2003 New Mexico State Water Plan

Appendix A

Water Resources Issues

January 9, 2004

Office of the State Engineer

Interstate Stream Commission

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List of Acronyms

ALP	Animas-La Plata Project
cfs	cubic feet per second
CID	Carlsbad Irrigation District
CRSP	Colorado River Storage Project
EBID	Elephant Butte Irrigation District
EIS	environmental impact statement
EP No. 1	El Paso Irrigation District No. 1
ESA	Endangered Species Act
gpm	gallons per minute
IBWC	International Boundary and Water Commission
ISC	Interstate Stream Commission
MRGAA	Middle Rio Grande Administrative Area
MRGCD	Middle Rio Grande Conservancy District
NEPA	National Environmental Policy Act
NGWSP	Navajo-Gallup Water Supply Project
NIIP	Navajo Indian Irrigation Project
OSE	Office of the State Engineer
PVACD	Pecos Valley Artesian Conservancy District
SJRBRIP	San Juan River Basin Recovery Implementation Program
SWCB	Southwest Closed Basins
TDS	total dissolved solids
URGWOPS	Upper Rio Grande Water Operations
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWB	Underground Water Basin

Water Resources Issues

This appendix summarizes water issues and provides generalized water budgets for the major river basins or drainage areas of the State. It is an update of information previously presented in the *Framework for Public Input to a State Water Plan* (ISC/OSE, 2002). Information is organized according to the 11 basin areas that together cover the entire state. An attempt is made to focus on the major issues in each basin; however, all issues are not addressed in this context.

Water Resource Assessment

"How much water do we have?" is the simplest and most important question to ask about our water supply. Realistic planning must be based on the amount of available water and the additional amount that may be made available in the future to meet projected demand. The question is increasingly urgent, because it is now clear that even with the unusually wet weather of the 1980s and 1990s, supplies barely accommodate—and have sometimes fallen short of—existing uses and needs. During times of average water supply, the demand for water will exceed the supply. This problem becomes acute during drought, which is expected to be a frequent occurrence.

As water planners seek a meaningful, consistent approach to meet existing and foreseeable water demands, the need to access water supply information becomes increasingly critical. Planning efforts to date have been impaired by both a lack of sufficient information and by differences of opinion on drawing conclusions from incomplete information, or interpreting uncertainty due to inherent error in measurements.

Summary of Major Issues

Total withdrawal of water from streams and aquifers in 2000 was more than 4.2 million acre-feet (ac-ft; an acre-foot is the equivalent of about 326,000 gallons) [Source: New Mexico Office of the State Engineer Technical Report 51, February 2003]. About 2.6 million ac-ft was consumed. Several issues are common to many river basins and broad regions of the state, including:

- In many areas, total water uses exceed total legal entitlements from the various sources of supply.
- While ground water is a primary source of drinking water supply for New Mexicans, and is also often used for agricultural and industrial purposes, the ground water supply in many areas is not replenished quickly enough to make it a sustainable supply source, and some current water uses are causing essentially permanent depletion of stored ground water. In addition, ground water is susceptible to contamination and, once contaminated, cannot generally be

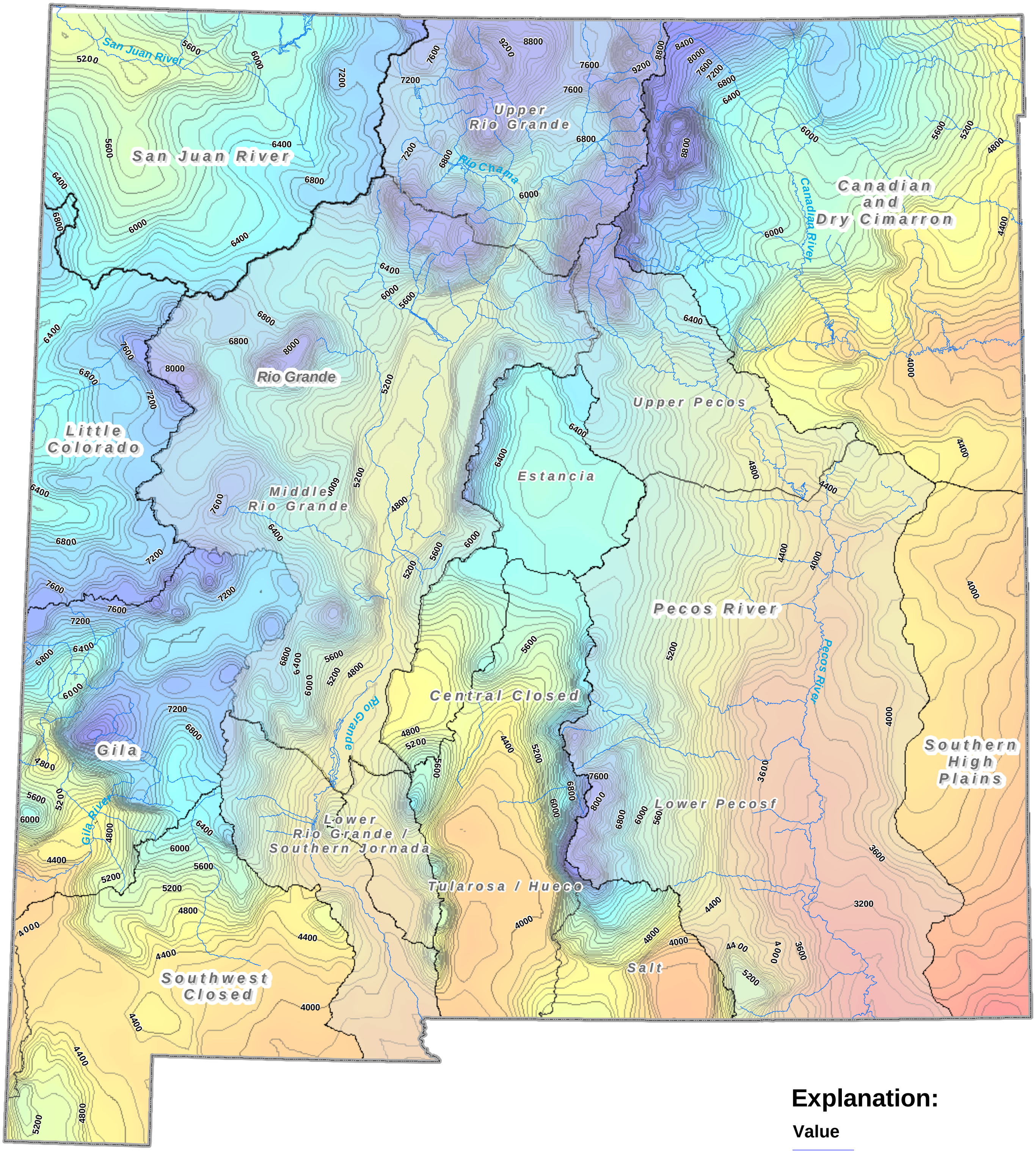
remediated quickly, and depending on the type of contamination, it may be unusable for certain purposes without treatment.

- Surface water supplies are also vulnerable due to highly variable rainfall, recurring droughts, and the continuing and uncontrollable reduction of surface water flows caused by historical ground water pumping. Conjunctive management of interconnected ground water and surface water rights becomes particularly challenging in times of surface water shortage. Ground water historically and currently pumped from some stream-connected aquifers will increase streamflow depletions for years to come.
- Conservation, more effective water management, discontinuance of existing uses of water, and development of new supplies are the primary means we have for meeting new demands. Current funding for these measures is inadequate.
- Certain environmental water uses, such as river flow targets for endangered fish, are supported by federal law and are the subject of much litigation. These federally mandated environmental water needs have not been fully quantified and were not previously taken into account when New Mexico's water supplies were fully allocated to other uses. The State must continue to insist that such uses comply with State water law and administrative procedures and that New Mexico's Compact delivery obligations not be impaired.

Exacerbating these challenges is the fact that water demand keeps increasing—both within New Mexico and beyond our borders. Interstate and international issues are of urgent concern in many areas owing to interstate compact obligations, unregulated ground water pumping just across the state line, efforts to export water, or water quality desires. In addition, since the late 1990s federal agencies and judges have imposed demands for water to comply with the federal Endangered Species Act (ESA), resulting in significant changes in the operation of federal water supply reservoirs upon which New Mexico water users depend.

This appendix discusses the water resources issues in each of the 11 basins in New Mexico (Figure 1). The discussion for each of the basins includes, as available and applicable, a description of hydrology, major issues, and water management, as well as a summary of supply and demand and reference to major water projects that are planned or in progress. For excellent maps illustrating much of the information covered in this section, see the New Mexico Water Resource Atlas (ISC/OSE, 2002), which is included in the *Framework for Public Input to a State Water Plan* and available on the Internet at http://www.seo.state.nm.us/water-info/NMWaterPlanning/framework.html.

Figure 1: Major River Basins or Drainage Areas of New Mexico



Explanation:

Value

10500 ft.

2800 ft.

100' contours

400' contours

Note: Sub-Basins are distinguished as part of larger basins by a lighter color.

Contours depict the generalized, pre-development water table. In most areas of the state, the shallow, often stream-connected water table aquifer is the best, and most commonly developed groundwater source. The map portrays water levels appropriate to identify general groundwater flow directions. The map is not intended to predict local groundwater conditions.

Rio Grande Basin

Colorado, New Mexico and Texas signed the Rio Grande Compact in 1938 to apportion among them the Rio Grande waters above Fort Quitman, Texas. The apportionment was based on 1929 water uses and an extensive water resources investigation conducted in the 1930s by the United States. Additionally, New Mexico and Colorado entered into the Costilla Creek Compact in 1944. Costilla Creek is located in the Sangre de Cristo Mountains of north-central New Mexico, and the Compact is described in the Upper Rio Grande section below.

The Rio Grande Compact requires that Colorado deliver a specified percentage of Rio Grande annual flows to the New Mexico state line. The percentage that Colorado must deliver to New Mexico is based on the amount of annual runoff in the headwaters of the Rio Grande in the Conejos, Los Pinos and San Antonio Rivers and in the Rio Grande at Del Norte. Colorado must deliver about one-third of the Rio Grande flow to New Mexico in an average year, about one-fourth of the flow in dry years, and about two-thirds in wet years.

New Mexico's portion of water supply from the Rio Grande is governed and constrained by the Rio Grande Compact. The Compact provides three sets of geographically based water supply entitlements within New Mexico along with corresponding obligations. These three geographical areas are along the Rio Grande between:

- the Colorado border and the Otowi stream gage (located just south of Española and north of White Rock Canyon and Cochiti Reservoir);
- Otowi gage and Elephant Butte Dam; and
- Elephant Butte Dam and the Texas border.

In each case, New Mexico is entitled to a defined amount of water:

- Upstream of the Otowi gage, New Mexico is entitled to continue to deplete as much water as it was depleting in 1929, although the Compact does not quantify this entitlement. The remaining annual flow must pass the Otowi gage.
- Between the Otowi gage and Elephant Butte Dam, New Mexico is entitled to deplete a specific amount of water annually. However, most of the water passing the Otowi gage must be delivered by New Mexico to Elephant Butte Reservoir. The actual amount, which varies depending on the annual flow of the Rio Grande at the Otowi gage, is specified in the Compact. At high annual flows, all of the extra water above an annual volume of about 1.1 million ac-ft must be delivered. New Mexico is entitled to deplete the remaining portion of the water flowing by Otowi gage as well as all of the inflow to the river arising between Otowi gage and Elephant Butte.

- Downstream from Elephant Butte Dam, New Mexico is entitled to deplete a pro rata share of the available Rio Grande Project water supply based on the ratio of acreage irrigated by the Project. That amount is not quantified by the Compact but is quantified by agreements that were contemporaneous to the Compact. New Mexico's percentage of the irrigated acreage and the water supply is 57 percent.

The Rio Grande Compact therefore in effect apportions the water of the Rio Grande not only among the states of Colorado, New Mexico, and Texas, but also among these three reaches of the river within New Mexico. In each geographic reach, New Mexico is obligated to see that its depletions of water do not exceed its entitlements to deplete water.

The native Rio Grande flow that passes the Otowi gage is the source of most of the water available to people in New Mexico's Middle and Lower Rio Grande Basins and to Texans and Mexicans in the El Paso and Juarez areas. As a general statement, about one-third of the long-term average of 1.1 million ac-ft of native Rio Grande surface water flow leaving the Upper Rio Grande basin at the Otowi gage comes from Colorado, one-third from the Sangre de Cristo Mountains, and the remaining third from the Rio Chama watershed.

The San Juan-Chama Diversion Project imports a portion of New Mexico's entitlement of Colorado River Basin water from the San Juan River into the Rio Grande Basin. The San Juan-Chama Project diverts water from tributaries of the San Juan River in Colorado and moves the water under the Continental Divide into the Chama River in New Mexico. This water is accounted separately from native water (i.e., water that originates within the Rio Grande basin) and is not subject to the Rio Grande Compact apportionments described above, but all of this imported water must be used in New Mexico.

Water resources management issues in the three geographic reaches of the Rio Grande are discussed in the three sections that follow.

Upper Rio Grande Basin

Major Issues

- Reservoirs and diversion works must be operated and water uses must be administered to assure both (1) compliance with the Rio Grande Compact and the two compacts that govern the use of Colorado River Basin water and (2) full use of New Mexico's apportionment of Upper Rio Grande water under these Compacts.

- San Juan-Chama Project water uses above Otowi gage and San Juan-Chama water flow across the Otowi gage must be properly accounted in order to accurately determine the amount of native Rio Grande flow at the Otowi gage. That native flow determines how much water New Mexico must deliver to Elephant Butte Reservoir.

- San Juan-Chama water supply projects for Upper Rio Grande Basin contractors should be developed.

- Water rights adjudications and settlement of Pueblo claims must be completed.

- The State must coordinate with the area's roughly 680 acequia associations about their water management concerns, including their efforts to control transfers of water rights by farmers out of individual acequias.

- Direct streamflows and reservoir releases must be properly distributed to the appropriate water right owners, and storage of flood flows for later use must be effectively managed.

- In-stream water demands for ESA compliance and other desires must be balanced with the water rights and needs of the Pueblos, irrigators, cities and domestic well users and with compliance with New Mexico's Rio Grande Compact obligations.

Water Resources Management

The Costilla Creek Compact. The Costilla Creek irrigation system begins at Costilla Reservoir in the Sangre de Cristo Mountains of north-central New Mexico and extends some 40 miles downstream through Costilla Creek and irrigation ditches onto the high desert plains of New Mexico and Colorado. The Costilla Creek Compact mandates segregation and delivery of direct flow and storage water at four state line delivery locations. It imposes strict limits on direct flow use by New Mexico users who are upstream of the state line. Use of the Costilla Creek Operations Manual by the water master and assistant water master (Interstate Stream Commission [ISC] employees who operate the system and administer water uses and state line deliveries) has helped to resolve long-standing controversies over this interstate operation. Administration is funded jointly by Colorado and New Mexico at a cost of about $100,000 per year, or $12 per irrigated acre per year.

