A Watershed Protection Plan for the Pecos River in Texas

An Overview

March 2010

AgriLIFE RESEARCH & EXTENSION
Texas A&M System

TEXAS A&M UNIVERSITY

Funding for this project was provided through a Clean Water Act §319(h) Nonpoint Source Grant from the Texas State Soil and Water Conservation Board and the U.S. Environmental Protection Agency.

For more information on the WPP or to get involved in WPP implementation, visit the project Web site at pecosbasin.tamu.edu.

Texas Water Resources Institute
make every drop count

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Soil Water TSSWCB
Texas State Soil & Water Conservation Board

A Watershed Protection Plan for the Pecos River in Texas
An Overview

The Watershed Protection Plan for the Pecos River in Texas (WPP) is a plan to restore water quality in the river and generally improve watershed health. Watershed landowners provided input and guidance to a project team consisting of the Texas AgriLife Extension Service, the U.S. Section of the International Boundary and Water Commission, Texas AgriLife Research, the Texas Water Resources Institute and the Texas State Soil and Water Conservation Board. The WPP describes water quality and quantity concerns and other natural resource issues for the Pecos River watershed and provides practical, landowner-supported solutions to address these concerns.

The WPP serves as a mechanism for addressing complex water quality problems across the entire Pecos River watershed in Texas and is being used as a tool to integrate activities and prioritize implementation projects based upon technical merit and benefits to the Pecos River landowners. The WPP promotes a unified approach to seeking funds for implementation and creates a coordinated public communication and education program. The overall goal of the WPP is to sustain a landowner-driven process to promote voluntary best management practices throughout the watershed that will improve water quality and overall health of the watershed.

Communicating with Landowners

The Pecos River Watershed Coordinator is responsible for coordinating and facilitating implementation of the WPP and serves as the primary conduit of information to landowners regarding the WPP and implementation efforts. The Pecos River Watershed Coordinator is responsible for tracking the implementation of specific management measures and education programs and for

Living saltcedar along the Pecos River near I-20

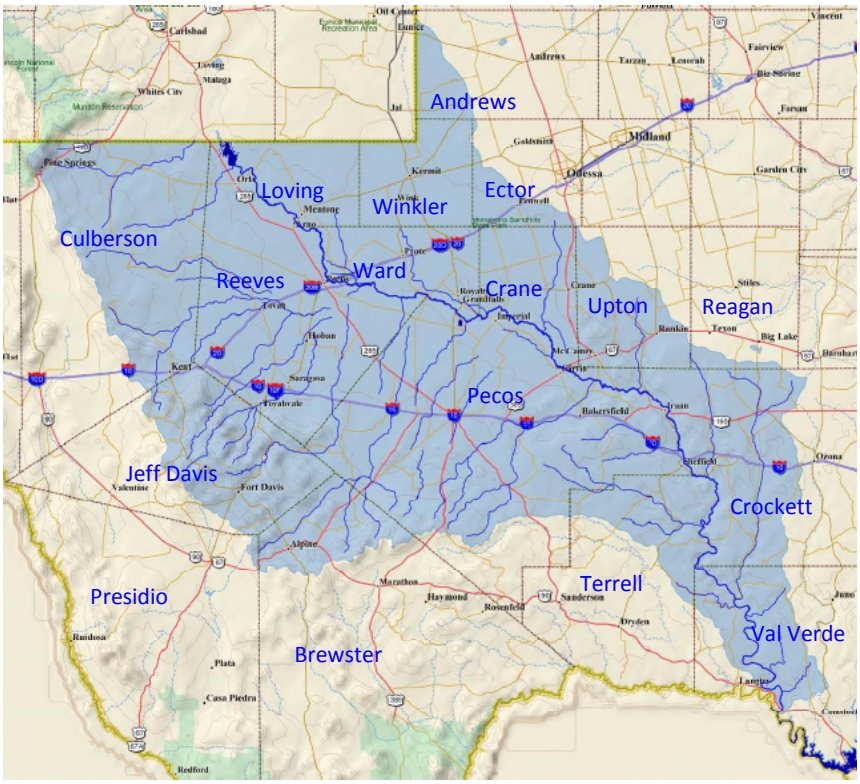
reporting to landowners on the progress in achieving the water quality and other natural resource goals identified in the WPP.

