

## **COLLABORATIVE SOLUTIONS TO COMPLEX PROBLEMS: A PECOS RIVER BASIN, NEW MEXICO CASE STUDY**

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### **ABSTRACT**

The Pecos River, a tributary of the Rio Grande, flows through eastern New Mexico for 500 miles and across four dams until it reaches the New Mexico-Texas state line south of Carlsbad, NM. The complex river system gains flows from snowmelt, flood inflows, and groundwater base inflow. The Pecos River Basin provides water to three irrigation districts, two of which rely primarily on surface water flows; the third pumps groundwater for irrigation. The New Mexico Interstate Stream Commission and the Office of the State Engineer (NMISC/OSE) are the primary state agencies jointly charged with water resource management in the basin.

One of the most important legal constraints on the system is the Pecos River Compact, which was ratified by New Mexico and Texas and approved by the U.S. Congress in 1948. Additionally, the fully appropriated basin is not completely adjudicated, adding additional legal stresses. To further complicate the basin's legal setting, the Pecos River is home to a federally threatened species of fish, the Pecos bluntnose shiner. As a result of the complex hydrologic conditions and legal constraints present in the Pecos River Basin, the NMISC/OSE has responded in innovative ways to provide solutions for meeting the water demands of various stakeholders in the basin.

The State has served as a facilitator, to bring numerous stakeholders with varying interests together to negotiate a settlement to a long-standing adjudication suit. To support the settlement process, the NMISC/OSE created a suite of models known as the Pecos River Decision Support System (PRDSS), which models the complex hydrology and river operations of the Pecos River system. As a result of the settlement, the agency is purchasing land and appurtenant water rights, the majority of which will be transferred to a large capacity well field, currently being constructed. These actions are intended to increase river flows and to prevent a priority call for Compact compliance. Additionally, the agency has become involved in Endangered Species Act and National Environmental Policy Act compliance activities, traditionally considered federal processes. Overall, the NMISC/OSE has been compelled to expand its role as water resource manager in

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the basin in order to provide long-lasting solutions to the water conflicts on the Pecos River.

## INTRODUCTION

The Pecos River is a typical western American desert river system surrounded by issues of complex hydrology, interstate/intrastate conflicts, endangered species law, and politics, that requires the State of New Mexico to take an atypical approach to water resource management compared to other river systems in the region. The purpose of this paper is to describe the setting that surrounds the Pecos River Basin and explain the steps that have been taken to balance the many competing needs that occur within the basin. Specifically, it is important to share with other water management agencies the approach the New Mexico Interstate Stream Commission and the Office of the State Engineer (NMISC/OSE) has taken to ensure that the necessary parties work together to develop long-lasting solutions to the basin's challenges.

### **Description of the Pecos River Basin**

Geography: The Pecos River originates in the Sangre de Cristo Mountains, in north central New Mexico. From its headwaters, it flows 500 river miles through eastern New Mexico and captures 19,000 square miles of New Mexico drainage area. As it flows, the river crosses four dams, irrigates approximately 45,000 acres of farmland, passes through two sections of federally designated critical habitat, and finally crosses the New Mexico-Texas state line south of Carlsbad, New Mexico (Figure 1). Once across the state line, the river flows another 400 river miles to its confluence with the Rio Grande near Langtry, Texas.

The majority of the Pecos River Basin is categorized as desert or semi-desert. The average rainfall across the basin is 11-15 inches per year. In the southern portions of the basin, where much of the agriculture economy is located, average summer temperatures vary from the high 60s to low 100s.

Hydrology: The water supply in the Pecos River Basin is derived from three sources: snowmelt runoff from the northern mountains, flood inflows from summer monsoon events, and groundwater inflows. The annual snowmelt and runoff from the Sangre de Cristo Mountains has averaged 50,000-60,000 acre-feet per year over the last 30 years. The flood inflows are, on average, the largest source of surface water supply in the basin, but are also highly variable. The largest flood events have recorded hundreds of thousands of acre-feet. In other years, the lack of flood inflows coincides with the most significant drought periods in the basin. Intermittent flow conditions in the river during the summer months are not uncommon.