The San Juan-Chama Project. The San Juan-Chama Project is authorized to divert water from tributaries of the San Juan River (the San Juan itself is a tributary of the Colorado River) through a tunnel under the Continental Divide into Heron Reservoir and the Rio Chama watershed. Native water cannot be stored in Heron Reservoir. The reservoir is located on Willow creek, a tributary of the Rio Chama, and it has a storage capacity of approximately 400,000 ac-ft. Since Project operations started in the early 1970s, the amount diverted annually into the reservoir has varied from about 6,000 ac-ft to as much as about 164,000 ac-ft, and has averaged about 90,800 ac-ft/yr. The calculated firm yield is 96,200 ac-ft/yr.

All of the firm yield water has been contracted or allocated to New Mexico entities in the Upper and Middle Rio Grande basins. Upper Rio Grande contractors—including the Jicarilla Apache Nation, San Juan Pueblo, the Department of Energy (Los Alamos), the Pojoaque Valley Irrigation District, the Cities of Española, Taos, and Red River, and the Village of Taos Ski Valley—have access to about 15,000 ac-ft/yr. An allocation of the last 2,990 ac-ft of available San Juan-Chama Project water has been reserved by the United States at the request of the ISC for the Taos area, including Taos Pueblo. Specific allocation of this water is being discussed in the context of settlement of the Taos Pueblo water right claims. The City and County of Santa Fe have contracted for 5,605 ac-ft/yr, which they can access either above or below the Otowi gage.

A number of communities in the Upper Rio Grande have contracted for San Juan-Chama Project water, but are not yet fully using it. The Office of the State Engineer and ISC encourage contractor communities to begin plans for direct diversion. The ISC is also a cooperating agency in National Environmental Policy Act (NEPA) compliance work by the United States that is a prerequisite to conversion of a number of San Juan-Chama Project contracts with limited terms to contracts that are permanent.

MRGCD Storage in El Vado Reservoir. El Vado Reservoir is located on the Rio Chama just west of Tierra Amarilla (about 80 miles north-northwest of its confluence with the Rio Grande) and currently has a storage capacity of approximately 183,000 ac-ft. The reservoir was constructed in the early 1930s to provide flood control for downstream areas and to supplement the natural flows of the Rio Grande in the middle valley through releases of storage water. It is the primary storage facility for native Rio Grande water in New Mexico above Elephant Butte Reservoir. In 1963 the Middle Rio Grande Conservancy District (MRGCD) assigned its storage rights in El Vado Reservoir to the U.S. Bureau of Reclamation. The Bureau currently operates the reservoir for the MRGCD.

Under Article VII of the Rio Grande Compact, when "Usable Water in Project Storage" falls below 400,000 ac-ft, New Mexico is prohibited from increasing storage of native Rio Grande water in reservoirs constructed after 1929. When the Compact Article VII upstream storage prohibition is in effect (as it is currently), native water above and beyond storage captured by the United States to ensure later delivery of water to the "prior and paramount" lands of the six Middle Rio Grande Pueblos cannot be stored in El Vado Reservoir in most circumstances. In 2003 and possibly for the next few years, a small amount of water can be stored in El Vado or other post-1929 reservoirs because in 2003 New Mexico relinquished (and Texas accepted) a significant amount of its accumulated credit water.

Acequias. About 680 acequias (community irrigation systems) are located within the Upper Rio Grande Basin. Many have existed since Spanish colonization. Except for those in the Rio Chama valley below Abiquiu Reservoir, most acequia water rights have not been adjudicated. Transfer of water rights from acequias is highly controversial. In its 2003 session, the New Mexico Legislature enacted HJC/HB 303, which is a law that will allow acequias to deny transfers if they find that it will be detrimental to the acequia.

Ownership Issues. The ownership of water flowing in the Rio Chama below Abiquiu Reservoir is complex. It includes, but is not limited to, direct flow native water, MRGCD native water released from storage for the use of its irrigators, San Juan-Chama water bound for various downstream beneficial uses, and conservation water released for downstream endangered species purposes or to meet Rio Grande Compact obligations. Unauthorized depletion of non-native or storage release flows is the subject of substantial controversy. These unauthorized depletions impair downstream users and may impact compliance with the ESA and Rio Grande Compact.

Upper Rio Grande Water Operations. The U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation and the ISC are cooperating in a comprehensive, five-year analysis called the Upper Rio Grande Water Operations (URGWOPS) Review and EIS. This analysis is an integrated environmental review of federal water operations above Ft. Quitman, Texas, including the preparation of an environmental impact statement (EIS). It includes assessment of potential flexibilities in existing river and reservoir operations to meet changing needs within the Rio Grande Basin of New Mexico. The re-evaluation includes possible revision of the operation plans for Heron and Abiquiu Reservoirs (ISC/OSE, 2002, Atlas Plate 13.1) in accordance with existing Congressional authorizations. The Review is scheduled for completion in 2005.

Abiquiu Reservoir Flood Control and Storage. Abiquiu Reservoir, which is owned and operated by the U.S. Army Corps of Engineers, is the only flood control reservoir in operation in the Upper Rio Grande basin. It is also authorized up to 200,000 ac-ft for conservation storage of either native water or San Juan-Chama Project water. The reservoir has a physical capacity of approximately 1.2 million ac-ft, but the legally allowed storage space is significantly less than that. The URGWOPS Review and EIS includes evaluation and NEPA compliance for storage of native water in Abiquiu Reservoir.

Middle Rio Grande Project. The U.S. Bureau of Reclamation's Middle Rio Grande Project, initiated in the early 1950s, was designed and constructed to reduce natural depletions in the Middle Rio Grande and improve water delivery to Elephant Butte Reservoir. Construction of the Rio Grande floodway between Velarde and Caballo Reservoir was part of this project.

Water Supply and Demand

Human-related depletions in the Upper Rio Grande appear to have declined since 1929 (the Rio Grande Compact baseline year) because of decreases in irrigation that more than offset increases in municipal and industrial use. If this is the case, more native water than required is passing the Otowi gage, where it is allocated for use in the Middle Rio Grande and for delivery by New Mexico to Elephant Butte Reservoir.

Because of contamination problems with several of its ground water wells, the City of Española is proceeding with an environmental review for construction of a surface water diversion and treatment facility to allow it to conjunctively manage its overall water resources and fully consume its annual 1,000 ac-ft San Juan-Chama Project allocation.

A deep drilling project in the Taos Valley is underway as an intermediate step in the water rights negotiation process among the Town of Taos, Taos Pueblo, Taos area acequias and other parties. Its objective is to evaluate the possibility of pumping deep ground water in the Taos Valley and its effect on streamflows in Taos Valley tributaries.

The endangered Rio Grande silvery minnow once existed in the Rio Grande up to the confluence of the Rio Chama (it is now found only in the middle Rio Grande between Cochiti Reservoir and Elephant Butte Reservoir). The Upper Rio Grande is therefore being considered for a re-population effort. One consideration is that such efforts do not interfere with planned human uses of surface water such as the Española surface water diversion project. The endangered southwestern willow flycatcher is also present in the basin. The additional water needs for its habitat, if any, have not been determInined.

In early 2003, the U.S. Court of Appeals affirmed a U.S. District Court order that San Juan-Chama Project water and native Rio Grande water could be reassigned by the U.S. Bureau of Reclamation from delivery to contractors in favor of providing additional water for in-streamflow for habitat for the endangered silvery minnow. However, in the fall of 2003, the U.S. Congress passed and the President signed a bill that includes a legislative rider specifically prohibiting the U.S. Bureau of Reclamation from reassigning delivery of San Juan-Chama water from contractors to the endangered silvery minnow. The appeals court ruling, if it stood, would have jeopardized the current and future water supply of San Juan-Chama Project contractors and many of the basin water development projects developed over the past 30 years. The rider removes that threat from San Juan-Chama contractors but not from native water right holders such as the MRGCD and the six middle Rio Grande Pueblos. In early 2004 the court vacated its ruling.

Despite this one success in preserving New Mexico control over its waters, federal management of federal water development projects to provide habitat for the Rio Grande silvery minnow and southwest willow flycatcher jeopardizes existing uses and new water projects in this basin. The Office of the State Engineer (OSE) and ISC are participating in many venues where these environmental uses of water are being planned, negotiated and litigated.

The Rio Grande Underground Water Basin (UWB) encompasses the entire Upper Rio Grande (ISC/OSE, 2002, Atlas Plate 2). No specific guidelines for ground water administration have been issued, but all applications, except those for domestic and stock wells and stock tanks, will be evaluated to ensure that no existing ground water or surface-water right will be impaired. Surface water is fully appropriated, which requires that surface water rights must be transferred to offset any depletion caused by new ground or surface water uses.

Native American Water Rights. The Upper Rio Grande basin includes Native American Tribal lands and several Pueblos. With the exception of the Jicarilla Apache Nation, none of the Native American water rights have been adjudicated, although several adjudication suits are pending. The Jicarilla Apache Nation water rights settlement provided it with 6,500 ac-ft/yr of San Juan-Chama Project water. Future use of this water is at the discretion of the Jicarilla Tribe and has not been determined.

Until all Indian rights have been adjudicated, the status of all water rights will be uncertain. Outstanding issues include:

- The amount of native water that should be stored in El Vado Reservoir by the United States for potential later release to ensure a supply for the six Middle Rio Grande Pueblos' approximately 8,800 acres of "prior and paramount" lands still needs to be determined.
- Claims of the Eight Northern Pueblos, including existing and potential allocations of San Juan-Chama water, have yet to be settled.
- A contract needs to be negotiated between Taos area stakeholders (including the Taos Pueblo) and the United States for use of the 2,990 ac-ft of San Juan-Chama water allocated to the Taos area by the ISC but not yet contracted by the United States.

Rio Grande Compact Article VII. Because the reservoir storage limitations imposed by Article VII of the Rio Grande Compact were triggered by the current drought, the only native Rio Grande water stored and released from El Vado Reservoir in the next few years may be water destined for use in the Middle Rio Grande basin by the six Middle Rio Grande Pueblos and water stored under the 2003 Emergency Drought Water Agreement (made possible by New Mexico's relinquishment of its credit water) for the benefit of MRGCD, the endangered silvery minnow and the City of Santa Fe. New Mexico must protect this stored water from unauthorized diversions to assure that it reaches the appropriate users and to comply with the Rio Grande Compact.

Middle Rio Grande Basin

Major Issues

The Middle Rio Grande region extends from the Otowi gage to Elephant Butte Dam. The primary issues affecting this basin are:

- Growing and increasingly diverse demands for water in the Middle Rio Grande region—including the water supply needs for about half of the State's population and economy, and for wildlife and ecological uses—cannot all be met. Depletions of water in the Middle Rio Grande over the long-term must be reduced in order to meet Rio Grande Compact obligations while protecting and maintaining beneficial uses of water. In particular:

  - Almost all municipal, domestic, and industrial uses in the Middle Rio Grande region are supplied from ground water, yet much of the ground water pumping is unsustainable. The current reliance on ground water is causing significant ground water mining that cannot be continued. Because the surface-water system is closely interconnected with ground water, ground water depletions affect the surface water supply as well.

  - Current water consumption exceeds the long-term average supply that is legally available for use in the Middle Rio Grande. Many ground water users, including large municipalities, have not secured Rio Grande water rights to offset the delayed depletion of Rio Grande streamflow caused by their current and historical ground water pumping.

  - The proliferation of domestic wells in the basin will also ultimately affect Rio Grande flows. Limits on domestic well uses and permits in heavily populated areas must be considered. Transfer mechanisms could provide water rights through simple transactions to cover the incremental junior depletions of domestic wells.

- Human uses of water in the Middle Rio Grande account for much less than half of the depletions of water from the Middle Rio Grande's share of river supply under the Rio Grande Compact. Natural depletions of water, including evapotranspiration in the bosque and evaporation from reservoirs, are predominant. New Mexico has historically relied on federal projects and river "maintenance" to control "natural" depletions as part of the strategy for New Mexico's Rio Grande Compact compliance. That federal work has stopped for all practical purposes, due to ESA-derived constraints and reprioritization of the use of federal agency manpower and appropriations.

- Non-native vegetation, such as salt cedar and Russian olive, has invaded a large portion of the bosque. Research indicates that these species use significant amounts of water, more than native vegetation. Control of the non-native vegetation along with management of the ground water table on a large scale may decrease demands for reservoir releases to meet endangered species needs and could contribute to New Mexico's compliance with the Rio Grande Compact.

- ESA compliance issues, along with federal budgetary constraints, have limited the State's ability to improve river channel and irrigation system conveyance efficiencies and have caused historical river channel and levee maintenance procedures to now be prohibited.

- New stringent limitations on the amount of arsenic in drinking water will place a major water treatment burden on drinking water suppliers in the Middle Rio Grande and elsewhere.

Water Resources Management

The Rio Grande Compact. The Rio Grande Compact requires that New Mexico deliver a specified percentage of flow in the Rio Grande to Texas based on flow measured at the Otowi gage (a few miles south of Española). In dry years, about 60 percent of the flow at Otowi must be delivered to Elephant Butte Reservoir, while in wet years, over 80 percent must be delivered.

Since the mid-1970s New Mexico has been in compliance with its Rio Grande Compact delivery requirements due primarily to (1) construction, operation and maintenance of the Middle Rio Grande Project, (2) a very wet climate, and (3) return flows from municipal ground water use that supplement the river. History indicates that Compact compliance can be much more difficult during dry periods. Should the State be entering an extended dry period, active administration of water use will be necessary to maintain Compact compliance.

The Rio Grande Compact Article VII restrictions on storage in post-1929 reservoirs (discussed in the Upper Rio Grande Water Resources Management section) were invoked for the first time in over 20 years in July 2002, resulting in the loss of native water storage operations by the MRGCD in El Vado Reservoir, by the City of Santa Fe in McClure and Nichols Reservoirs on the Santa Fe River, and by the U.S. Army Corps of Engineers in Abiquiu and Jemez Canyon Reservoirs. In 2003, the Article VII storage prohibition remained in effect, and New Mexico proposed and Texas accepted the relinquishment of a portion of New Mexico's accrued Compact credit. The only native water stored above Elephant Butte Reservoir in 2003 was that associated with the six Middle Rio Grande Pueblos' "prior and paramount" operations, and a portion of the relinquishment water.

San Juan-Chama Project Water Contracted to Middle Rio Grande Entities. Middle basin San Juan-Chama Project contractors include the City of Albuquerque (48,200 ac-ft/yr), the MRGCD (20,900 ac-ft/yr), the City and County of Santa Fe (5,605 ac-ft/yr), the Town of Belen (500 ac-ft/yr), the Town of Bernalillo (400 ac-ft/yr) and the Village of Los Lunas (400 ac-ft/yr). Several of these municipalities wish to develop this renewable water supply but face numerous difficulties and obstacles in doing so.