The project Web site serves as a source of information for anyone interested in learning more about the WPP and the associated technical reports. The WPP and the reports are available at the project Web site: pecosbasin.tamu.edu.

The Pecos River Watershed

The Pecos River flows 926 miles from its headwaters in the Sangre de Cristo Mountains of northern New Mexico south to its confluence with the Rio Grande. The watershed covers portions of western Texas and eastern New Mexico and is the largest U.S. tributary of the Rio Grande.

In Texas, the river traverses 418 miles of the driest part of the state and the watershed encompasses all or parts of 17 counties as it spans approximately 10 million acres. This river has long served as a vital source of water throughout the Trans-Pecos region and exhibits starkly different characteristics within its reaches. Landowners indicated that Interstate 10 (I-10) is an appropriate dividing line when it comes to differentiating the Pecos River into upper and lower portions. North of I-10, the river and its watershed is predominately flat or gently rolling landscapes, dominated by smaller brush species while the southern part of the watershed, south of I-10, is filled with plateaus and valleys that are dominated by larger brush species.



Pecos River watershed in Texas and included counties

The volume and quality of water above and below this dividing line also differs drastically. Above I-10, irrigation waters periodically released from Red Bluff Reservoir near the state line provide the bulk of flow with minimal inputs from intermittent streams following infrequent rain events. Water in this part of the river typically flows slowly and is often quite muddy. Below I-10, water quality and quantity drastically improve. An increased number of springs and flowing tributaries add life to the river. Waters are typically clear and the more rugged landscape provides rapid elevation changes that produce a swift current and rapids throughout much of the lower portion of the river.

Human influence over the past 150 years paired with the harsh Trans-Pecos climate has undoubtedly changed the river and led to declines in water quality, water quantity, and the health of the watershed. The WPP, when implemented, will restore water quality and attempt to supplement water quantity while simultaneously improving the health of the watershed and supporting landowners' management goals and objectives.

Watershed Concerns

Landowners expressed a host of concerns that they believe ultimately influence the quality and quantity of water in the Pecos River. Landowners were polled during public meetings regarding their concerns for the river and watershed. Results shown in Table 1 illustrate their concerns and served as a road map for WPP development. Other water quality concerns included in the WPP were derived from the *2008 Texas Water Quality Inventory and 303(d) List*, which outlines water quality impairments and concerns for waterbodies across Texas. Included in this list were dissolved oxygen impairments, golden algae concerns, and concerns for elevated levels of nutrients in the Pecos River and Red Bluff Reservoir. Increasing trends in salinity levels in the International Amistad Reservoir also pose a concern for the Pecos River as it annually contributes an estimated 26 percent of salt loading to the reservoir as compared to only 9.5 percent of the reservoir's total annual inflows.

Table 1. Landowner Concerns for the Pecos River Watershed in Order of Occurrence

Concern	*Total*
Brush Control	118
Preservation of Private Property Rights	110
Water Quality (salinity)	91
Landowner Education	46
Water Quantity	42
Funding for Projects	19
Loss of Water Rights to New Mexico	15
Water Marketing to other parts of Texas	14
Low Population Shouldn't Equal Low Priority	12
Let Natural Processes Work	11
Standing Dead Saltcedar Removal	10
Limit Development of Platted Subdivisions	7
Minimize Government Regulation	7
Promote Revegetation	6
Recreational Uses	5
Wildlife Habitat	3
Riparian Management	3
Negative Impacts of Dams	1

What's in the Plan

The WPP is a broad-based document that includes an extensive overview of the watershed and the physical characteristics that define the watershed. The WPP outlines broad concern categories that include many of the specific issues voiced by watershed landowners. After each concern is identified, information on the *Causes and Sources, Critical Areas for Management, Estimated Load Reductions, Management Measures,* and *Assistance Needed* illustrate what will be done in each situation. A summary of each major concern presented in the WPP is outlined below.

Salinity: The sources of elevated salinity in the Pecos River are naturally occurring salt deposits across the Permian Basin and saline groundwater entering the river in several locations. Human influences and activities can alter the effects of natural sources of salt on the river's salinity. These sources occur in New Mexico and Texas, yet both influence the quality of water in Texas. Two critical areas for management and further investigation are the groundwater intrusion points near Malaga, NM and Imperial, TX. A pilot project conducted near Malaga, NM in the 1960s verified that a 25 percent load reduction in salinity is feasible through pumping a saline aquifer and harvesting the salt. Similar results could be expected near Imperial if this practice is implemented there. Although highly saline inflows have been noted near the Imperial area, specific information about the intrusion point and salinity of these inflows is currently unknown. Further information will be needed prior to implementing management measures in this area.