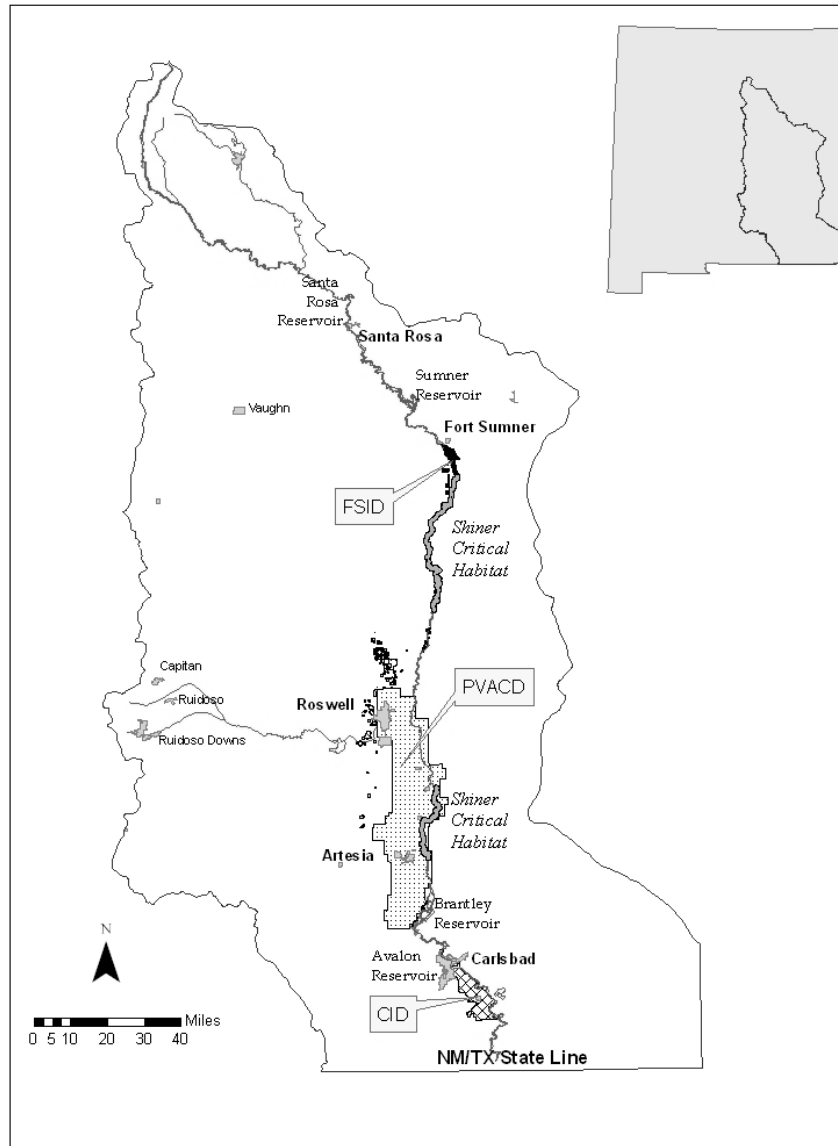


Figure 1: Map of Pecos River Basin, New Mexico

Groundwater inflow, or base flow, is an important contributor to the Pecos River's water budget. Base flows occur in three main locations along the river. The most northern source of base flow originates from the springs located near Santa Rosa, NM. These springs contribute 36,000-60,000 acre-feet annual to the river. Downstream, south of Roswell, base flow originates in artesian and shallow aquifers. This area is called the Roswell Artesian Basin (RAB) and is recharged by the mountains and tributaries to the west of the Pecos River. The base inflow from the RAB has been as high as 120,000 acre-feet and as low as 15,000 acre-feet (Longworth and Carron, 2003). The wide fluctuation in the base flow can be contributed to a groundwater-dependent agriculture economy developed in the region in the early 1900s. Continuing south, the final location of large base

inflows occurs in the Carlsbad area, from the Capitan aquifer and agriculture return flow. Base flow from the Capitan aquifer has been largely eliminated due to groundwater diversions. The agricultural return flow typically provides 30,000 acre-feet to the Pecos River (id).

### **Key Stakeholders**

**NMISC/OSE:** The New Mexico Interstate Stream Commission and Office of the State Engineer (NMISC/OSE) is charged with actively protecting and managing the water resources of New Mexico for beneficial uses by its people, in accordance with the law (NMISC Strategic Plan, 2004). Specifically, in the Pecos River Basin, the NMISC must comply with the Pecos River Compact, signed in 1948 by New Mexico and Texas, and the U.S. Supreme Court Amended Decree, issued in 1988. In 2001, the NMISC coordinated communications in the basin that resulted in the Carlsbad Project Settlement Agreement, signed in 2003 (Reclamation, 2006).