The Middle Rio Grande Conservancy District. The MRGCD has four major river diversion points and a vast network of irrigation canals and ditches stretching about 150 miles between Cochiti and the Bosque del Apache National Wildlife Refuge. Additionally, passive diversion by MRGCD occurs from the river to the adjacent riverside drains. Typically, MRGCD utilizes the native flow of the river during spring run-off and attempts to fill El Vado Reservoir. When native flow is insufficient to meet MRGCD irrigation demand, the water from the reservoir storage is released. In the past, up to 30,000 ac-ft of El Vado Reservoir's storage space has been used to ensure delivery of "prior and paramount" water to the six Middle Rio Grande Pueblos, which are part of the MRGCD.

The MRGCD has not yet submitted documentation regarding the water that it has put to beneficial use since its permit was issued in 1930. Without such documentation and critical evaluation of the documentation by the State Engineer, it will remain unclear what the rights under the 1930 permit are.

Flood Control. Cochiti Reservoir on the Rio Grande, Galisteo Reservoir on Galisteo Creek and Jemez Canyon Reservoir on the Jemez River are flood control reservoirs owned and operated by the U.S. Army Corps of Engineers. These reservoirs are not authorized for conservation storage. The north and south diversion channels in Albuquerque are other major flood control works.

In a number of areas within the basin, the Rio Grande flood control levees are in poor shape because static federal budgets and ESA compliance issues/costs have limited the ability of federal agencies to maintain them. Endangered species habitat concerns have caused historical river channel and levee maintenance procedures to now be prohibited. Because the bottom of the river is higher than the floodplain in many areas, failure of a levee in these areas will cause the river to leave its channel and flood the developed floodplain, farms, communities, and irrigation and drainage infrastructure.

Middle Rio Grande Administrative Guidelines. In September 2000, the OSE adopted guidelines for the administration of the Middle Rio Grande Administrative Area (MRGAA) designed to protect water rights, Rio Grande Compact compliance and the aquifer, and to minimize land subsidence. New ground water appropriations will be approved in the MRGAA only if surface water rights are obtained and transferred to offset the corresponding streamflow depletion. MRGAA Critical Management Areas, which are now limited to parts of Albuquerque, are closed to additional pumping.

Endangered Species Act. In determining what needs to be done to protect the endangered Rio Grande silvery minnow—particularly in dry years—the U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service (USFWS) had focused almost exclusively on securing supplemental water supplies. Issues that had previously been ignored—such as predation, minnow food sources, habitat needs at specific life cycle stages and activities such as moving the minnow to reaches of the river that have perennial flow—are now being studied by the ESA Collaborative Program workgroup. The workgroup is also implementing projects intended to improve the status of the silvery minnow. The workgroup proposes the introduction of federal authorizing legislation for the program to continue efforts to improve the status of the minnow while assuring that other water uses are able to continue.

Native American Water Rights. Pueblo water rights have not been fully quantified, yet they constitute the most senior water claims in the basin. The amount of water available for the Pueblos and others remains uncertain.

Sandia and Isleta Pueblos have EPA-approved water-quality standards, which means that upstream discharges, including treated wastewater return flows from Bernalillo, Rio Rancho and Albuquerque, must meet Pueblo standards.

Water Supply and Demand

Most of the water supply for the Middle Rio Grande originates as water flowing past the Otowi gage. This includes both direct flow and reservoir releases of San Juan-Chama Project water and stored native water. These inflows are highly variable from year to year. Additionally, New Mexico is entitled to deplete all tributary flows that originate in the Middle Rio Grande. These tributary flows are also extremely variable.

The Rio Grande Compact requires that most of the native Rio Grande's flow past the Otowi gage be protected by New Mexico for delivery to Elephant Butte Reservoir for downstream users in New Mexico and Texas. New Mexico historically has had major difficulty in complying with this obligation, but those difficulties were overcome by federal projects that minimized conveyance losses and salvaged water though drainage. These projects are now thought to have damaged the habitat features required by the Rio Grande silvery minnow and to have contributed to its decline.

Pursuant to State policy prior to September 2000, many ground water users, including municipalities and industries, in the Middle Rio Grande were allowed to begin pumping without securing water rights. Because of return flows of treated wastewater and the delayed impact of ground water pumping on river depletions, this practice has not resulted in net river flow diminishment. However, the ability of return flows from pumped ground water to offset river depletions caused by pumping depends on ever increasing ground water pumping. When pumping levels off, which it must, return flows will no longer be sufficient to offset the depletion of the Rio Grande caused by historical pumping.

There is considerable concern that the need for these ground water users to acquire and transfer water rights is very large and may exceed the quantity of readily transferable water rights. Under current practices, only pre-1907 water rights can be transferred. The 1930 water rights developed by the MRGCD have never been available for transfer. In any event, fallowing irrigated farmland so that water rights can be transferred may not result in reduced water depletions if salt cedar and Russian olive infest the former farmland.

Given the need to identify rights available for transfer, adjudication and settlement of Middle Rio Grande and Pueblo water rights seems crucially important. However, no adjudication or other water rights quantification or settlement processes are underway in the Middle Rio Grande due to limited human and fiscal resources.

Water Resources Projects

Several major water projects or feasibility investigations are in progress or under consideration, including:

- The City of Albuquerque proposes to divert twice its annual allocation of San Juan-Chama Project water from the Rio Grande to reduce the City's unsustainable reliance on ground water. Because half of the diversion would end up as return flow to the river, the City maintains that the project will not impair downstream water users or endangered species. The City has submitted an application to the OSE for the project, and several groups have protested the application.

- The City and County of Santa Fe, as well as the Las Campanas development, are planning for a direct diversion of surface water from the Rio Grande near the Buckman well field in the Middle Rio Grande Basin to meet current and planned demand. The planned diversion includes both San Juan-Chama water and native Rio Grande waters.

- The Mount Taylor Water Supply Project would convey water from the Westwater Canyon aquifer to Gallup. Water would be available to the Laguna and Acoma Pueblos, and perhaps other users, primarily for municipal supply.

- Because of aggradation of the riverbed from the Bosque del Apache south to the headwaters of Elephant Butte Reservoir, the U.S. Bureau of Reclamation has proposed to relocate the river and the low-flow conveyance channel below San Marcial to the west side of the floodplain, where the ground elevations are substantially higher than the present river channel. The proposal, as currently conceived, has significant water conveyance and depletion problems. If the project is implemented without modification, it will affect New Mexico's ability to comply with the Rio Grande Compact.

- The U.S. Army Corps of Engineers is re-evaluating its proposal to reconstruct the river levee from San Acacia to San Marcial, New Mexico. It is also considering moving the San Marcial railroad bridge to reduce the significant flood threat and to allow for increased releases from upstream reservoirs. The project has been delayed since the middle 1990s due to threats of litigation related to ESA compliance.

- The ISC and U.S. Army Corps of Engineers, in coordination with New Mexico Tech, are conducting a detailed investigation in the Socorro area to better understand the connection between surface water and ground water in the area and to determine if there are better ways to meet the varying demands for water in this critical reach of the river.

- Water conveyance through the exposed sediment delta of Elephant Butte Reservoir (the sediment delta is the area between the terminus of the river channel at the upstream end of the reservoir and the reservoir pool) is very poor. This poor conveyance efficiency affects New Mexico's Rio Grande Compact deliveries and therefore impacts all Middle Rio Grande water users. The U.S. Bureau of Reclamation and the ISC have constructed a channel through the exposed sediment delta of Elephant Butte Reservoir to the active reservoir pool. To date approximately 18 miles of channel have been constructed and the river was successfully connected to the reservoir pool in the fall of 2003. As many as 25 miles of channel may ultimately need to be constructed and maintained. ESA compliance issues delayed initiation of the project for several years.

Lower Rio Grande and Southern Jornada Basins

Major Issues

The Lower Rio Grande basin has both ground water and surface water, and in some cases these supplies are closely linked. Close proximity to El Paso and Ciudad Juarez metropolitan areas—with a population of almost 2 million—means that competition for water supplies is intense. Major issues include:

- Rio Grande Compact compliance must be assured.

- Texas has threatened to sue New Mexico regarding compliance with the Rio Grande Compact in an attempt to secure more water.

- Intensive ground water pumping in Texas and Mexico will negatively affect New Mexico's ground water supplies. No regulatory framework has been established to address this problem. To cite one example, the New Mexico community of Santa Teresa may be negatively impacted because of pumping in the Mesilla Bolson in Texas and Mexico.

- Texas may pursue the importation of both ground water and surface water from New Mexico.

Water Resources Management

The Rio Grande Project. Caballo Dam and Reservoir and Elephant Butte Dam and Reservoir were built as part of the Rio Grande Project, as were several diversion dams, about 140 miles of canals, 450 miles of laterals and 465 miles of drains in New Mexico and Texas. The Project was designed to provide a reliable supply of surface water to specific lands in what are now the Elephant Butte Irrigation District (EBID) and El Paso Irrigation District No. 1 (EP No. 1), plus 60,000 ac-ft/yr of water to Mexico under the terms of a 1906 treaty. The allocation of Project water to New Mexico and Texas is approximately 57 percent and 43 percent respectively.

Water is released from Caballo Reservoir during the irrigation season and diverted at the Percha and Leasburg diversion dams for use in New Mexico by EBID irrigators in the Rincon and Upper Mesilla Valleys. Water is also diverted at the Mesilla diversion dam for use in New Mexico by EBID irrigators and in Texas by EP No. 1 irrigators in the lower Mesilla Valley. The American Diversion Dam supplies water to EP No.1 irrigators in Texas below El Paso, and the International Dam supplies water to Mexico.

Adjudication. An adjudication suit has been pending in the Lower Rio Grande basin since 1986. Hydrographic surveys to establish the extent and priority date of each existing water right are in progress by the OSE.

OSE Administrative Guidelines for the Mesilla Basin. The Lower Rio Grande UWB includes most of the Lower Rio Grande and Southern Jornada basins (ISC/OSE, 2002, Atlas Plate 2). In 1999, the OSE established guidelines for the review of water right applications for a sub-region referred to as the Mesilla Valley Administrative Area. Administrative standards include (1) limiting streamflow depletion due to ground water pumping to less than 0.1 ac-ft/yr unless offsetting surface water rights are obtained, (2) limiting average annual local ground water level declines to less than one foot, and (3) designation of High Impact Areas (areas where ground water depth is less than 100 feet, where pumping may have large and immediate effects on Rio Grande flows).

Water Supply and Demand

The Las Cruces-El Paso Sustainable Water Project. The New Mexico-Texas Water Commission, formed as a result of the 1991 El Paso Water Suit Settlement Agreement, has developed plans for the Las Cruces-El Paso Sustainable Water Project, which entails diverting water from the Rio Grande—possibly in Texas—for purification at the state line and use in communities in both states. As originally planned, the project would seek to make high-quality water available to the communities of Hatch, Las Cruces and Anthony, New Mexico, and El Paso, Texas, using Rio Grande surface water diversions and surface water treatment plants. A 32-mile pipeline across Anthony Gap would carry treated water to northeastern El Paso in the Hueco Bolson, where much of the water would be stored in an aquifer storage and recovery project for later use.

Aquifer Storage and Recovery Projects. The City of Las Cruces and the Lower Rio Grande Water Users Organization are currently considering the feasibility of aquifer storage and recovery projects in the Mesilla basin and Jornada basin in Doña Ana County.

The Special District Act. In 2003, the legislature enacted the Special District Act, which allows for the creation of special districts where the administrative tools needed for effective water banking (adjudication, measurement, and hydrologic modeling) are in place to allow for the efficient and timely transfer of water from one use to another. EBID and communities in the Lower Rio Grande promoted this legislation, and the Lower Rio Grande is expected to be a proving ground for the effectiveness of this water management tool. The administrative regulations for these special districts are under development by the OSE.

El Paso Water Utilities Projects. The El Paso Water Utilities Public Service Board has been obtaining land with irrigation water rights in the Mesilla Valley in New Mexico and seeks to use the water represented by those New Mexico rights in Texas. This marks the first attempt by El Paso to obtain surface water from New Mexico.

The El Paso utility has also been pumping water from the Canutillo Well Field immediately across the state line. It is now installing more wells and new pipelines to increase this pumping. This affects the Rio Grande and may affect the quantity and quality of Rio Grande Project water delivered to EP No.1).

Canadian and Dry Cimarron Basins

Major Issues

The Canadian and Dry Cimarron Basins in northeastern New Mexico rely on a combination of surface water and ground water supplies. Major issues within these basins include:

- Surface flows provide a little less than half of supplies. Surface-water supplies above Conchas Dam are fully appropriated, and finding water supplies for growing populations along the eastern slopes of the Sangre de Cristo Mountains will be difficult.
- Agricultural use of the High Plains, Ogallala, and other aquifers has been extensive. Water tables in those aquifers are dropping rapidly, especially in the eastern portion of the region along the Texas-New Mexico border, where unrestricted ground water pumping in Texas is depleting the aquifer in New Mexico.
- Without development of additional sources of water, the viability of eastern New Mexico communities and economies, which are currently dependent on rapidly declining ground water supply, is uncertain.
- The reach of the Canadian River from Logan, New Mexico, to just downstream of Ute Reservoir has been declared critical habitat for the endangered Arkansas River Shiner. This has the potential to negatively affect agriculture and development of the Ute Reservoir supply.
- The area is susceptible to drought and needs drought planning. Drought and a proliferation of stock ponds have created substantial conflict among water users along the Mora River, and the State Engineer is preparing to administer water uses along the Mora River.

Hydrology

The Canadian and Dry Cimarron basins are parts of the larger Arkansas-White-Red River basin. The Canadian River, the principal river in the basin, is perennial throughout its reach in New Mexico. However, prior to the construction of downstream reservoirs, it was occasionally dry in its downstream reaches. The Dry Cimarron River, which flows eastward very close to the northern boundary of the state, is perennial, but in dry years may only flow in its upper reaches.

Many of the important tributaries to the Canadian River flow from the east side of the Sangre de Cristo Mountains and include the Vermejo River, Cimarron Creek and Mora River. Additional tributaries, with headwaters in the eastern plains, are the Conchas River and the Ute and Revuelto Creeks. Tramperos Creek, an intermittent tributary to the Canadian that flows in Union County and crosses the Texas border, also provides some surface water supplies. Most measurement on the Canadian River and its tributaries is done by U.S. Geological Survey stream gages.

Major reservoirs in the basins are Eagle Nest Lake, Conchas Lake and Ute Reservoir with storage capacities of 78,000 ac-ft, 529,000 ac-ft and 200,000 ac-ft, respectively. Eagle Nest Lake was completed in the early 1900s, Conchas Dam was completed in 1939 for flood control and for regulation of irrigation water of the Arch Hurley Conservancy District, and Ute Dam was completed in 1963 and modified in 1984. There are several other smaller reservoirs.

Water Supply and Demand

Irrigated agriculture below Conchas Dam relies heavily on surface flows, and surface water provides a little less than half of the water for public supplies. Surface-water supplies above Conchas Dam are fully appropriated.