Living and dead saltcedar along the Pecos River near Girvin, Texas

Saltcedar (*Tamarix spp.*) removal and subsequent water salvage also has the ability to decrease salinity. Decreases in salinity will be inversely related to increases in streamflow because of saltcedar removal. Previously treated saltcedar and planned saltcedar treatment also have the ability to influence in-stream salinity concentrations if salvaged water materializes as streamflow. Saltcedar control is discussed in detail in the *Biological Diversity* section.

Biological Diversity: Biological diversity refers to a variety of features in the watershed that can include aquatic, riparian, and upland vegetation; aquatic life species; and wildlife species. The changes in these aspects of the watershed are due primarily to human influences occurring over the last 150 years. The combination of overgrazing in the late 1800s, extensive droughts, the introduction of the invasive species saltcedar, and the increased use of water from the river and aquifers have been the driving factors in changing the biological diversity. Critical areas for improving biological diversity have been identified in three primary areas: riparian brush control and revegetation, upland brush management, and aquatic habitat improvement. Specific management measures recommended to achieve biological diversity restoration are widespread saltcedar control followed by prescribed burns to remove debris and promote natural revegetation, controlling other invasive species in riparian areas such as giant cane and willow baccharis, conducting upland

brush control and implementing improved land management practices, and working to improve aquatic habitat.

Estimated changes in biological diversity are extensive and it will take many years to fully realize these changes. Over 2,000 acres of invasive saltcedar trees remain to be treated in the riparian corridor along with undocumented new growth and regrowth from previously treated saltcedar. Chemical treatment paired with biological control is not anticipated to eradicate this invasive species but rather to prevent it from consuming thousands of acres as it has in the past. Aquatic habitat, also expected to improve over an extended period, will be dependent upon many of the management measures implemented throughout the watershed.

Water Quantity: Water quantity issues are always a concern in a desert environment. Causes of water shortages in the river are a combination of climate and increased water consumption throughout the watershed. Critical areas for managing water quantity are improving on-farm irrigation and delivery of irrigation water, promoting water conservation throughout the watershed, controlling invasive plant species, and promoting new management practices to enhance existing land stewardship. Estimated improvements in water quantity are primarily derived from irrigation efficiency improvements, reservoir release modifications, and saltcedar control. Irrigation efficiency of 95 to 97 percent can be achieved using drip irrigation technology, thus making a 20 percent savings realistic as compared to surge flow irrigation. Reservoir releases currently lose more than 50 percent of the released water, and research shows that these losses could be reduced to around 35 percent. Lastly, saltcedar removal is anticipated to salvage 0.5 to 1 acre-foot of water per acre of saltcedar treated and this salvaged water should supplement shallow water tables or streamflow.

Golden Algae: Toxic blooms of golden algae have been documented in the Pecos River since 1985 and have caused the deaths of more than 2 million fish, according to Texas Parks and Wildlife Department estimates. Little is known about this species and management measures for large waterbodies are likewise limited. Multiple state and federal agencies are evaluating the feasibility and effectiveness of various management strategies.

Dissolved Oxygen: Improving dissolved oxygen (DO) levels in the river between Pecos and Girvin is one of the primary objectives of the WPP. Maintaining sufficient DO levels in the river is critical to the survival of aquatic life and an indicator of overall river health. The critical area for improving DO levels in the river is the stretch between Business 20 near Pecos downstream to US 67 near Girvin. Data collected