**Federal Agencies:** The Bureau of Reclamation (Reclamation) is the major federal stakeholder in the Pecos River Basin. Reclamation owns three of the four dams on the Pecos River. Reclamation is under contract with CID to store and deliver water for the purpose of irrigation. Reclamation, through the U.S. Department of the Interior, is a party to the Settlement Agreement. As the lead federal agency in the basin, Reclamation has the responsibility to consult with the U.S. Fish and Wildlife Service (FWS) on endangered species issues. The FWS is responsible for ensuring that other federal agencies plan or modify Federal projects so that they will have minimal impact on federally listed species and their habitats (Shipley, 2004).

**Irrigation Districts:** The Carlsbad Irrigation District (CID) has the most senior surface water storage right in the basin and is authorized to irrigate 25,055 acres of cropland. In 1976, the CID requested that the New Mexico State Engineer implement the doctrine of prior appropriation through a priority call. The request was not approved for several reasons: legal limitations due to a lack of adjudication and a determination of “futility”. The State Engineer determined that curtailing Upper Pecos junior surface water users and the slow response time of groundwater accrual to the river in the lower Pecos from curtailing junior groundwater users would not result in a significant increase to the CID surface water supply. The State Engineer determined that the priority call would ultimately reduce the water supply available to many users (Reynolds, 1976). To date, the CID has not withdrawn their request. The Pecos Valley Artesian Conservancy District (PVACD) irrigates nearly 100,000 acres and represents the groundwater users in the basin. PVACD is located upstream from CID and intercepts much of the groundwater flow that would otherwise reach the Pecos River and contribute to CID’s surface water supply.

## LEGAL SETTING

A complex legal setting defines, to a large extent, how water is managed in the basin. Both federal and state constraints exist. Several of the more prominent laws are described below. In addition, a combination of State water law, including the doctrine of prior appropriation, various adjudications, State Engineer Orders and Decrees, and Active Water Resources Management define the Pecos Basin water use regulatory environment.

### **Pecos River Compact and Amended Decree**

In 1947, New Mexico and Texas negotiated the Pecos River Compact (Compact), which was ratified by the U.S. Congress in 1948. In 1988, as a result of a lawsuit filed by Texas against New Mexico, the U.S. Supreme Court issued an Amended Decree (Decree), which appointed a federal River Master and established an accounting methodology to verify state line water deliveries. In addition, New Mexico was required to pay a \$14 million fine for past Compact violations. As part of the Decree, New Mexico is required to meet its Compact obligation with the delivery of water; monetary compensation is not permitted. The State can over-deliver water in any single year and accrue a state line credit, however failure to deliver sufficient water such that a net shortfall occurs is a violation of the Compact and Decree. Since 1988, New Mexico has struggled with maintaining compliance with the Compact and Decree, which enjoins the State from defaulting on its annual obligation to deliver Pecos River water to the State of Texas. New Mexico's failure to comply with the terms of the Compact and Decree could result in the federal government intervening to manage water operations on the river to ensure Compact compliance.

### **Water Resource Conservation Project (NMSA §72-1-2.2)**

In 1991, the New Mexico Legislature recognized that a water shortage existed in the Pecos River Basin and that maintaining compliance with the Compact based upon natural flows of the river would be difficult. As a result, they drafted legislation to create a Water Resource Conservation Project (NMSA §72-1-2.2) and the NMISC began purchasing and retiring water rights and leasing water from farmers in the basin. The leased water is used specifically for state line delivery to maintain compliance with the Compact, while the purchased water is retired to increase river flows.

### **NEPA**

The National Environmental Policy Act (NEPA) of 1969 requires federal agencies to evaluate and publicly disclose the environmental effects of any "major federal action" prior to making a decision to proceed with that action. The environmental evaluation is usually documented in an Environmental Assessment (EA), or less commonly an Environmental Impact Statement (EIS). NEPA encourages federal

agencies to coordinate and cooperate with state and local governments when a major federal action is contemplated to occur within their jurisdiction. Due to the Pecos River Compact and Settlement Agreement, almost any major federal action related to water resource management that occurs within the Pecos River Basin prompts the involvement of the NMISC/OSE.