Surface water yield in the Dry Cimarron and Canadian River Basins is estimated to be approximately 240,000 ac-ft/yr, and depletions are estimated to be approximately equivalent to yield. Estimates are based on approximations of evaporation and tributary inflows calculated from rough estimates of drainage yields and less than comprehensive gaging of discharges. The average annual flow of the Canadian The City of Albuquerque Land Use Facilitated Meetings Program approximately 30 river miles west of the Texas border, is approximately 30,000 ac-ft. The average annual flow of Revuelto Creek, which joins the Canadian approximately 12 miles downstream of Logan, is approximately 26,000 ac-ft per year. Water quality is poor in many parts of the basin. Much of the middle and western portions of the region do not have sufficient quality or quantities of water to support increased municipal demands.

Communities in and along the eastern slopes of the Sangre de Cristo and Rocky Mountains will have an increasingly difficult time obtaining the supply needed to provide for municipal needs. Downstream of Conchas Dam, the Ute Reservoir annual yield of 24,000 ac-ft is available for beneficial use and is intended to provide a sustainable source of water for a number of eastern New Mexico communities. The ISC owns and operates Ute Reservoir. This water is currently under contract to the Ute Water Commission, which under the contract has an option to purchase the entire 24,000-ac-ft annual yield. Development of the 24,000-ac-ft/yr safe yield of Ute Reservoir represents the best source of a renewable municipal supply for much of eastern New Mexico, and eastern New Mexico communities must develop this source if they are to have a viable future.

Other than the Arch-Hurley Irrigation Project which uses surface water from Conchas Dam, basin agriculture has largely depended upon mined ground water out of the High Plains, Ogallala and other aquifers. The aquifer levels are dropping rapidly, especially in the eastern portion of the region along the Texas-New Mexico border, where unrestricted ground water pumping in Texas is depleting the aquifer in New Mexico. Conservation, improved irrigation techniques, and low water use and dry farmed crops will be necessary in the future.

Water Planning

The Eastern New Mexico Rural Water Association proposes construction of a pipeline to deliver the 24,000-ac-ft/yr safe yield of Ute Reservoir to a number of communities in eastern New Mexico. The cost for such a pipeline is estimated to be on the order of $300 to $350 million. Federal support may cover 50 percent to 65 percent of costs, though hopes remain for a greater federal cost share.

Southern High Plains Basin

Major Issues

- Because of declining ground water levels and deteriorating water quality in east-central New Mexico (in the vicinity of Ute Reservoir and the area of the Southern High Plains aquifer), there is a need for an alternative water supply.
- Several aquifers extend into Texas, and Texas's approach for managing these aquifers is different from New Mexico's. Interstate cooperation is needed to manage appropriations and preserving ground water quality.

Surface Water Hydrology

The Southern High Plains represents the upland fringe of watersheds whose major rivers flow across Texas and into the Gulf of Mexico. Surface water in the New Mexico Southern High Plains occurs in ephemeral channels, small natural lakes, some springs and scattered playas or salt flats. There are no perennial streams, and typically, surface water flows only following intense storms. Ranger Lake and Salt Lake in Lea County are a result of both surface-water inflow and ground water discharge. Numerous ephemeral playa lakes cover an area roughly less than one acre each, though some can be much larger. Some spring flow has historically been observed in places such as the base of Mescalero Ridge, but flows are reported to have diminished due to ground water pumping.

Ground Water Hydrology

By far the most important aquifer in the Southern High Plains basin has been the High Plains aquifer, a veneer of unconsolidated sand, silt, clay and gravel comprising the Ogallala Formation, overlying much less permeable bedrock (ISC/OSE, 2002, Atlas Plate 5). The saturated thickness is irregular: to the north and west and in central areas (northern Lea County and southern Roosevelt County), it is generally thinner than it is near the state line, while the saturated thickness in Texas is generally greater. Well yields range widely, from less than 100 to nearly 2,000 gallons per minute (gpm); higher yields are at least partly attributable to greater saturated thickness.

Before intense pumping began, ground water in the High Plains aquifer generally flowed to the southeast into Texas. Due to more than 50 years of intensive pumping in both New Mexico and Texas, the direction of flow has shifted, particularly in areas where ground water pumping has been the heaviest. The predevelopment rate of ground water flow from New Mexico into Texas through the High Plains aquifer was significant. As shown in Table 1, OSE models show that as the saturated thickness decreased, the flow into Texas has been less than in times before pumping began.

Table 1. Predevelopment and recent ground water flow from New Mexico to Texas in the Southern High Plains Basin

	Lea County Model		Curry and Portales Valley Model	
Time Period	Approximate Flow (ac-ft/yr)	Date	Approximate Flow (ac-ft/yr)	Date
Predevelopment	42,500 [a]	1948	34,000 [b]	1909
Late 20th Century	35,000 [a] to 48,729 [c]	Mid-1990s	13,000 [b]	1990

[a] From Musharrafieh and Chudnoff, 1999.
[b] From Leedshill-Herkenhoff et al., 2000. Calculated using Darcy's Law and hydraulic conductivity values from Musharrafieh and Chudnoff, 1999.
[c] From Musharrafieh and Logan, 1999.

In some areas of the High Plains aquifer in New Mexico, ground water levels have declined 125 feet since pumping began. Drawdowns are even greater in Texas, particularly in areas of concentrated pumping. At present day pumping rates, water levels will continue to decline, and eventually, wells will lose economic yields or go dry.

The quality of water from the High Plains aquifer is adequate for most uses in the basin. Problems with ground water contamination generally have been associated with leaking underground storage tanks, nitrate from agricultural activities, dairy operations, septic tanks, public and private sewage treatment plants, and oil- and gas-field operations. Thousands of oil and gas wells have been drilled through the area's aquifers, and oil and gas operations have created some contamination problems with total dissolved solids (TDS) as well as with crude oil, methane and chloride. Generally, these problems are associated with historical disposal of oil-field brine.

In areas where the High Plains aquifer is thin or nonexistent, other geologic units such as alluvial deposits near the City of Jal or Mesozoic sedimentary rocks, including the Santa Rosa Sandstone and Antler Formation, provide ground water supplies. Deeper geologic units that have been reported as productive, primarily in the southern part of the basin (such as the Rustler Formation), have not been sufficiently explored to estimate their aquifer potential.

Water Resources Management

The Southern High Plains basin includes parts of several UWBs administered by the OSE: the Curry County, Lea County, Portales, Capitan, Jal, and Carlsbad UWBs (ISC/OSE, 2002, Atlas Plate 2). There is a large undeclared area between the Portales and Lea County UWBs. The Curry County, Portales and Lea County UWBs are mined aquifers, and it is recognized that continued pumping at present-day rates will deplete the aquifer. The OSE still accepts applications for new appropriations, subject to review using administrative criteria intended to preserve a life-expectancy for existing wells.

Pumping of ground water from aquifers underlying more than one state is not subject to any interstate regulation, and state laws manage those portions of the aquifer within their territory. Texas has a different system of ground water appropriation than New Mexico; essentially Texans are entitled to ground water that is underneath their land, whereas New Mexico law governs water use according to the system of prior appropriation. Lea County water users have expressed an interest in working with counties in Texas to participate in interstate management of aquifers. Continued pumping for irrigation and resulting water-level declines have created a need for administrative criteria in the declared UWBs. Ground water contamination, while mostly localized, is an issue for consideration in basin administration.

Water Supply and Demand

In 1995, about 511,600 ac-ft of water was withdrawn for irrigation, representing about 89 percent of water-use in the High Plains aquifer. The next largest water use category, accounting for about 5 percent of total withdrawals, is public water supply, for which about 30,700 ac-ft of ground water was pumped in 1995. In 1995, most of the water that was withdrawn in the aquifer was consumed. While overall withdrawals and depletions have fluctuated over the years, withdrawals were higher in 1975 (greater than 743,000 ac-ft) and lower in 1995 (less than 565,056 ac-ft); however, depletions have increased from about 410,500 ac-ft in 1975 to about 451,300 ac-ft in 1995. Some of the difference between the 1975 and 1995 uses may be related to changes in calculating irrigation agricultural water use that were implemented in 1985.

Recent estimates of stored and recoverable water, based on models published by the OSE, are shown in Table 2. One of the largest components of the water balance in the High Plains aquifer is ground water pumping, and most of the water pumped is from aquifer storage.

There is potential for the development of ground water stored in aquifers beneath the High Plains aquifer. None of these aquifers possess the capacity of the High Plains aquifer, and deeper wells and pumping will increase costs. More hydrogeologic analysis will be required to assess the potential of deeper aquifers. Additionally, desalination of aquifers with high-TDS water may someday be a technology that could be combined with the development of these deeper water-bearing units.

Due to declining water levels and deteriorating water quality, an alternative water supply is needed. The alternative of choice for most communities is water stored in Ute Reservoir. The Eastern New Mexico Rural Water System is a project designed to pipe water available in Ute Reservoir to several communities in the northern part of the Southern High Plains basin and also to certain communities in the Canadian River basin.

Specifically, this water-supply project was designed to convey up to 24,000 ac-ft/yr of treated water from Ute Reservoir to Clovis, Elida, Grady, Logan, Melrose, Portales, San Jon, Texico, Tucumcari, Cannon Air Force Base, and Curry, Quay and Roosevelt Counties. Preliminary costs to construct the pipeline project were estimated at $300 to $350 million. This project remains in the planning stage.

Precipitation enhancement (cloud seeding) and agricultural conservation are other projects that have been investigated or considered to augment or extend supplies in the Southern High Plains basin.

Table 2. Ground water stored in the High Plains aquifer in areas containing New Mexico administrative underground water basins

				Estimated Ground Water in Storage (ac-ft)		
Modeled Area	Aquifer Area (acres)	Average Specific Yield	Date	Total	Recoverable (45% of total)	Recoverable (all but bottom 40 feet)
Lea County UWB model [a]	1,400,000	0.21	1995-1998	31,100,000	14,000,000	—
Curry and Portales UWBs model [b]	1,730,000	0.21	2000	15,300,000	6,900,000	9,300,000

[a] Storage estimates reported by Leedshill-Herkenhoff et al. (2000, Table 6-5).
[b] Storage estimates based on historical ground-water pumping from 1909 to 1990 and projected ground-water pumping between 1991 and 2000, estimated from model files prepared in report by Musharrafieh and Logan (1999).

Pecos River Basin

Major Issues

Assuring compliance with the Pecos River Compact and a United States Supreme Court Amended Decree and Injunction issued in 1988 has been the focus of a great deal of activity and discussion over the past few years. The Office of the State Engineer (OSE), ISC and Pecos Basin water users have worked to solve problems similar to ones that much of the state will soon face. Key issues include:

- State efforts and investment that have assured Compact compliance to date do not assure a permanent solution. Long-term compliance requires increasing the state line flow by at least 15,000 acre-feet per year (ac-ft/yr) and building up a delivery credit of about 120,000 ac-ft to prevent future crises.

- The adjudication of Carlsbad Irrigation District (CID) water rights, which has been ongoing for many years, must be settled before water rights for long-term Compact compliance can be obtained.

- Recently proposed habitat protection for invertebrates in the Roswell Artesian Basin could impose constraints on ground-water development and/or management.

- Communities that depend on perched aquifers and fractured media aquifers high in the Sacramento Mountains (for example, Ruidoso) experience serious water supply problems during drought years; drought planning is therefore needed.

- The impacts of watershed management on water supply are poorly understood. In particular, the effectiveness of riparian vegetation removal and other water salvage methods should be thoroughly evaluated before funding for any new efforts is authorized.

- Water rights enforcement is needed, especially where there are instances of diversions in excess of rights.

Surface Water Hydrology

The total average annual surface water supply for the New Mexico portion of the Pecos Basin is estimated to be 217,600 ac-ft/yr, composed primarily of snowmelt, flood runoff and base flows (Table 3). The surface water supply is extremely variable from year to year. The flow of the Pecos River is largely controlled by a number of mainstem dams (Santa Rosa, Fort Sumner, Brantley and Avalon) that control delivery of water to the CID. Until the beginning of the ISC lease program, the entire flow of the Pecos River at Lake Avalon was in many years diverted into the main CID canal for irrigation purposes.

Table 3. Estimated average of Pecos River flow components

River Reach	Average Flow [a] (ac-ft/yr)		
	Snowmelt	Flood Runoff	Base Flow
Headwaters to Santa Rosa	45,300	29,700	13,500
Santa Rosa Dam to Sumner Dam	0	0	52,600
Sumner Dam to Carlsbad	0	33,600	27,200 [b]
Carlsbad to the state line	0	12,300	3,400 [c]

[a] Averages are calculated based on 1976 to 2000 data.
[b] Refers to Acme to Artesia portion of the reach.
[c] Refers to the Carlsbad to Malaga portion of the reach.

Ground Water Hydrology

In the Upper Pecos Basin (above Sumner Dam), only some small alluvial aquifers occur near the river. In the Fort Sumner Basin, the principal water-producing aquifers are the alluvial aquifer and Santa Rosa Sandstone aquifer. In the Lower Pecos Basin (below Sumner Dam), the principal aquifers are the Roswell Artesian aquifer and alluvial aquifer, plus the Capitan Reef aquifer and alluvial aquifers located in the Carlsbad area. These Lower Pecos Basin aquifers are described below.

Roswell Artesian and Alluvial Basin. The Roswell Artesian aquifer is an extensive, highly transmissive, limestone aquifer extending from the Pecos River 20 miles to the west throughout the Roswell Basin. The artesian aquifer is overlain by a shallow alluvial aquifer extending west from the Pecos River several miles. These aquifers are separated by a thick semi-confining unit in the southern half of the basin, making the hydraulic connection between the two aquifers poor in this area. In the northern part of the basin near Roswell, the two aquifers are in better hydrologic connection due to thinning or absence of the semi-confining unit.

Estimated average natural recharge to both aquifers is about 300,000 ac-ft/yr. About two-thirds of the natural recharge that feeds the artesian aquifer is derived from the western mountain area. Artificial recharge to the alluvial aquifer occurs from irrigation seepage.

After metering began in 1967, ground water diversions stabilized at a level of about 250,000 ac-ft/yr. Shallow aquifer diversions have been about 110,000 ac-ft/yr in the 1990s. The largest ground water diverters in the artesian aquifer include the Pecos Valley Artesian Conservancy District (PVACD), the City of Roswell and dairy farms.

Ground water is under pressure in the Roswell Artesian aquifer, and before major development of the aquifer, wells flowed freely at the surface. Ground water development has resulted in a decline in water levels by as much as 100 feet, and summer water levels drop more than 100 feet below winter levels in some areas, indicating that the aquifer is heavily stressed during the summer irrigation season. Whereas an estimated 31 million ac-ft were stored in the Roswell Artesian aquifer in predevelopment times, development of ground water in this aquifer has reduced that figure by about 2 percent.

Water levels have declined significantly in the shallow alluvial aquifer also. The estimated 17 million ac-ft that the alluvial aquifer stored before ground water development is now estimated to be reduced by 20 percent.

Carlsbad Basin. The two major aquifers in this basin are the Capitan Reef aquifer and a shallow alluvial aquifer:

- The Capitan Reef is a long curved feature, 10 to 14 miles wide, composed of limestones in which large solution channels and caverns (such as Carlsbad Caverns) have been formed. The part of the Reef located near and west of the Pecos River is highly transmissive and produces water of good quality.
- The shallow alluvial aquifer extends along the Pecos River from a few miles north of the City of Carlsbad to south of Black River. Near the City of Carlsbad, a small part of the alluvial aquifer directly overlies the Capitan Reef aquifer, and the two aquifers are in hydraulic connection.

