

Pecos River Basin Assessment Program

*Annual Report
December 2007*



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Partners
Texas AgriLife Extension
Texas AgriLife Research
International Boundary and Water Commission Clean Rivers Program
Texas Water Resources Institute



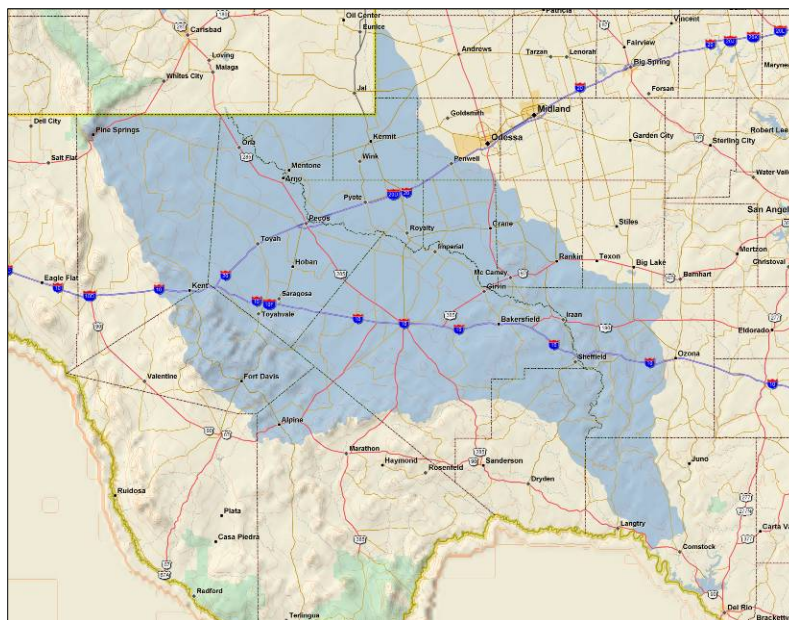
Table of Contents

Executive Summary	3
Introduction	4
Task 1 Basin Assessment	5
Aerial Photography, Delineation, and Characterization	5
Historical Water Quality, Irrigation Delivery, Rainfall, Red Bluff Lake Levels and Groundwater Monitoring.....	6
Aquatic Life and Habitat Inventory	6
Identify and Characterize the Volume and Quality of Tributaries and Springs	6
Identify and Characterize Saline Water Sources Entering the Pecos River	7
Simulate flow and Salinity of the Pecos River for Evaluating River Management Options	8
Economic Modeling of the Pecos River Basin and Assessment of Saltcedar Control Activities	8
Task 2 Educational Programming	9
Publish Written Informational Materials to Educate Private Landowners, Stakeholders, and Policy Makers about the Pecos River Basin and the Effects of Saltcedar	9
Educational Meetings of Interested Parties for Input and Organizational Support	11
Develop a Web site for Dissemination of Information	12
Task 3 Monitoring Program	12
Develop a QAPP for Sampling Protocol	12
Water Quality Monitoring, including Total Dissolved Solids, Total Suspended Solids. pH, Dissolved Oxygen, and Electrical Conductivity	12
Quantity and Fate of Water Salvage as a result of Saltcedar Control	13
Task 4 Watershed Protection Plan	14
Develop Annual Reports and a Final Report Summarizing Basin Assessment, Educational Programming, and Monitoring	14
Produce the Final Watershed Protection Plan for the Pecos River Segments 2312, 2311, and 2310	14

Executive Summary

The third year of the Pecos River Basin Assessment Program is now completed and the project will soon be moving into a different phase. The physical assessment of the river basin is completed in all but one subtask. The economic modeling subtask leader returned from active military duty in 2007 and resumed work on the project, to be completed in 2008. The U.S. International Boundary and Water Commission (USIBWC) and Texas Commission on Environmental Quality (TCEQ) coordinated and conducted an aquatic life and habitat survey on the Upper Pecos River above Independence Creek. The results of this study were combined with a replica study conducted by the United States Geological Survey (USGS) on the lower reaches of the river. The main focus of all other assessment activities focused on the completion of subtask final reports, resulting in five reports being published by the Texas Water Resources Institute (TWRI) during 2007.

A historical document including oral interviews that outline how Pecos River regional conditions have changed overtime was printed and distributed at meetings in the watershed. A complimentary condensed version of the historical publication was also drafted and printed. The project website has been continually updated as new material is published and posted for public use. This site will continue to serve as an outlet for project information and updates in the future. The first draft of the Watershed Protection Plan (WPP) for the Pecos River in Texas was completed and distributed to landowners and other interested parties. A series of five public meetings was held to receive comments regarding the WPP first draft and comments were also accepted online for a specified period of time. The WPP was also presented to local Soil and Water Conservation Districts throughout the Pecos Basin for informational purposes and to seek their feedback and support for implementing the plan.