### **ESA**

The Endangered Species Act (ESA) of 1973 mandates all Federal agencies to protect threatened and endangered species and preserve their habitats. Agencies must use their authorities to conserve listed species and make sure their actions do not jeopardize the continued existence of a listed species (Shipley, 2004). The Pecos River Basin contains many federally threatened and endangered species. Those species most often involved in the Pecos water management discussion include: the Pecos bluntnose shiner (shiner) (*Notropis simus pecosensis*), Interior least tern (*Sterna antillarum athalossos*), Pecos assiminea (*Assiminea pecos*), Noel's amphipod (*Gammarus desperatus*), Roswell springsnail (*Pyrgulopsis roswellensis*), Koster's springsnail (*Tryonia kosteri*), and the Pecos sunflower (*Helianthus paradoxus*). All seven of these federally protected species are dependent on water resources in some way. The shiner lives in the mainstem of the Pecos and can be negatively affected by Pecos river operations. The Interior least tern is a bird species that has recently nested within the conservation storage space of Brantley Reservoir. The Pecos assiminea, Noel's amphipod, Roswell springsnail, and Koster's springsnail are invertebrate species that occur at sinkholes, springs, and associated wetlands near the Pecos River. The Pecos sunflower is dependent on wetland areas near spring seeps and cienegas.

## **SOLUTIONS**

### **Consensus Plan and the Carlsbad Project Settlement**

In the summer of 2001, the NMISC/OSE announced that the potential for a delivery shortfall at the state line existed. The proposed response to this situation was the implementation of priority administration. Under priority administration, water right holders would have their water usage involuntarily curtailed until Compact delivery requirements are met. To consider alternative measures, the NMISC/OSE facilitated the creation of an *ad hoc* committee comprised of representatives from local governments, industries, and agriculture who were charged with creating both short and long-term solutions to the ongoing issues associated with complying with the Compact and Decree. Formation of the *ad hoc* committee was monumental in itself. Many of the members and the entities they represented had long-standing disputes over water issues.

The committee reached a consensus to resolve both interim and permanent issues regarding Compact delivery obligations (Consensus Plan) (LPRBC, 2002). The

Consensus Plan and a budget request were presented to the New Mexico Legislature. The resulting legislation, NMSA §72-1-2.4, was based, in part, upon the resolutions of the Consensus Plan; additional requirements were established and the program was partially funded. Key components of the statute are: 1) purchasing farmland and appurtenant water rights of varying amounts in the Carlsbad, Roswell, and Ft. Sumner areas, 2) settling a 50-year old lawsuit, known as the Lewis Adjudication, between the CID and PVACD, prior to any purchases, with contractual agreement between all parties, and 3) establishing priority of purchases (King and Sims, 2005). Elements from the statute were incorporated into the Carlsbad Project Settlement Agreement (Settlement).

The U.S. Department of the Interior, State of New Mexico, NMISC, CID, and PVACD entered into the Settlement in early 2003. At its core, the Settlement resolves a long-standing adjudication lawsuit in the Pecos Basin between the CID and PVACD. The Settlement has three primary components: 1) Entry of a Partial Final Decree (PFD), 2) Implementation of the Consensus Plan, and 3) Completion of Federal NEPA compliance activities. The PFD judicially establishes the allowable annual diversion and storage rights of the United States and the CID, and CID's right to deliver water for members of the CID (State of New Mexico, 2003). The Consensus Plan requires the State to purchase a minimum of 4,500 acres of land and water rights in the CID and 7,500 acres of land and appurtenant senior artesian water rights in the RAB. Full implementation of the Settlement requires the purchase and retirement of 18,000 acres and appurtenant water rights. Additionally, the Consensus Plan requires the NMISC/OSE to develop an augmentation well field capable of producing 15,750 acre-feet of water annually to the river to supplement CID water supply, and aid in meeting Compact delivery obligations. All acreage amounts established by the Consensus Plan were negotiated by the Settlement parties. These amounts were modeled using the decision-making tools (described in the PRDSS section below), found to be acceptable, and were finalized, before signing the Settlement. Finally, as part of the Settlement, the State is required to complete two environmental impact statements, described below.

The New Mexico Legislature has partially funded the Settlement. To date \$66.5 million have been appropriated for implementation. It is estimated that an additional \$30 million is required for full implementation. The State has acquired 2,350 acres in CID, and 4,138 acres in RAB all with appurtenant water rights. NMISC/OSE has developed the full augmentation well capacity, however pipeline delivery infrastructures are still being constructed. The well field project has also been supported by a \$1 million grant (State matching funds required) from the federal Water 2025 Program.

## NEPA

Currently, the NMISC/OSE is jointly leading the development of two Environmental Impact Statements (EIS) with Reclamation. Completion of the EIS documents will satisfy one component of the Settlement.