The Capitan Reef aquifer receives natural recharge of 10,000 to 20,000 ac-ft/yr in the Guadalupe Mountains and along Dark Canyon west of Carlsbad. Additionally, about 15,000 ac-ft/yr of artificial recharge to both the Capitan Reef and alluvial aquifers occurs from Lake Avalon leakage.

Highly variable natural recharge to the shallow alluvial aquifer occurs along arroyos and through areal recharge. Amounts range from none to 20,000 ac-ft/yr from the arroyos and from none to 8,000 ac-ft/yr from areal recharge, and the average from both sources is estimated to be about 8,000 ac-ft/yr. Irrigation seepage of 20,000 to 50,000 ac-ft/yr (average 36,000 ac-ft/yr) artificially recharges the alluvial aquifer, predominantly within the CID.

During the 1990s, when CID had close to a full surface water supply, irrigation ground water diversions from the Capitan Reef were between 8,000 and 13,000 ac-ft/yr, most of which was from primary ground water rights. Historically, much larger irrigation diversions occurred during periods of drought. The major active ground water diverters included CID and non-CID irrigators, the City of Carlsbad and the potash industry.

The amount of water stored in the Capitan Reef aquifer near and east of the Pecos River is estimated at about 0.9 million ac-ft. This includes the entire thickness of the reef (up to 2,000 feet), which extends to depths greater than 2,000 feet. Much of this water cannot be economically recovered, and much of the deep water would probably be of poor quality.

Much of the estimated 0.75 million ac-ft stored in the alluvial aquifer is also of low quality, especially within the CID where TDS concentrations are quite high.

Aquifer pumping depletes base inflows to the Pecos River. Major hydraulic head declines in the aquifers would reverse flow direction from the river to the aquifers, resulting in streamflow depletion. Flow depletion in the Carlsbad area through primary and supplemental pumping in the Carlsbad Basin directly impacts New Mexico's ability to comply with the Pecos River Compact and the Amended Decree.

Water Resources Management

In 1948, the states of New Mexico and Texas agreed that "…New Mexico shall not deplete by man's activities the flow of the Pecos River at the New Mexico-Texas state line below an amount which will give to Texas a quantity of water equivalent to that available to Texas under the 1947 condition." While this agreement set up the concept defining New Mexico's Pecos River Compact obligation, it did not clearly define a process for accounting for New Mexico's annual delivery obligation.

It was believed that salt cedar eradication would provide salvaged water for New Mexico to offset any stream depletions resulting from delayed pumping effects that might be experienced by New Mexico. This eradication program started in the mid-1960s and cleared 33,230 acres. However, a hydrologic evaluation by the U.S. Geological Survey (Welder, 1988) found no conclusive evidence that the eradication increased Pecos River flow.

In 1974, to increase the water it received, Texas sued New Mexico before the U.S. Supreme Court, with the result that New Mexico had to pay a $14 million fine and comply with the enforcement terms of the 1988 final Amended Decree. The two most important terms are:

- A federally appointed River Master provides an annual accounting of New Mexico's delivery obligation.
- New Mexico may never accumulate its annual delivery shortfalls, although its delivery credits may be applied against any future shortfalls. If a net shortfall occurs, New Mexico has six months to deliver the shortfall water to Texas to comply with the River Master's "Approved Plan."

New Mexico may seek to amend the Supreme Court Amended Decree if it can demonstrate that the "inflow-outflow" method does not "reflect the realities of the river." The OSE/ISC may also request modifications to the River Master Manual.

Through extensive cooperative efforts a historic and comprehensive Consensus Plan to address the terms of the Compact and the Amended Decree has been developed by major water users in the lower Pecos River Basin and the ISC. The 2002 legislature affirmed the Consensus Plan by appropriating $30 million toward its implementation. That plan is designed to minimize the economic impact on the basin as a whole, by providing a substitute for strict application of the seniority rule for water rights administration (known as priority administration) that would be required to meet a net shortfall in deliveries to Texas. Through implementation of this consensus solution, far fewer junior water rights holders—which include many of the region's cities and towns—will be directly affected by the enforcement of water delivery obligations. The Consensus Plan prerequisite—settlement of long-standing water rights litigation among CID, PVACD and the United States—has been signed but requires a number of conditions to be met before it takes full effect.

In 2002, implementation of the Consensus Plan for long-term Compact compliance had been estimated to cost $68 million. Now that implementation of the negotiated Settlement is underway, the original $68 million cost estimate appears to be low. If the Consensus Plan/Settlement cannot be implemented, a net shortfall in deliveries seems certain to trigger priority administration, which would have a major economic and social impact on the region. The OSE has increased its preparations, materially, to implement priority administration to remedy or prevent a net shortfall. However, such administration will likely result in much litigation.

The Consensus Plan will accomplish two essential steps for compliance with the Amended Decree. It reduces depletions of water in New Mexico and also gets sufficient water to and through the last dam in New Mexico for delivery to the state line. Priority administration to accomplish these two essential elements will cause intense litigation.

Water Supply and Demand

Due to a series of wet years during the 1980s and the 1990s, CID members have had full allotments (3 feet) in many years. However, their surface water allotment was only 1.3 feet in 2002 and only 1.15 feet in 2003.

Through aggressive leasing and purchasing of water rights in the Lower Pecos River Basin designed to increase state line deliveries, the State of New Mexico has successfully maintained compliance with the Supreme Court Decree through 2002, including retaining a delivery credit of 6,900 ac-ft. There remains, however, a constant threat of net shortfall. New Mexico must permanently increase state line flows by at least 15,000 ac-ft/yr and build up a delivery credit of about 120,000 ac-ft/yr for long-term compliance.

Treatment and reuse of produced water has the potential to provide new water. However, technical, economic, legal and institutional feasibility questions remain to be answered. Riparian vegetation removal and other water salvage methods have been implemented on the Pecos River, but despite the long and extensive history of these efforts, there is no clear evidence of significant water salvage.

ESA compliance activities have placed a new demand on the Pecos River water. For example, low flow releases from Sumner Dam to provide habitat for the threatened Pecos bluntnose shiner could deplete large quantities of the water supply in this fully appropriated river basin. New Mexico currently relies on the voluntary efforts of federal agencies to offset depletions resulting from revised Sumner Dam operations to meet the ESA needs. New annual incremental ESA depletions may be equivalent in magnitude, under some conditions of operation and hydrology, to the historical over-depletion of water in New Mexico determined by the United States Supreme Court in *Texas v. New Mexico.* According to the studies being carried out by the Pecos River NEPA Team, new depletions could range from 3,000 ac-ft/yr to 35,000 ac-ft/yr (the upper end of the range is for a target flow of 71 cubic feet per second [cfs] at Acme), depending on the specific flow requirements for the fish. Efforts to reach a long-term solution to compact compliance may be compromised if additional depletions to the river system resulting from changes in operations to conserve the Pecos bluntnose shiner are not offset.

The most recent Biological Opinion for the Bureau of Reclamation's Proposed Pecos River Dam Operations, which is valid for March 1, 2003 through February 28, 2006, targets a range of flows depending upon the types of water years, which are defined according to the amount of water available in storage. For all year types in the winter, the Biological Opinion requires a target flow of 35 cfs at the Acme gage. For dry years in the summer, the requirement is to avoid, if at all possible, intermittency at the Acme gage. For average and wet years in the summer, the flow targets at the Acme gages are 20 and 35 cfs, respectively.

It is critical that New Mexico conduct its own biologic investigations to provide a better scientific basis of the legitimate water needs of endangered species. This requires significant funding and staff. New Mexico must also continue to actively participate and take a leadership role in NEPA compliance activities in order to assure that State's Pecos River interests are protected

Central Closed Basins

The Central Closed basins include the Estancia, Tularosa, and Salt basins. A basin is said to be closed if surface water does not exit (i.e., drain out of) it. Because these basins are for the most part mined basins, ground water development is time-limited, and utilizing these sources for municipal supply presumes that the water will someday have to be replaced by another source.

These basins each have distinct characteristics, water supplies and issues and thus are described and discussed separately in the following subsections.

Estancia Basin

Major Issues

- Ground water mining has caused serious water level declines in the valley fill aquifer, and computer modeling of the basin predicts that wells will continue to dry up in the coming decades.

- Water right licenses, declarations and permits in the Estancia basin far exceed historical pumping, and the basin has not been adjudicated. As with several other mined ground water basins in the state, the basin is administered by the OSE to allow gradual depletion.

- Pressure to export Estancia basin water is growing, and water is already being exported from former irrigation wells in the northern part of the basin. Whether further export projects should be built is an important planning issue.

Hydrology

Surface-water supplies in the Estancia basin are minor. There are no perennial streams. Numerous small salt-water lakes, such as Laguna del Perro, occupy the central part of the basin.

The major aquifers are the valley fill sediments and the bedrock Madera Limestone:

- The valley fill aquifer is located in the central portion of the basin and is composed of sand, silt and gravel. Most of the irrigation wells in the basin draw from the valley fill aquifer. Ground water development from the valley fill is concentrated from several miles north of Moriarty to several miles south of Willard.

- The Madera Limestone is the principal aquifer in the west-central and northwestern portions of the basin. Ground water in the Madera generally flows along bedding planes and along fractures.

Other formations are also aquifers in certain areas.

Water Supply and Demand

Ground water furnishes nearly all of the water used in the Estancia basin. Whereas ground water inflow to the Estancia basin is approximately 31,000 ac-ft/yr, in 1995, an estimated 61,000 ac-ft was withdrawn with about 95 percent of this applied to irrigation. As a result of this type of discrepancy between inflows and outflows, water levels have declined over much of the area, by as much as around 70 feet. Irrigated agriculture totaled more than 34,000 acres in 1980 and had declined to 25,895 acres by 1995. Table 4 provides an estimate of the Estancia basin ground water budget prior to pumping of basin water by man.

Table 4. Steady-state ground-water flow balance for the Estancia basin

Flow Category	Inflow (ac-ft/yr)	Outflow (ac-ft/yr)
Recharge	30,100	
Evapotranspiration		26,430
Ground water discharge to Galisteo basin		3,930
Ground water discharge to Tularosa basin		420
Ground water inflow to Madera Group	900	
Total	31,000	30,780

Although the total ground water in storage is substantial, much of it is not recoverable, particularly in bedrock areas where fracturing has not increased the aquifer permeability sufficiently to support high well yields. Thus, while some wells may be deepened to regain a water supply, the lower formations may provide less yield. Additionally, some of this water may contain high salt concentrations that preclude certain uses. Although water-quality issues are generally not currently affecting supplies, ground water pumping may draw more saline water toward the pumping wells.

In addition to the water quality issues, ground water in storage is not necessarily available water. Estimates of ground water in storage do not reflect legal and State administrative constraints on ground water pumping for protection of existing rights nor do they reflect economic limits on access to the ground water. Much of the total ground water is in aquifers that would not yield sufficient water for economical irrigation.

There is no central water authority or irrigation district in the Estancia basin. For the most part, water rights remain appurtenant to historically irrigated lands. Water right licenses, declarations and permits far exceed historical pumping, and the basin has not been adjudicated.

The most important legal constraint on water use in the Estancia basin is the recently established set of administrative guidelines for processing water rights applications. Under the guidelines and an accompanying State Engineer Order, there will be no new ground water appropriation in the basin. This restriction on new appropriations is intended to extend the life of the aquifer and to protect existing rights. The OSE will still consider water rights transfers, supplemental wells and applications for domestic wells.

Tularosa and Hueco Basins

Major Issues

The Tularosa UWB (ISC/OSE, 2002, Atlas Plate 2) was declared in 1982, and the Hueco UWB was declared in 1980. Major issues for the two basins are:

- Water levels are declining and water quality is becoming degraded in the Tularosa UWB. If no measures are taken to limit the water level declines, saline water encroachment will degrade remaining fresh water supplies. Subdivision development allowing single household wells and septic tanks is another source of water quality degradation.

- In addition to New Mexico's uses, both El Paso County and Cuidad Juarez rely heavily on the Hueco UWB aquifer. Aquifer water levels have declined up to 200 feet in parts of these metropolitan areas. There is no compact dealing with cross-border ground-water issues.

Hydrology

Surface water, including that imported through the Bonito pipeline from the Lower Pecos basin, furnishes almost one-third of the water used in the Tularosa basin. The Rio Tularosa, La Luz Creek and springs along the slopes of the Sacramento Mountains comprise the surface water in the basin. Flows from springs used by the City of Alamogordo totaled 5,696 ac-ft in 1995. Annual surface water flows measured at U.S. Geological Survey stream gages in the basin are summarized in Table 5.

The Santa Fe Group formation that contains the aquifer is primarily made up of basin-fill deposits composed of gravel, sand, silt and clay. The formation is coarser grained (higher permeability) in areas adjacent to mountain fronts and finer grained (lower permeability) toward the center of the basin. In addition, an important constraint on the use of ground water in the Tularosa basin is its quality; much of the water contains TDS concentrations greater than 1,000 mg/L (the upper limit for potable water). Fresher water is found close to the recharge zones along the base of the mountains, and saline water is present in the central and deeper parts of the basin. Communities that utilize water from this aquifer include Alamogordo, Tularosa, and Holloman Air Force Base in New Mexico and the cities of El Paso, Texas and Ciudad Juarez, Chihuahua, Mexico.

Table 5. Annual surface flows for the Tularosa basin

Gaging Station	USGS ID	Drainage Area (sq. mi)	Time Period	Annual Flow (ac-ft/yr)			
				Average	Minimum	Median	Maximum
La Luz Creek at La Luz, NM [a]	08484500	74	1983-1986	5,800	2,200	6,100	8,700
Tularosa Creek near Bent, NM [b]	08481500	120	1948-1995	9,500	5,800	7,900	17,200
Salt Creek near Tularosa, NM	08480595	NA	1996-1998	700	560	580	1,060

[a] Flows influenced by upstream diversions for municipal supply for City of Alamogordo.
[b] Flows influenced by upstream diversions for irrigation of about 1,000 acres (1959 determination).

Under predevelopment conditions, recharge is estimated to have totaled about 86,000 ac-ft/yr for the entire Tularosa basin. As recharge enters the sediments and flows southward, the water quality degrades. Less than 0.2 percent of ground water stored in the basin may be considered fresh (1,000 mg/L or less) and is mainly found adjacent to the mountain fronts south of Alamogordo and next to the southern San Andres Mountains to the New Mexico-Texas state line. Because the fresh and saline water are hydrologically connected, well diversions in the fresh zone may cause saline encroachment towards potable water zones.