Pecos River Basin of Texas

Introduction

The Pecos River is a greatly depleted western river winding 418 miles through hot, dry, semi-arid landscapes in Texas. It is the largest river flowing into the Rio Grande River in Texas. However, flow in the once great Pecos River has dwindled to a mere trickle due to many causes – both natural and man-induced. Its upper reaches in Texas now resemble a poor quality creek rather than a river.

Due to the lowered water quality and stream flows, the aquatic community of the Pecos River has been drastically altered according to fishery biologists and to local users of the river. No longer does it have a healthy diverse community of aquatic plants, invertebrates, microorganisms, fish and amphibians. The greatly reduced aquatic diversity has been negatively affected by changes in river hydrology, riparian community destruction, oil and gas activities, irrigation demands, long and short-term droughts, damming of the river and the desertification of the upland watershed due to grazing mismanagement. These factors have allowed introduced plant species, such as saltcedar, to dominate the riparian systems within the watershed.

According to IBWC data, Pecos River flow accounts for 11% of the stream inflow into Lake Amistad and 29.5% of the total salt loading. Salinity in Amistad exceeded 1000 ppm for a month in 1988, and has fluctuated since. It is important to control salt loading from the Pecos River to the Rio Grande River if we are to be successful in keeping salinity of Lake Amistad below 1000 ppm.

The decreasing water quality in the Pecos River has negatively affected the Rio Grande River. Being an international river, the Rio Grande is relied upon by both Mexico and the United States as a source of water for drinking, irrigation, and industry purposes. Users of the Rio Grande's waters depend heavily upon flow from the Pecos River to bolster the available supplies downstream. The Pecos River itself is also the lifeblood of many communities within its reaches, providing irrigation water, recreation, and recharge for underlying aquifers. The environmental condition of both the Pecos River and the lower Rio Grande River is extremely crucial to hundreds of thousands of residents of both Mexico and the U.S.

This project has assessed the physical features of the Pecos River basin, facilitated communications with landowners and other groups in all counties within the watershed, and has monitored the water quality of the Pecos River. Through this project a Watershed Protection Plan has been developed to assess current management measures as well as determine what future management measures will need to be implemented in the river basin to protect the water quality of the Pecos River.

Task 1

Basin Assessment

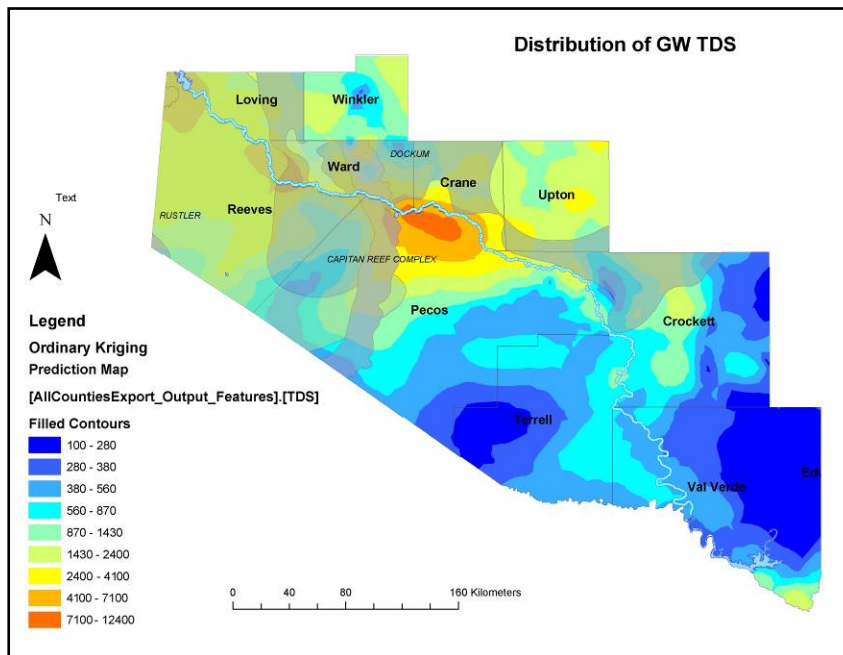
Subtask 1.1 Aerial Photography, Delineation, and Characterization

Investigator:

Dr. Charles Hart and Dr. Zhuping Sheng

The primary focus of activities related to this task in 2007 was the completion and publication of the subtask final report. The report was published by the Texas Water Resources Institute (TWRI) as “Geographical Information System Coverage for Characterization of the Pecos River Basin,” Technical Report 300. The report discusses procedures for data processing and mapping, and presents images produced using aerial imagery of the Pecos River from Grandfalls to the confluence of the Pecos and Rio Grande Rivers (214 river miles). Various maps included in the report were created using data downloaded from online environmental data sources.