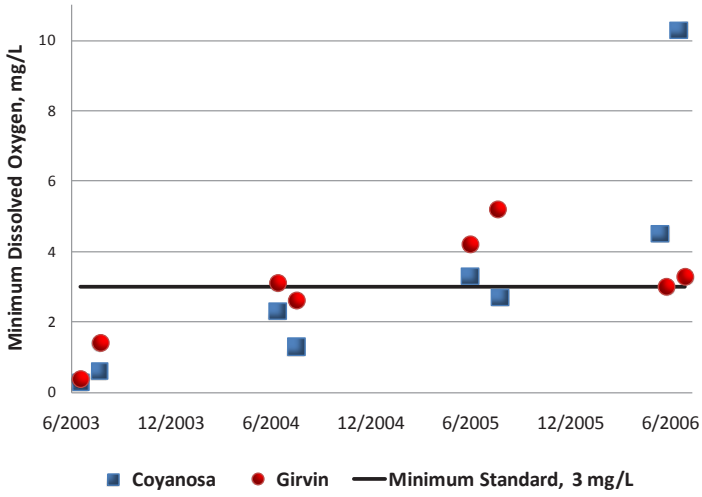


Figure 1: 24-hour minimum DO data collected at Coyanosa and Girvin and used in the 2008 water quality assessment resulting in the waterbody's impaired status

in this area over a three-year period as illustrated in Figure 1 resulted in this reach of the river being listed as impaired on the *2008 303(d) List* for not meeting current water quality standards. Depressed DO can stem from a variety of causes and sources such as low flows, high nutrients and algal growth, higher salinity, and increased biological oxygen demand; however, these have not been fully evaluated for the Pecos River. Planned work will use computer-based modeling to evaluate the influence of environmental parameters on in-stream DO levels.

Without a sound understanding of the causes leading to low DO levels, appropriate management measures cannot be recommended; however, increasing the agitation of the river, decreasing water temperatures and salinity in the river, decreasing the amount of dead organic matter in the river, and reducing nutrient loading into the river will all positively affect DO levels in the river.

Sediment: Sediment loading in the Pecos River is not a major problem in most areas; however, planned saltcedar debris removal activities will increase the risk of excessive sediment until vegetation is re-established. Establishing healthy ground cover in upland and riverbank areas will have the greatest positive impact on sediment levels and may increase available grazing in the watershed. Critical areas where erosion potential will need to be managed are in areas where saltcedar debris is burned. Sediment loading to the river will be reduced by 6,192 tons if all treatable areas are sprayed, burned, and subsequently revegetated.

Oil and Gas Production: The long-standing influence of the oil and gas industry in the Pecos River watershed has led to many landowner concerns about potential industry-related water quality impacts. Some landowners have reported abandoned wells, leaking wells, and/or improper brine disposal on their land or adjacent lands, all of which could pose significant threats to water quality. The critical area to watch for these activities and issues is in the upper portion of the watershed (above I-10) where exploration and drilling began almost 100 years ago and the bulk of today's oil and gas production in the region still occurs (see Table 2).

Table 2. Hydrocarbon Production in the Counties that make up the Pecos River Watershed

Note: Only counties reporting production are included; not all watershed counties are listed.	2006 Data		2002 Data
County	**Oil (BBL)**	**Casinghead Gas (MCF)**	**Total Injected Material (BBL)**
Andrews	24,347,354	32,838,714	347,603,281
Crane	9,413,072	44,244,598	161,443,362
Crockett	1,668,572	1,584,007	58,972,170
Culberson	110,606	165,998	1,586,900
Ector	18,292,257	27,998,446	325,277,218
Loving	1,053,702	2,968,704	13,980,329
Pecos	11,621,389	62,743,794	131,244,130
Reagan	645,016	3,005,827	46,518,770
Reeves	858,584	2,142,962	11,584,865
Terrell	856	11,114	349,780
Upton	2,903,629	2,461,256	90,949,153
Val Verde	1,852	5,612	15,570
Ward	5,196,940	15,522,984	55,248,443
Winkler	4,073,030	15,880,941	86,386,496
Pecos Totals	**80,186,859**	**211,574,957**	**1,331,160,467**
Texas Totals	**346,988,668**	**679,640,996**	**5,367,018,227**
Percent of State Totals	**23.1%**	**31.1%**	**24.8%**

On management measure recommended in the WPP is to document the date and

location of abandoned wells, leaking wells, and/or improper brine disposal and report them to the Railroad Commission of Texas (RRC) or to the Pecos River Watershed Coordinator. Once problem areas are identified, solutions with industry and state and federal agencies can be achieved.

Nutrients and chlorophyll-a: Several segments of the Pecos River and Red Bluff Reservoir have elevated nutrient levels and are listed as concerns on the *2008 Texas Water Quality Inventory*. Critical areas for implementing nutrient management measures are in the upper portions of the watershed in Texas and in irrigated agriculture areas in New Mexico. The elevated nutrients in Red Bluff Reservoir indicate that excessive levels of nutrients are being delivered in the river from New Mexico. Management techniques and educational activities recommended in the WPP will help address this issue.