Water Resources Management

New Mexico's administration of its portion of the Hueco basin is complicated by ground water development outside New Mexico in Texas and Mexico. There is no compact dealing with cross-border ground-water issues, and the Hueco basin is probably the most critical of the trans-international boundary aquifers in this area, because in addition to New Mexico's uses, both El Paso County, with a population of more than 700,000, and Cuidad Juarez, with a population of over 1.2 million, rely heavily on the aquifer. Aquifer water levels have declined up to 200 feet in parts of these metropolitan areas, and studies suggest that the aquifer on the Texas side may be depleted within the next few decades. Well withdrawals in Texas already affect both water levels and water quality on the New Mexico side.

Water Supply and Demand

While there is a considerable amount of ground water stored in the Tularosa Basin in basin-fill and bedrock aquifers (Table 6), only a very small portion of the potable water may be recoverable. Additional ground water is physically recoverable in the basin, but will require treatment if it is to be usable. Practical water availability limitations are also imposed by State administrative constraints to protect existing rights and economic limitations on its recovery and/or treatment.

Table 6. Total ground water in storage and estimated recoverable ground water, by water quality category, for Tularosa basin

Aquifer Category	Water in Storage (ac/ft) by TDS Concentration (mg/L) Range				
	<1,000	1,000-5,000	5,000-10,000	≥10,000	Total
Basin fill, total	32,500,000	232,000,000	238,000,000	26,800,000	529,300,000
Bedrock, total	19,100,000	56,300,000	161,000	0	75,561,000
Basin fill, recoverable	8,120,000	48,000,000	43,700,000	4,700,000	104,520,000
Bedrock, recoverable	9,570,000	28,200,000	81,000	0	37,851,000

The total ground water withdrawn in the Tularosa basin in 1995 was an estimated 47,140 ac-ft. Public water supplies are obtained from both surface water and ground water, while irrigation tends to rely primarily on ground water supplies. Of the surface water withdrawn for public supplies, some is imported from Bonito Lake, in the Rio Hondo watershed of the Lower Pecos basin. Water piped from Bonito Lake provides water to the communities of Nogal, Carrizozo, Alamogordo and Holloman Air Force Base. Combined, these users have rights to a little more than 3,000 ac-ft/yr from Bonito Lake in Lincoln County.

The City of Alamogordo has been very progressive in managing available water resources. An aquifer storage and recovery project is being developed to store the excess winter surface water in the aquifer by well injection and to pump it back during high summer demand. The costs are small (estimated at about $0.15 per ac-ft) because the injection will operate by gravity. Alamogordo has also filed water rights applications to extract saline water and is planning a desalination plant to remove dissolved minerals from ground water. Preliminary cost estimates for a desalination plant in Alamogordo, which could treat 8 million gallons per day, are $15 to $20 million.

Salt Basin

Major Issues

On September 13, 2000, the New Mexico State Engineer declared the Salt UWB to be under his administrative review (ISC/OSE, 2002, Atlas Plate 2). Until the basin was declared, water resource issues were not regulated or monitored. Development pressure within the New Mexico side of the basin has been very modest, less than in Texas. Major issues include:

- Little development of the Salt Basin has occurred in New Mexico, but pressure to develop this resource is growing. Ground water depletions must be managed to prevent mining of the basin's aquifers.

- The Salt basin is being considered by some entities as a water source to augment supplies in southwest Texas. Steps must be taken to ensure that water from the basin is preserved to meet growing demands in southern New Mexico.

Surface Water Hydrology

The Sacramento River, Shiloh Draw and Piñon Creek are the major streams in the Salt basin; all but the Sacramento River are intermittent. There are no surface water reservoirs, other than stock ponds, in the basin. The Sacramento River was gaged from 1985 to 1988, during which time annual flow ranged from about 1,800 to 5,500 ac-ft. Some water from the Sacramento River is diverted for irrigation.

Areal recharge from the Sacramento River and the smaller watersheds around the basin (a total of 358 square miles) is estimated at 35,000 ac-ft/yr.

Ground Water Hydrology

The Salt basin is a complex down-faulted basin, filled with unconsolidated and consolidated sediments. The thickness of Santa Fe Group basin-fill sediments has been reported to be as much as 500 feet, but in most places it is between 25 and 300 feet, and ground water saturation is much less. Bedrock limestone aquifers in the basin are productive where fractured and where solution of minerals has enhanced permeability.

The basin-fill aquifer provides water in the southern Crow Flats, while the bedrock aquifers comprise the main aquifer in the Crow Flats area and other parts of the basin. There are few wells and pumping tests to assess the ground water beneath much of the basin.

Well yields depend on location, depth, and the degree of fracturing in the bedrock aquifer. Reported yields in a few wells reach 6,000 gpm, and irrigation wells can generally produce more than 1,000 gpm. Where bedrock units are less fractured, well yields are generally less than 50 gpm.

Most of the stored and recoverable ground water is in bedrock aquifers (Table 7). The hydrology of the basin is poorly understood, and the estimates in Table 7 are provided for comparison purposes only. The estimates do not reflect legal and State administrative constraints on ground water pumping for protection of existing rights, nor the economic limits to accessing the ground water. Additionally, much of the total ground water is in aquifers that would not support well yields sufficient for economic irrigation. Thorough evaluation of the basin would require many new wells and pumping tests.

Depth to water in the central part of the Salt basin is usually around 200 feet, but is about 400 feet in upland areas surrounding the central basin and about 1,000 feet east of Piñon. Between 1950 and 1995, ground water declines of up to 30 feet have been recorded in the Crow Flats area.

Table 7. Estimated total ground water in storage and recoverable ground water, by water quality category, for Salt basin

	Water in Storage (ac/ft) by TDS Concentration (mg/L) Range				
Aquifer Category	<1,000	1,000-5,000	5,000-10,000	≥10,000	Total
Basin fill, total	230,000	2,690,000	0	0	2,920,000
Bedrock, total [a]	30,000,000	27,500,000	0	0	57,500,000
Basin fill, recoverable	115,000	1,340,000	0	0	1,455,000
Bedrock, recoverable [a]	15,000,000	13,800,000	0	0	28,800,000

Source: Modified from J. Shomaker & Associates, Inc., 2001,
[a] Assuming 750 feet average saturated thickness and porosity of 0.05 for total volume of water in bedrock; half of the stored water was estimated to be recoverable.

Water Resources Management

Ground water supplies most of the water used in the Salt basin. In 1995, an estimated 10,000 ac-ft was diverted for irrigation, and out of that, an estimated 8,100 ac-ft was consumed. An average of over 600 ac-ft/yr is used for public supply, much of it at Timberon. Livestock, commercial and industrial uses diverted 540 ac-ft of surface water and 80 ac-ft of ground water; an estimated 10 ac-ft was diverted for other uses.

Several entities are considering the Salt basin as a water source to augment supplies across southern New Mexico and in southwest Texas. Due to the clear need for any available renewable water resources to meet growing demands in southern New Mexico, the ISC has filed an application to appropriate water from the Salt Basin for uses throughout southern New Mexico. Other entities have also filed applications to develop and export water. Any such transfer out of New Mexico would be subject to water rights applications and subsequent approval of a permit from the State Engineer.

Water Supply and Demand

Prior to the basin being declared, water resources in the Salt basin were not administered by the OSE. Historical resource development and existing, established water rights have only been estimated. Like other ground water basins, the potential for ground water development is time-limited in the sense that most ground water depletions will not be quickly replenished by natural recharge.

Although the total diversion represented by declared water rights is more than 47,000 ac-ft/yr, the transferable water related to these rights (i.e., the historical consumptive use) is probably close to the 8,100 ac-ft/yr mentioned above. Any additional appropriation would be subject to new applications and approval by the State Engineer. Most of the ground water that might be pumped and exported would actually come from storage and would lead to significant drawdowns in the areas of well fields.

As noted in the Water Resources Management section, speculation about large-scale water development projects in Texas, New Mexico, or both is occurring. However, the technical studies conducted to date appear general in nature. Because it is very difficult to predict well yields and life in fractured limestone aquifers, in-depth field studies would be needed to defensibly support such projects. While a ground water model of the Salt Basin was prepared, it was not intended to be an administrative model. In addition, data to assess the accuracy of the model predictions are scant. Because land ownership in the basin, although mixed, is dominated by federal and State entities, development of ground water that would likely be piped elsewhere would be complicated.

Southwest Closed Basins

Major Issues

- In an effort to develop a renewable supply of water, part of New Mexico's 18,000 ac-ft/yr apportionment of Gila River system water under the Central Arizona Project (CAP) may be used in the Southwest Closed Basins (details regarding the CAP are provided in the Water Planning subsection of the Gila Basin section). Construction of a reservoir or suitable alternative for impounding and storing the water is needed to take advantage of this additional water source.

- Pumping in Mexico is likely to affect water levels on the New Mexico side of the border, yet no mechanism governing cross-border ground water issues exists.

Hydrology

Table 8 summarizes the main hydrologic features of each basin in the Southwest Closed Basins (SWCB) region, including the Mimbres, Nutt-Hockett, Hachita-Moscos, Playas, and Animas basins. A discussion of the hydrology of each basin in the SWCB region follows. The *Framework for Public Input to a State Water Plan* (ISC/OSE, 2002, Atlas Plates 19.1 and 19.2) provides additional hydrologic information about these basins.

Table 8. Hydrology summary for the Southwest Closed Basins

Basin	Area of Entire Basin	Estimated Recoverable Stored Ground Water	Recharge (ac-ft/yr)	1995 Ground Water Pumping (ac-ft)
Mimbres	5,140	30,600,000	39,940	127,000
Uvas valley (Nutt-Hockett)	133	2,400,000	633	27,600
Hachita-Moscos	1,040	4,860,000	4,860	5,900
Playas	925	4,860,000	5,670	
Animas	2,448	9,500,000	12,700	30,200

Note: Numbers apply to both New Mexico and Mexico portions of the basins.

Hachita-Moscos and Playas ground water pumping amounts reported as one value

The ***Mimbres basin*** is 5,140 square miles in area, 4,410 square miles of which are located in New Mexico and the rest in Mexico. The only significant stream in the basin is the upper reach of the Mimbres River, which is typically perennial to the Grant-Luna

County line and is used for irrigation. Below that, the Mimbres River is intermittent and rarely flows beyond Deming. Average flow of the Mimbres River at the Mimbres gage over the period of record is 10,300 ac-ft/yr. The measured flows range widely, from flows greater than 3,900 ac-ft/yr about four years in five, to flows greater than 7,200 ac-ft/yr occurring in about half of the years, and flows that exceed 18,600 ac-ft/yr occurring in one year in five.

The principal aquifer in the Mimbres basin is the basin fill, which is composed of the Gila Conglomerate and younger sediments and associated volcanic rocks and is up to 4,000 feet thick. Estimates of recharge range between 40,000 and 80,000 ac-ft/yr. Prior to extensive development, ground water flowed southward from New Mexico into Chihuahua at 4,100 to 6,500 ac-ft/yr. However, much of this flow has been intercepted by ground water pumping in New Mexico, and in places, ground water may now flow from south to north across the border.

The total amount of ground water withdrawn between 1931 and 1985 was about 3.4 million ac-ft. Areas of heavy ground water withdrawal include Silver City and Hurley (primarily for municipal and mining purposes) and near Deming and Columbus (mainly for irrigated agriculture). In the northern and central parts of the basin, water is generally suitable for most uses (TDS less than 500 mg/L), but in the southern and eastern areas, it may not be suitable for irrigation or domestic uses (TDS 500 to 1,000 mg/L).

The ***Uvas valley****,* also referred to as the Nutt-Hockett basin, occupies 133 square miles in the northeastern corner of the SWCB region. Surface-water supplies in the basin are insignificant, and ground water in the basin represents the major water supply, used mostly for irrigated agriculture. Ground water in the Uvas valley is stored in several aquifers, but basin-fill of the Santa Fe Group is the major aquifer in the basin. Ground water flow in the Uvas valley is from the mountains to the northeast, toward the Rio Grande. Recharge in the basin is estimated to be about 663 ac-ft/yr. Ground water quality is typically good (TDS less than 1,000 mg/L).

The ***Hachita-Moscos basin*** is a trans-international-boundary basin covering about 1,040 square miles. More than half of the basin (620 square miles) is in New Mexico; the rest is in the Mexican state of Chihuahua. There are no perennial streams in the Hachita-Moscos basin and there has not been much ground water development. Ground water in the basin fill flows from the northern and western parts of the basin southeast toward Mexico. Preliminary estimates of this flow are 2,000 ac-ft/yr or less. Recharge of some 4,800 ac-ft/yr enters the basin fill at and near the mountain fronts. Generally, the water quality in the New Mexico portion of the Hachita-Moscos basin is suitable for irrigated agriculture (TDS less than 500 mg/L).

The ***Playas basin*** covers an area of about 925 square miles. Streams in the basin are ephemeral. Ground water flow in the basin-fill aquifer is generally from south to north, although some flow comes from Mexico. Average annual ground water recharge has been estimated at about 5,670 ac-ft. Predevelopment ground water discharge was to springs and to Playas Lake, and some ground water may leave the basin through underflow to adjacent basins to the east and north. The maximum basin-fill thickness in the Playas basin is 1,650 feet; however, the productive aquifer typically is not thicker than 660 feet.

Historically, ground water in the basin was pumped for irrigation, but in recent times, irrigation water rights have been transferred to mineral processing uses at the smelter at Playas, in the central part of the basin. It is estimated that about 4,913 ac-ft of water was used for mineral processing in 1995, but the smelter is now closed. Ground water quality is generally suitable for most types of irrigated agriculture. In the southern and central parts of the basin, TDS content of ground water is generally less than 500 mg/L. In the northern half of the basin, ground water typically ranges from 500 mg/L to 1,000 mg/L TDS.

The ***Animas basin*** is topographically closed, but it has a drained ground water system. The total area of the basin is about 2,448 square miles (mostly in New Mexico). There are no major perennial streams in the basin. The major aquifer is the basin fill. Recharge is about 12,700 ac-ft/yr. Ground water generally flows to the north and northwest and discharges beyond the Animas basin boundary as underflow into the Gila River basin. Irrigated agriculture in the Animas basin is located in the lower Lordsburg and Animas valleys and totaled about 8,600 acres in 1995. Irrigation ground water withdrawals have drawn mainly on aquifer storage and have not significantly affected natural discharge to the Gila River basin, estimated to range from 5,913 ac-ft/yr to 12,700 ac-ft/yr.

The basin-fill is up to 2,000 feet thick, but only the upper 660 feet of the aquifer is considered productive. The water is good to marginal for agricultural use, with TDS ranging from less than 250 mg/L in the southern part of the basin to greater than 250 mg/L and in some cases greater than 1,000 mg/L in the northern part.

Water Resources Management

Within the SWCB are several declared administrative UWBs: the Animas, Lordsburg Valley, Playas Valley, Nutt-Hockett and Mimbres Valley (ISC/OSE, 2002, Atlas Plate 2). The UWBs do not cover all areas, and wells may be drilled without water rights or State Engineer permits in the undeclared areas. Administrative criteria exist for the Lordsburg Valley, Mimbres Valley and Playas Valley basins; criteria for the Mimbres Valley basin are described below.