Carlsbad Project EIS: The Carlsbad Project Water Operations and Water Supply EIS involves the federal action of modifying river operations between Sumner Reservoir and Brantley Reservoir to provide water for the shiner. Historically, Reclamation has operated the dams on the Pecos River to maximize the delivery efficiency of irrigation water for use by CID. This method of controlling flow in the river has resulted in river drying during hot, dry summers. The section of the river that is most susceptible to drying has been classified by the FWS as critical habitat for the shiner. The Carlsbad Project EIS attempts to strike a compromise between the needs of CID and the needs of the shiner. NMISC/OSE is involved in NEPA process to ensure 1) the State's interests in the Pecos River Compact are protected, 2) the modified river operations do not result in new depletions, and 3) the Settlement is not compromised.

Long Term Miscellaneous Purposes Contract EIS (LT MPK EIS): The NMISC/OSE and Reclamation are jointly preparing the LTMPK EIS to evaluate the environmental impacts of entering into a long term contract that converts Carlsbad Project water from irrigation purposes to purposes other than irrigation, specifically state line delivery. This contract would enable the state to take delivery of its portion of the annual allotment of Project water and any water that it may lease from CID members and release it to the state line. Under the contract, the State will have the ability to divert up to 50,000 acre-feet annually for state line delivery, for a term of 40 years.

## ESA

Over the last five years, the NMISC/OSE has become more involved in conservation efforts related to federally threatened and endangered species. Traditionally, it is the role of the FWS and the NM Department of Game and Fish to undertake research and monitoring activities to conserve special status species on the state level. Due to potential impacts of species conservation efforts on the Pecos River Compact, the Settlement Agreement, and existing water rights, the NMISC/OSE has been compelled to become a more active participant in these ESA discussions and activities, as they relate to the Pecos River Basin.

One approach the NMISC/OSE has taken is to obtain legislative funding to conduct unique research activities on the river to determine the habitat and stream flow needs of the shiner. For example, in 2004, the agency funded an "egg drift" study that evaluated the amount of egg retention between Sumner Reservoir and Brantley Reservoir during a routine release of water for irrigation (called a block release). The purpose of the study was to determine if block releases were

affecting the ability of the shiner to survive in the main stem of the Pecos River (Kehmeier and Medley, 2004). The project resulted in a determination that block releases, when kept to certain duration, did not constitute a threat to the shiner. It was also determined that management activities should focus on shiner habitat protection instead of block release regulation.

The NMISC/OSE has also taken steps to investigate the idea of re-introducing the shiner into other reaches of the river within the fish's historical range. The agency plans to be actively involved in the recovery planning process with the FWS in the near future. The NMISC/OSE understands that in order to regain the flexibility in water management on the Pecos River, the recovery of the shiner is necessary.

### **PRDSS**

In response to the many conflicts and challenges in the Pecos River Basin, the NMISC/OSE developed a suite of hydrologic models referred to as the Pecos River Decision Support System (PRDSS). The PRDSS includes a RiverWare surface water model of the Pecos River, two groundwater MODFLOW models – the Carlsbad Area Ground Water Model (CAGW) and Roswell Artesian Basin Ground Water Model (RABGW), the Red Bluff Accounting Model (RBAM), and a Data Processing Tool (DPT). The models are based on the best available scientific data and standard, widely accepted methods. The PRDSS has been used extensively to evaluate the effects of potential modified river operations and the effects of the Settlement.

The PRDSS has been a valuable decision-making tool for quickly modeling and evaluating the outcomes of various agreements and policies implemented in the Pecos River Basin without waiting years to observe the physical results of management decisions. The NMISC/OSE sees the PRDSS as another step the state agency has taken to ensure that the state's interests are protected and the Compact obligations are met. The PRDSS is an important tool that provides technical information to decision makers to guide their management strategies.

### **SUMMARY**

The NMISC/OSE has taken the steps necessary to ensure the Pecos River Basin stakeholders work together to develop long-lasting solutions to the basin's water resource challenges. These proactive steps have required the State to redefine its role from traditional water resource management agency to facilitator with other federal and state agencies. The State is continually challenged with finding the optimal solution to the many competing demands on the Pecos water supply including the needs of endangered species, irrigation districts, and federal Compacts. The ongoing activities in the Pecos Basin are representative of the types of activities currently being managed by the NMISC/OSE throughout the State.

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