Management measures specific to nutrients are primarily education based. Educational programs and workshops will teach participants about proper nutrient management and will lead to reduced nutrient levels in the river. Coordinating with New Mexico is also a key to effectively managing nutrient levels in Texas.

Conservation Planning: Conservation planning is a voluntary tool landowners can use to pair their desired production goals for their ranch or farm with proven management practices known to have positive impacts on water quality and overall watershed health. Conservation plans are critical tools described in the Pecos River WPP to be used to implement many of the management practices recommended by landowners in the WPP. Local soil and water conservation districts (SWCDs) will provide technical assistance to landowners to develop conservation plans on agricultural lands in the Pecos River watershed. Further, SWCDs will assist landowners in acquiring financial assistance to implement the specific management practices landowners include

Natural riffle in the Pecos River

in their conservation plans. Financial assistance is available from the Texas State Soil and Water Conservation Board, the USDA Natural Resources Conservation Service and other entities for management practices that achieve the pollutant load reductions described in the Pecos River WPP, including cross-fencing, alternative water sources for livestock, rangeland planting, riparian buffers, and nutrient management.

Education and Outreach

The WPP outlines planned education and outreach programs, including meetings, workshops, short courses, and seminars. The Texas Watershed Steward Program, the Lone Star Healthy Streams Program, wildlife management workshops, irrigation management workshops, and nutrient management workshops will be the keystones of the educational efforts. The Pecos River Watershed Coordinator will facilitate and coordinate all education and outreach events and will work with watershed landowners to deliver desired education and outreach events.

Implementation Schedules and Milestones

The timeline for implementing recommended management strategies in the WPP provides a general idea of recommended management measures feasible now and in the future. Timing of actual practice implementation relies on many factors, including available funding, weather conditions, and establishment of cooperative agreements. All management measures discussed in the *Watershed Concerns and Management* section of the WPP are listed in the implementation schedule along with information on their costs, the expected number of each practice to be implemented, where technical or financial assistance can be found, and the expected timing for implementing each practice.

Irrigated cotton in the Pecos River watershed

The WPP also presents implementation milestones that outline specific management practices planned for the short-term (2010-2012), mid-term (2013-2015), and long-term (2016-2019+). These milestones serve as interim measures for the WPP and will be used to evaluate the success of implementing the WPP and achieving the water quality and other natural resource goals identified in the WPP.

Adaptive management will be used throughout implementation of the WPP as a tool to incorporate newly collected watershed information into planning and implementation efforts. New research,

monitoring data, and experiences in the field will be the driving factors behind the adaptive management process and will be critical in the future evolution of the WPP.

Monitoring

The WPP describes the water quality, quantity, aquatic habitat, and other data that will be collected and used to determine the effects of implementing the WPP. In crafting the WPP, Pecos River landowners sought to bolster the monitoring currently being conducted by numerous entities including the U.S. Section of the International Boundary and Water Commission (through the Texas Clean Rivers Program), the Texas Commission on Environmental Quality and the U.S. Geological Survey. Specifically, the WPP calls for funding to expand the existing continuous water quality monitoring network of five stations by installing new continuous monitoring stations near Girvin and at three other locations. These continuous water quality monitoring stations provide temperature, pH, DO, and specific conductance data readings every 15 minutes; this data is available to the public in near real-time on the Internet.

Continuous Water Quality Monitoring station on the Pecos River upstream of Business 20 crossing east of Pecos, Texas

Respecting Property Rights through Voluntary Participation

At the request of watershed landowners and in response to their concerns about private property rights and the potential for government units to direct management activities on private lands, the WPP clearly states that at no point will a landowner's private property rights be infringed upon through the implementation of the WPP. Choosing to implement management practices included in the WPP is 100 percent voluntary. Should landowners elect to receive financial assistance, they will be required to enter into contractual agreements with the respective parties providing the financial assistance. The guidelines and stipulations within these agreements will be made clear upfront and landowners will be able to make an informed decision regarding the specific agreement. The WPP has no regulatory implications and will not be used to force anyone to do anything. All actions taken as a result of implementing the WPP will be strictly voluntary.

For more information on the WPP or to get involved in WPP implementation, visit the project Web site at pecosbasin.tamu.edu or contact the Watershed Coordinator.