The Mimbres Valley UWB was declared in 1931, and in the years since, additional areas have been added to it. Some areas in the basin, mostly in Luna County, were determined by the OSE to be fully appropriated and were closed to additional ground water appropriation and remain closed. The remaining parts of the basin are administered based on a ground water flow model developed by the OSE and the U.S. Geological

Survey in the late 1970s. The basin is divided into four-square-mile administrative blocks based on the model grid. New appropriations are allowed if the non-pumping water level 20 years after the pumping begins is less than 128 feet below the land surface in any administrative block in which there are ground water irrigation rights, and if the average rate of decline of the water level does not exceed 2.5 ft/yr. Critical administrative blocks are those that have a drawdown rate that exceeds 2.5 ft/yr or, in blocks with irrigation rights, where the calculated 1994 pumping level is at or below 128 feet. The criteria are also designed to protect surface-water rights in the fully appropriated Gila and Mimbres Rivers. The criteria, based on agricultural economics of the early 1970s, are still in effect.

Water Supply and Demand

The total water withdrawn in the SWCB in 1995 was 216,800 ac-ft, and total consumptive use was 131,400 ac-ft. Agriculture in the SWCB is the largest category of water use, withdrawing about 178,300 ac-ft of water in 1995. Mining and public supply account for much of the remainder, about 24,800 and 9,500 ac-ft, respectively. With the exception of irrigation, 14 percent of which is provided by surface water, most other use is of ground water.

The estimated total amount of ground water in storage that will be available for future recovery in the basins of the SWCB region is summarized in Table 8. None of these estimates takes into consideration the number of wells needed, the costs, or the potential impacts to existing wells of recovering this water. Development of this ground water for any particular project would require case-by-case analysis of these factors based on site-specific information.

Water Planning

Because surface water resources are relatively insignificant in the SWCB region, and no interstate or international streams or compacts exist, management of ground water is the primary policy issue. Supplies will need to be managed to provide for long-term availability of ground water for agricultural, municipal and industrial demands in the region. Administrative criteria may need to be updated in those basins with existing criteria, such as the Mimbres Valley and Lordsburg Valley, and criteria are needed for those basins currently lacking criteria. Administering to meet these criteria will require (1) developing appropriate technical tools, which may include ground water flow models capable of evaluating effects on water supplies, (2) monitoring and protecting water quality, and (3) assessing impacts of proposed development on other existing water users. Declaration of new UWBs and/or extensions to existing declared UWBs, such as those recently proposed for the Animas and Lordsburg Valley UWBs, may be needed to manage development as the subdivision of rural areas in the region continues.

Ground water pumping is likely to increase in the part of the Mimbres basin that lies in Mexico, with consequent effects on the water available on the New Mexico side of the border. There is no treaty, regulation, or even cooperative agreement dealing with cross-border ground water issues.

Gila Basin

Major Issues

The Gila Basin region relies on a combination of surface water and ground water for its supplies. Major issues include:

- The 18,000 ac-ft of Gila River water apportioned to New Mexico in the 1968 Colorado River Basin Project Act may be the last undeveloped, renewable water source in the region and is therefore key for future development in the region. Construction of a reservoir or suitable alternative for impounding and storing the water is needed to take advantage of this additional water source.

- Sen. Kyl (R-AZ) recently introduced the Arizona Water Settlements Act, S. 437. This legislation will resolve long-standing water issues among certain Arizona Indian Tribes and water users in New Mexico and Arizona. It is of great importance to the State of Arizona and will bring numerous benefits to water users and communities throughout the Gila River Basin. The State is currently negotiating amendments to this bill that will advance New Mexico interests and must remain engaged in negotiating the provisions of the Act to assure protection of existing New Mexico uses in the Gila Basin and to preserve New Mexico's right and access to the 18,000-ac-ft apportionment.

- The Southwestern willow flycatcher, the loach and spikedace minnows, and the Western (or Apache) leopard frog are all species listed as endangered under the ESA. The Gila trout and the Gila chub, among others, have been proposed for listing.

- The area is currently experiencing severe drought conditions.

- Bayard-Silver City water supplies may not be sufficient to meet needs within 40 years.

Water Resources Management

Water resources in the Gila Basin are fully apportioned. A number of legal and legislative mandates affect water management in the Gila Basin region.

The Boulder Canyon Project Act of 1928 gave Arizona exclusive beneficial use of the Gila River excluding pre-existing water rights, thus limiting any further development in New Mexico on the Gila River. In the 1935 Globe Equity Act (sometimes termed the Gila Decree) in the U.S. District Court for Arizona, water uses on the upper Gila River were essentially adjudicated.

The 1964 U.S. Supreme Court Decree in *Arizona v. California* limited depletions and irrigated acreage in the San Simon, San Francisco and Gila streams, setting out specific annual and cumulative 10-year use criteria for each stream.

Water Supply and Demand

Recent modeling by the OSE indicates that water levels in most aquifers within the basin will remain sufficient for current uses in the near future. However, pumping in the Bayard-Silver City and Deming areas will reduce saturated thickness in some well fields to the point that wells may be nonproductive, and Bayard-Silver City supplies may not be sufficient to meet needs within 40 years. Some data suggest that ground water levels in the San Agustin Plains are also in decline.

The current drought has severely impacted water supply in the region. Streamflows in recent years have dropped to as low as 9 percent to 16 percent of average flows. Continuation of the drought could place a number of communities in a drinking water emergency and worsen the already critical livestock and irrigation supplies.

Water Planning

Public Law 90-537 (90th Congress, S. 1004, September 30, 1968), which authorized the Central Arizona Project (CAP), gave an apportionment to New Mexico of 18,000 ac-ft/yr of Gila River system water over and above the amounts in the Gila and the *Arizona v. California* decrees, provided that CAP water is delivered to offset impacts to downstream rights. The law also authorized the completion of a reservoir or a suitable alternative in the New Mexico portion of the basin to develop the additional apportionment. Several projects, notably dams on the Gila River at the Connor and Hooker sites, have been proposed for impounding and storing water for use in New Mexico, but nothing yet has been realized. This water may be the last undeveloped, renewable water source in the region. New Mexico must preserve its right to that water and develop the mechanisms to access it. If at some point this water is developed, it would be logical to use it for municipal and industrial supplies in the southwestern part of the state.

Little Colorado Basin

Major Issues

New Mexico water uses from the Little Colorado River Basin are subject to the Colorado River Compact, which apportions the use of water from the Colorado River system to the Upper and Lower basins. However, the State of New Mexico's entitlement within the Lower Basin apportionment to the tributary waters in the Little Colorado River Basin has not been quantified. Other issues include:

- Ground water use in the basin is not sustainable.
- The surface water supply is very limited and seasonal shortages frequently occur.
- Community water distribution systems need to be upgraded to accommodate delivery of water from the planned Navajo-Gallup Water Supply Project (NGWSP).

NGWSP issues relating to Compact administration, federal environmental law compliance and a proposed Navajo Nation water rights settlement in the San Juan River Basin are addressed in the section on the San Juan River Basin.

Water Supply and Demand

The availability of surface water supply in the Little Colorado River Basin in New Mexico is very limited. Black Rock Reservoir and a few other small reservoirs regulate surface flow for irrigation of small amounts of land, mostly in the Zuni River drainage. Even though storage facilities exist in the basin, storage water is generally insufficient for all of the irrigated lands, and seasonal shortages often occur. Average annual consumptive uses in the basin, including for agriculture, municipal, industrial and domestic uses, aggregate to approximately 12,000 ac-ft/yr.

Most of the water used in and near the City of Gallup is pumped from the Gallup Sandstone and Dakota-Westwater aquifers. The aquifers are deep, and static water levels in the aquifers have declined up to several hundred feet during the past 30 years. The ground water use by the City of Gallup is not sustainable.

In addition to the water use by the City of Gallup, Indian water uses constitute a significant fraction of the total water use in the basin. The Zuni River adjudication, in which the water rights of Zuni Pueblo will be adjudicated, is ongoing.

Water Planning

Water Development

The Bureau of Reclamation is planning the NGWSP to divert water from the San Juan River for delivery and use in Gallup and surrounding communities within the Little Colorado River Basin. When implemented, the Project will provide a renewable supply of approximately 14,000 ac-ft/yr to the City of Gallup and nearby Navajo communities. Of that amount, 7,500 ac-ft/yr of water would be allocated to the City of Gallup and 6,500 ac-ft/yr of water to the Navajo communities near Gallup to both replace existing ground water uses and meet projected future water demands. The financial feasibility of the Project has yet to be established, and federal funding and local cost shares likely will be needed to fund the Project.

The Corps of Engineers plans to construct the Little Puerco Wash Flood Control Project to provide flood protection to downtown Gallup. The City of Gallup will sponsor and provide cost sharing for the project.

Federal Environmental Laws

Riparian habitat in the Little Colorado River Basin provides some habitat for the Southwestern willow flycatcher, which is listed as endangered under the ESA. One area that the Southwestern willow flycatcher may seasonally occupy is along the Zuni River.

San Juan River Basin

Major Issues

Representation and defense of New Mexico's interest in treaties with Mexico and interstate compacts must continue to be vigorously pursued. Among the primary matters of concern are:

- During dry periods Colorado's performance under the La Plata River Compact typically falls short.

- Planned development of the NGWSP is triggering a number of needs, including:

    - Completion by the U.S. Bureau of Reclamation of the corresponding EIS and feasibility study, which will address endangered species (Colorado pikeminnow and razorback sucker) habitat impacts, among other topics.

    - Upgrades to community water distribution systems operated by the Indian Health Service, the Navajo Tribal Utility Authority and Gallup.

    - The estimated $463.4 million in funding needed for the NGWSP itself.

- Colorado River Compact compliance issues related to the proposed diversion of water from the Upper Basin (including parts of Arizona, Colorado, New Mexico, Utah and Wyoming) for use in the Lower Basin (including parts of Arizona, California, Nevada, New Mexico and Utah) need resolving.

- Proposed Navajo Dam operations changes to benefit endangered species—part of the San Juan River Basin Recovery Implementation Program—may have negative effects on tailwater trout, hydropower generation, diversion structures and water quality.

- Settlement of Navajo Nation claims to San Juan waters (if achieved) is likely to require water rights and federal funding for construction and operation of projects such as the Navajo Indian Irrigation Project (NIIP), as well as public support to gain Congressional approval.

- The NIIP requires funding of more than $277 million for new irrigation facilities, plus additional funds for rehabilitation of older systems and the Hogback and Fruitland irrigation projects.

- The Animas-La Plata Project (ALP), although authorized, has not been funded, nor have operating criteria been established for it. In addition, assignment of State Engineer Permit No. 2883 has not been confirmed.

- In some matters, progress hinges on adjudication of water rights. However, the hydrologic data needed for adjudication to proceed are lacking, and funding for data collection is inadequate.

- Drought and growing water demand are dictating the need for either a shortage sharing agreement or priority administration of water rights. This may also be needed for the State to have full use of its Upper Basin waters.

Water Resources Management

Water uses in New Mexico from the San Juan River and its tributaries are subject to the 1944 Mexican Water Treaty and the Colorado River, Upper Colorado River Basin, La Plata River and ALP compacts:

- The 1944 Mexican Water Treaty apportions the waters of the Colorado River system between the United States and Mexico.
- The Colorado River Compact apportions the use of waters of the Colorado River system within the United States to the Upper and Lower basins. Parts of Arizona, Colorado, New Mexico, Utah and Wyoming constitute the Upper Basin; the Lower Basin includes parts of Arizona, California, Nevada, New Mexico and Utah.
- The Upper Colorado River Basin Compact apportions among the Upper Basin states the use of waters that are available for use each year by the Upper Basin under the Colorado River Compact. The State of New Mexico is apportioned consumptive use equaling 11.25 percent of the quantity of consumptive use available and remaining after deduction of the limited use made in Arizona from the Upper Basin. The Upper Colorado River Commission administers the provisions of the Upper Colorado River Basin Compact.
- The La Plata River Compact governs the terms by which the waters of the La Plata River are to be distributed daily between Colorado and New Mexico, and it is administered by the State Engineers of the two states.
- The ALP Compact establishes equal priority for the water supply to be diverted by the Project between uses under the Project in Colorado and New Mexico.

In the early 1950s, planning for development of the water supply apportioned to New Mexico by the Upper Colorado River Basin Compact concentrated on several major federal projects that would put to use the undeveloped water available to New Mexico. The Bureau of Indian Affairs, Bureau of Reclamation, Navajo Nation, State of New Mexico, and several local interests were involved. Federal projects subsequently authorized by Congress include the Navajo Dam and Reservoir, the San Juan-Chama Project, the ALP, the Hammond Project and the NIIP. Construction of the NIIP and the ALP has yet to be completed. Water from these federal projects is supplied under contracts with the Secretary of the Interior to water users in New Mexico.

The Bureau of Indian Affairs also maintains the Hogback and Fruitland irrigation projects, which serve Navajo Nation lands, and the Bureau of Reclamation is in the process of developing an EIS and feasibility report for the NGWSP. The construction and operation of federal water projects must comply with federal environmental laws, including NEPA, the Clean Water Act and the ESA. The San Juan River below its confluence with the Animas River provides designated critical habitat for two fish species listed as endangered, and water bodies in the San Juan River Basin also support habitat for endangered bird species.

The 1948 Echo Ditch Decree adjudicated non-Indian water rights in the San Juan River Basin. In addition, permits and licenses to divert and use water in the basin have been issued by the State Engineer since 1948. Some of the permits were acquired and assigned by the ISC to the Secretary of the Interior for the purpose of developing New Mexico's Upper Basin apportionment. In recent years, Congress authorized a settlement of the water rights claims of the Jicarilla Apache Nation to waters of the San Juan River Basin, and a partial final decree stating the Jicarilla's rights for historical and future uses was entered in the San Juan Basin adjudication. The OSE/ISC and the Navajo Nation have drafted legislation to settle Navajo water rights claims in the San Juan River Basin in New Mexico. Indian uses constitute a large fraction of the total water use in the basin.

The State Engineer is implementing a process to collect and record data needed to proceed with the current San Juan Basin adjudication. However, an updated hydrographic survey has not been started, and completion of the adjudication is many years away. The adjudication is hampered by a lack of resources with which to conduct it.

The State of New Mexico and the Navajo Nation executed a Memorandum of Agreement committing to formally negotiate a settlement of the water rights claims of the Navajo Nation to waters of the San Juan River Basin in New Mexico, including contracting rights from Navajo Reservoir. The draft requires water rights and federal funding for water development (for example, construction and operation of the NIIP, the ALP and the NGWSP). The settlement also will need the support of water users in the San Juan Basin if it is to be approved by Congress. The United States has appointed a federal water rights negotiation team to assist in furthering a negotiated settlement.

Water Supply and Demand

New Mexico has held that its apportionment for consumptive use of water from the Upper Basin is 727,000 ac-ft/yr based on the terms of the Colorado River and Upper Colorado River Basin compacts and the hydrologic or water supply record. The use of

New Mexico’s apportionment is made from waters of the San Juan River, its tributaries, and underground water sources, and uses occur both within the San Juan River Basin in New Mexico and outside the basin in other areas of New Mexico through the San Juan-Chama trans-basin diversion.

