina cyanea*
Painted bunting	*Passerina ciris*
Spotted towhee	*Pipilo maculatus*
Brown towhee	*Pipilo fuscus*
Dark-eyed junco	*Junco hyemalis*
Rufous-crowned sparrow	*Aimophila ruficeps*
American tree sparrow	*Spizella arborea*
Chipping sparrow	*Spizella passerina*
Lark sparrow	*Chondestes grammacus*
Black-throated sparrow	*Amphispiza bilineata*
Lark bunting	*Calamospiza melanocorys*
Lincoln's sparrow	*Melospiza lincolnii*
White-crowned sparrow	*Zonotrichia leucophrys*
Red-wing blackbird	*Agelaius phoeniceus*
Western meadowlark	*Sturnella neglecta*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Brewer's blackbird	*Euphagus cyanocephalus*
Great-tailed grackle	*Quiscalus mexicanus*
Bronzed cowbird	*Molothrus aeneus*
Brown-headed cowbird	*Molothrus ater*
Orchard oriole	*Icterus spurius*
Northern oriole	*Icterus galbula bullockii*
House finch	*Carpodacus mexicanus*
Lesser goldfinch	*Carduelis psaltria*

Appendix D. Common and Scientific Names of Fish That May Occur in the Middle Rio Grande (NM).

Common Name	Scientific Name
Gizzard shad (N)	*Dorosoma cepedianum*
Rainbow trout (I)	*Oncorhynchus mykiss*
Brown trout (I)	*Salmo trutta*
Northern pike (I)	*Esox lucius*
Red shiner (N)	*Cyprinella lutrensis*
Common carp (I)	*Cyprinus carpio*
Rio Grande chub (N)	*Gila pandora*
Rio Grande silvery minnow (N)	*Hybognathus amarus*
Fathead minnow (N)	*Pimephales promelas*
Flathead chub (N)	*Platygobio gracilis*
Longnose dace (N)	*Rhinichthys cataractae*
River carpsucker (N)	*Carpiodes carpio*
Flathead catfish (N)	*Pylodictis olivaris*
White sucker (I)	*Catostomus commersoni*
Rio Grande sucker (N)	*Catostomus plebeius*
Smallmouth buffalo (N)	*Ictiobus bubalus*
Black bullhead (I)	*Ictalurus melas*
Yellow bullhead (I)	*Ictalurus natalis*
Channel catfish (I)	*Ictalurus punctatus*
Western mosquitofish (N)	*Gambusia affinis*
White bass (I)	*Morone chrysops*
Green sunfish (I)	*Lepomis cyanellus*
Bluegill (N)	*Lepomis macrochirus*
Longear sunfish (I)	*Lepomis megalotis*
Largemouth bass (I)	*Micropterus salmoides*
White crappie (I)	*Pomoxis annularis*
Black crappie (I)	*Pomoxis nigromaculatus*
Yellow perch (I)	*Perca flavescens*

(N=native, I=introduced or non-native)

Appendix E. Common and Scientific Names of Plants That May Occur in the Middle Rio Grande (NM) Floodplain.

Common Name	**Scientific Name**
Baccharis (N)	*Baccharis spp.*
Seepwillow (N)	*Baccharis glutinosa*
Coyote willow (N)	*Salix exigua*
Peachleaf willow (N)	*Salix amygdaloides*
Goodding's willow (N)	*Salix gooddingii*
Buttonbush (N)	*Cephalanthus spp.*
False indigo bush (N)	*Amorpha fruticosa*
New Mexico olive (N)	*Forestiera neomexicana*
Black locust (N)	*Robinia pseudo-acacia*
Boxelder (N)	*Acer negundo*
Chinaberry (I)	*Melia azedarach*
Rio Grande cottonwood (N)	*Populus fremonti*
White mulberry (I)	*Morus alba*
Russian olive (I)	*Elaeagnus angustifolia*
Saltcedar (I)	*Tamarix spp.*
Siberian elm (I)	*Ulmus pumila*
Tree-of-heaven (I)	*Ailanthus altissima*
Apache plume (N)	*Fallugia paradoxa*
Wolfberry (N)	*Lycium andersonii*
Fourwing saltbush (N)	*Atriplex canescens*
Virginia creeper (I)	*Parthenocissus inserta*
Phragmites (N)	*Phragmites communis*
Sago pondweed (N)	*Potamogeton pectinatus*
Sedge (N)	*Carex spp.*
Saltgrass (N)	*Distichlis stricta*
Spikerush(N)	*Eleocharis spp.*
Horsetail (N)	*Equisetum spp.*
Rush (N)	*Juncus spp.*
Bulrush (N)	*Scirpus spp.*
Sacaton (N)	*Sporobolus spp.*
Cattail (N)	*Typha latifolia*
Smartweed (N)	*Polygonum lapathifolium*
American milfoil (N)	*Myriophyllum exalbescens*
Yerba manza (N)	*Anemopsis californica*
Primrose (N)	*Oenothera spp.*
Fendler globemallow (N)	*Sphaeralcea fendleri*
Pricklypear (N)	*Opuntia spp.*
Buffalo gourd (N)	*Cucurbita foetidissima*
Spiny aster (I)	*Aster spinosus*
Golden currant (N)	*Ribes aureum*
Watercress (N)	*Nasturtium officionale*

(N=native, I=introduced or non-native)