In 1988, the Bureau of Reclamation determined that the firm yield available to the Upper Basin is at least 6.0 million ac-ft annually. However, the Upper Colorado River Commission disagrees with the assumption used by Reclamation in its hydrologic determination of a minimum release of 8.23 million ac-ft annually from Glen Canyon Dam. Also, Reclamation’s hydrologic determination does not account for salvage by use (i.e., water saved by using it instead of allowing it to be stored and thereby losing some of it to evaporation). Although the Commission and Upper Division States disagree with portions of the analysis contained in the hydrologic determination, the Upper Division States at this time have not objected to assuming a yield to the Upper Basin of at least 6.0 million ac-ft/yr for planning purposes and water supply studies within the Colorado River Basin. This is because the hydrologic determination does not constrain uses in the Upper Basin in the near future.

Based solely on the Reclamation’s hydrologic determination, New Mexico’s Upper Basin apportionment is at least 669,000 ac-ft/yr, or about 611,000 ac-ft/yr for use within the State after deduction of Colorado River Storage Project (CRSP) evaporation chargeable to New Mexico. The CRSP is operated to maintain the Upper Basin’s delivery requirement at Lee Ferry under the Colorado River Compact, and all Upper Division States must share in the evaporation loss resulting from said operation. New Mexico’s estimate of its apportionment assumes a firm yield to the Upper Basin of 6.3 million acre-feet annually and accounting of salvage by use.

For planning purposes, the Upper Colorado River Commission has adopted projections of future depletions within each of the Upper Division States and the Upper Basin as a whole. In December 2001, New Mexico submitted for the Commission’s consideration a revised depletion schedule for projections of water use from the Upper Basin in New Mexico through the year 2060. The revised depletion schedule for New Mexico projects that consumptive uses within the State, without consideration of water salvage and excluding CRSP evaporation, will approach 600,000 ac-ft/yr during the period 2040 to 2060. The depletion schedule is not an acceptance of any assumption that limits the Upper Colorado River Basin’s depletion.

Current consumptive uses within or from the San Juan River Basin in New Mexico fluctuate yearly and aggregate to a total depletion averaging on the order of 400,000 ac-ft/yr. Over half of this amount is consumptively used by irrigated agriculture, and more irrigation use will occur in the future as construction of the NIIP proceeds. The amount of acreage irrigated in recent years on the NIIP has approached approximately 50,000 acres, and the acreage for the project authorized by Congress is 110,630 acres.

The depletion from the basin includes the amount of San Juan-Chama Project water diverted from the San Juan Basin drainage in Colorado and exported to the Rio Grande Basin. Recent hydrologic studies suggest that a long-term average annual diversion by the San Juan-Chama Project of approximately 108,000 ac-ft/yr will be needed to supply the contracted yield of 96,200 ac-ft/yr from the project at Heron Dam in the Rio Grande Basin. Approximately 50,000 ac-ft of water per year is consumed in the generation of thermal electric power within the San Juan Basin, and lesser amounts of depletions occur from municipal, industrial, commercial, domestic and other uses.

Water users from the San Juan and Animas rivers generally have a full supply of water during all but the driest years. In contrast, irrigators on the La Plata River suffer water supply shortages nearly every summer and fall. For example, in the Chaco River drainage, lack of a dependable water supply in ephemeral tributaries limits irrigation or other uses in the basin.

Most of the water use in the San Juan River Basin is from surface water sources. Few of the underlying rock formations are capable of yielding large quantities of ground water, and ground water from those that could yield large quantities is likely to be of poor quality. Ground water is used primarily for livestock and for rural household and minerals-processing purposes. It has been estimated that large quantities of ground water exist in the basin, but most of it may be too saline or too costly to develop to be of practical use. Good-quality ground water is obtainable where the San Jose formation crops out in the eastern part of the basin, in the outcrop area of the sandstone formations to the west, and in the valley alluvium adjacent to the San Juan River and its perennial tributaries. Water found elsewhere is apt to contain more than 1,000 milligrams per liter (mg/L) of TDS and generally is unsuited for domestic use.

Water Planning

Compacts, Decrees and Treaties

In the San Juan River Basin, New Mexico’s consumptive use apportionment is dependent on water available to the Upper Basin, and that availability is dependent on delivery requirements to the Lower Basin and Mexico and on the operation of Colorado River system reservoirs. The State Engineer represents the State of New Mexico in Seven Basin States forums to protect New Mexico’s interests in Colorado River system operations.

For example, the State Engineer or his designee participates in the Secretary of the Interior’s consultation with the Seven Basin States on preparation each year of an annual operating plan for Colorado River Basin reservoirs to meet the delivery requirement to Mexico, to deliver water in accordance with the decree in *Arizona v. California,* and to satisfy project purposes under varying hydrologic conditions. The Secretary of the Interior has adopted interim surplus guidelines that provide for conditional declarations of surplus conditions as the criterion governing the operation of Lake Mead, so long as California meets specific benchmarks in implementing a plan to reduce its demand for Colorado River water to its basic apportionment of 4.4 million ac-ft/yr by 2015.

The State Engineer also participates in the Glen Canyon Dam Adaptive Management Work Group, which is a federal advisory committee chartered to apply adaptive management to operation of Glen Canyon Dam to conserve sediment resources and sand bars in the Colorado River through the Glen, Marble and Grand Canyons for protection of fish habitat, riparian vegetation, rafter campsites and archeological sites. Of concern to the Upper Division States is the possibility that periodic releases from Glen Canyon Dam in excess of power plant capacity might be identified as necessary to conserve sediment resources and endangered fish in the canyons below the dam, thus adversely affecting the availability of water for use by power producers and the Upper Division States.

Further downstream, the International Boundary and Water Commission (IBWC), United States and Mexico adopted Minute 306 to the 1944 Mexican Water Treaty to establish a conceptual framework for international studies that are preparing recommendations concerning restoration of the riparian and estuary ecology of the Limitrophe Section of the Colorado River and its associated delta. The Seven Basin States have stated their opposition to any proposed restoration measures that would involve delivery of Colorado River water from the United States in excess of the current treaty delivery obligation.

Also, the United States must comply with streamflow salinity standards for the Colorado River set by Minute 242 of the 1944 Mexican Water Treaty. The State Engineer participates on the Colorado River Basin Salinity Control Forum to assist in the evaluation and implementation of federal salinity-control measures upstream of Imperial Dam. The Yuma Desalting Plant, constructed to desalt irrigation return flows for delivery to Mexico, has been in standby status due to high operation costs, but should be maintained to enable restart within a reasonable time.

Water Development

Many communities and people on the Navajo Indian Reservation have inadequate domestic water supplies. The NGWSP is being planned to provide good-quality, renewable domestic water supplies to Navajo communities in the San Juan Basin, the Rio Grande Basin and the Little Colorado River Basin, and to the City of Gallup. The NGWSP also would serve the southern portion of the Jicarilla Apache Indian Reservation. The amount of funding that will be required to construct the NGWSP is on the order of $400 million. New Mexico is working with the Seven Basin States to resolve Compact issues relating to the project’s proposed diversion of water from the Upper Basin for use in the Lower Basin.

Community water distribution systems operated by the Indian Health Service, the Navajo Tribal Utility Authority and the City of Gallup need to be upgraded to accommodate delivery of NGWSP water. The total depletion by NGWSP users in New Mexico is planned to be over 27,000 ac-ft, and the project also would provide roughly 6,000 ac-ft for uses in Arizona under that state's Compact apportionments.

Although Congress authorized the NIIP in 1962, appropriations to date have been insufficient to complete construction of the project. Additional funding in an amount exceeding $200 million is needed to construct irrigation facilities on the three blocks of the NIIP that remain to be constructed. Older portions of the NIIP are in need of refurbishment. In addition, the Hogback and Fruitland irrigation projects are in need of rehabilitation. Progress on improvements to these projects is important to the Navajo Nation.

The Jicarilla Apache Nation may utilize a portion of its water rights to supply some of the water demand under the NGWSP. Also, the Public Service Company of New Mexico's (PNM) contract for water from the Navajo Reservoir to supply uses at the San Juan Generating Station expires in 2005, but PNM has negotiated a contract with the Jicarilla Apache Nation to lease 16,200 ac-ft/yr of the Jicarilla's Navajo Reservoir water for use at the station during 2006 through 2027.

In 2000 Congress authorized construction of the ALP as a part of the water rights settlement legislation for the Colorado Ute Tribes. The authorization provides for a total annual project depletion averaging 57,100 ac-ft/yr, for municipal, domestic and industrial uses only, in Colorado and New Mexico. The States of Colorado and New Mexico need to pursue operating criteria for the ALP. Congress also authorized construction of the Farmington-Shiprock pipeline, at a non-reimbursable cost, to convey the water allocated to the Navajo Nation. The authorizing legislation provides that upon the request of the State Engineer, the Secretary of the Interior shall assign to the New Mexico ALP beneficiaries or to the ISC, in accordance with the request, the Department of the Interior's interest in State Engineer Permit Number 2883, in order to fulfill the New Mexico non-Navajo purposes of the project.

Interstate Issues

Interstate issues relating to New Mexico's apportionment under the Upper Colorado River Basin Compact and Upper Basin water development in New Mexico are summarized in the preceding sections. New Mexico also has concerns regarding the State of Colorado's chronic underdeliveries of La Plata River Compact water during dry periods, which New Mexico believes are caused in part by Colorado's river operations. Although the amount of underdelivery may be comparatively small relative to water supplies on other streams in the San Juan Basin, it is a significant amount to ditches in the La Plata River drainage in New Mexico.

Federal Environmental Laws

A large portion of the water use in the San Juan River Basin in New Mexico is made possible by the operation of federal water projects, and all federal activities in the basin must comply with the ESA. Federal water projects to supply uses in New Mexico that have successfully completed ESA Section 7 consultation with the USFWS include the NIIP and the ALP. The operation of Navajo Dam, the San Juan-Chama Project and the NGWSP must still undergo Section 7 consultation.

The Colorado pikeminnow and razorback sucker, both of which are listed as endangered under the ESA, inhabit the San Juan River below its confluence with the Animas River. Operating Navajo Dam to mimic a natural hydrograph—for example, with high flows during the spring snowmelt and low base flows at other times of the year—is believed to provide for the habitat needs of the endangered fish species. Such dam operation is needed to provide ESA compliance for continued operation of Navajo Dam, as well as for further development of New Mexico's Upper Basin Compact apportionment.

To recover the two endangered fish species in the San Juan River while proceeding with water development in the basin consistent with applicable laws, the State of New Mexico committed to participate in the San Juan River Basin Recovery Implementation Program (SJRBRIP). In 1999 the SJRBRIP adopted recommendations for flows that biologists deemed necessary to provide for the habitat needs of endangered fish in the San Juan River downstream from Farmington. In order to meet the flow recommendations, the Bureau of Reclamation has proposed operating Navajo Dam with base flow releases as low as 250 cfs and peak flow releases as high as 5,000 cfs.

In 2003, the Bureau of Reclamation expects to complete a final EIS on its proposed dam operations. While the proposed dam operations might benefit endangered fish recovery and both Indian and non-Indian water development and use in New Mexico, concerns have been expressed by some in the San Juan Basin regarding negative impacts of the proposal on (1) the high-quality tailwater trout fishery below Navajo Dam, (2) hydropower generation at the City of Farmington's Navajo Dam power plant, and (3) diversion structures and water quality in the San Juan River between the dam and Farmington.

Along with input to the operation of Navajo Dam to meet the flow recommendations for endangered fish habitat, the SJRBRIP acts to promote recovery of the endangered fish species in the San Juan River and to mitigate adverse impacts of water development and water management activities in the basin. The SJRBRIP has identified a need to implement capital works to recover the endangered fish at a tentatively estimated cost of about $18 million. These works include fish passage structures at diversion dams, fish screens on diversions and physical habitat modifications. Such works have been designed and are being implemented at the Hogback, Fruitland and PNM diversion weirs. Federal legislation provides for cost-sharing of such works in the San Juan River and Upper

Colorado River basins among the Secretary of the Interior, the Upper Basin States and CRSP power users. New Mexico's estimated share of the cost is about $2.74 million.

The San Juan River Basin, as well as elsewhere along the Colorado River system, also provides habitat for the endangered southwestern willow flycatcher, which breeds exclusively in riparian areas in the southwestern United States. The impacts of river regulation and dewatering by water development on native riparian vegetation and ecosystems have been cited as a principal cause for decline of the species. In some instances, flycatcher habitat has been established along reservoir shorelines or within reservoir areas during periods of low storage. Some organizations have raised concerns regarding the impact of fluctuating water levels in reservoirs on flycatcher habitat.

Under the Clean Water Act, point source discharges are regulated by the U.S. Environmental Protection Agency pursuant to permits written to protect against violation of the State of New Mexico's stream water quality standards. Wastewater discharge permits to the San Juan River may need to be rewritten if the Bureau of Reclamation adopts and implements its proposed Navajo Dam operation. The New Mexico Environment Department currently is in the process of establishing total maximum daily load standards for streams in the San Juan River Basin to develop a plan for reducing non-point pollution loadings to reaches where water quality is impaired as compared to the standards.

When the State of New Mexico committed to participate in the SJRBRIP, it agreed to protect from diversion the releases of water from Navajo Dam that are made to benefit the endangered fish in the San Juan River. Protecting Navajo Dam storage releases will help to maintain ESA compliance and needed water supplies for federal water projects and their contractors in New Mexico.

To date, New Mexico has not administered diversions. However, record drought in the San Juan Basin during 2002, combined with dam releases to provide for endangered fish habitat while overcoming excessive diversions from the San Juan River below Navajo Dam, resulted in substantial declines in Navajo Reservoir storage and the possibility of water supply shortages to water contractors in 2003. Consequently, the Bureau of Reclamation and the Navajo Nation requested that the State Engineer administer diversions in the San Juan River Basin in 2003. In the meantime, the Navajo Nation and other water users in the basin, along with the State of New Mexico and the Bureau of Reclamation, were able to negotiate and implement an unprecedented shortage sharing agreement, averting the need for administration. At the end of 2003, however, Navajo Reservoir storage is even lower, and negotiations for another shortage sharing agreement are once again underway even as the State Engineer prepares for administration if it proves necessary in 2004.

To prepare for administration of diversions, the ISC is funding cooperative installation and improvement of metering facilities on irrigation ditches on the San Juan, Animas and La Plata rivers. Municipal and industrial diversions in the basin already are metered. While the La Plata River diversions currently are measured and administered by a local water master, irrigation diversions in the remainder of the basin are not administered. Other factors to address before implementing administration include the development of specific shortage sharing criteria among Navajo Reservoir supply water contractors and hydrologic criteria for administration of direct flow rights in the basin.

The State Engineer has appointed a task force comprised of selected water users in the San Juan River Basin to evaluate current hydrologic conditions and river administration concerns, and to make recommendations regarding the operation or administration of the rivers. While the 2003 request to administer diversions in the basin was brought on by drought, New Mexico will have to address these issues in any event as it approaches full use of its Upper Basin Compact apportionment.

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