Aerial photos were taken to determine the acreage of saltcedar sprayed to date within the Pecos Basin, and to help differentiate invasive and non-invasive vegetation (i.e. saltcedar, mesquite and other native species). Remote sensing was used to identify the various characteristics of stream channel locations, saltcedar overgrowth and treatment areas and land use. Geographical Information Systems (GIS) were used to develop a baseline assessment of the Pecos River Basin’s characteristics (Stream channel morphology, riparian vegetation aerial photography, etc.).



Map of
Groundwater
TDS
Distribution in
the Pecos Basin
(from subtask
1.1 final report)

Subtask 1.2 Historical Water Quality, Irrigation Delivery, Rainfall, Red Bluff Lake Levels, and Groundwater Monitoring

Investigator: Mike Mecke

The focus of this subtask in year 3 was the collection of groundwater data within the Pecos Basin and the development of the subtask final report. The unpublished final report has been used primarily as a resource for tables and figures to be included in the Pecos River Watershed Protection Plan (WPP). Background documents that provide historical information about the Pecos River basin and additional information were also collected and added to the project website; <http://pecosbasin.tamu.edu>.

Subtask 1.3 Aquatic Life and Habitat Inventory

Investigator: Wayne Belzer

The U.S. International Boundary and Water Commission (USIBWC) and Texas Commission on Environmental Quality (TCEQ) coordinated and conducted an aquatic life and habitat survey on the Upper Pecos River above Independence Creek. Samples were acquired in the same manner as the study completed as part of this project by USGS below Independence Creek. Data and biological samples from both studies were lab tested and analyzed by TCEQ. Resulting data includes aquatic habitat and species inventories at seven sampling sites between Red Bluff Reservoir and the confluence of the Pecos River and Rio Grande in Texas. These data and results are published by TWRI in the subtask final report titled “Aquatic Life and Habitat Inventory Assessment,” Technical Report 305.

The study concluded that the upper portions of the Pecos River have been influenced by irregular flows and high salinity values that have suppressed aquatic diversity and species richness. With the introduction of freshwater and regular flows in the Lower Pecos, biological indicators improve even though the habitat does not improve. Previous studies in the river show that little change has occurred over the past 20 years with some degradation in the biological diversity occurring in the upper portion of the Pecos River.

Subtask 1.4 Identify and Characterize the Volume and Quality of Tributaries and Springs

Investigator: Wayne Belzer

The absence of measurable water quantities in Pecos River tributaries precluded the majority of monitoring activities planned as part of this subtask. Activities in 2007 focused on the drafting the final report for this subtask. The report was based primarily on historical information and sediment samples collected at various tributaries including; Salt Draw, Toyah Creek, Coyanosa Draw, Barilla Draw and Hackberry Draw (Table 1).

The subtask report is published by TWRI as “Identifying and Characterizing the Volume and Quality of Tributaries and Springs,” Technical Report 302.

Tributary Sediment Analyses (from subtask 1.4 final report)

Site Location	Sodium (mg/kg)	Chloride (mg/kg)	Potassium (mg/kg)	Sulfate (mg/kg)	Nitrate (mg/kg)
Salt Draw 18860	371	13.8	6569	140	1.1
Toyah Creek 18861	899	42	4860	14109	7.5
Coyanosa Draw 18864	309	<5.0	5036	232	1.9
Barilla Draw 18862	418	<5.0	5502	39	1.7
Hackberry Draw 18863	412	<5.0	5527	44	3.8

Results of the sediment analyses show that none of the tributaries possess high concentrations of surface salt, suggesting they have little affect on the salt loading in the Pecos River during high rain events with the exception of possibly Toyah Creek due to high sulfate content in the soil. Any impact would be short lived and not be subject to a management plan. The report also suggests that subsurface flow from Salt Draw and Toyah Creek may be contributing salts to the Pecos River in its upper portion in Texas. Routine monitoring data on the lower Pecos River, Independence Creek, and in Amistad Lake shows that, in the Lower Pecos, perennial streams and springs introduce freshwater thereby reducing salt concentrations prior to the Pecos River entering Amistad Lake.

Subtask 1.5 Identify and Characterize Saline Water Sources Entering the Pecos River

Investigator: Dr. Seiichi Miyamoto

Work on this task was completed during 2006 and published by TWRI as “Reconnaissance Survey of Salt Sources and Loading into the Pecos River,” Technical Report 291. This report and all other subtask final reports are available at the project website under the “Project Reports” link. In addition to the Reconnaissance Survey, a report titled “Water Balance, Salt Loading, and Salinity Control Options of Red Bluff Reservoir, Texas,” Technical Report 298, was published as an addendum to this subtask.

Subtask 1.6 Simulate Flow and Salinity of the Pecos River for Evaluating River Management Options

Investigator: Dr. Seiichi Miyamoto

This subtask was completed in 2007 with the approval and publication of its corresponding final report. The report, "Influence of Tributaries on the Salinity of Amistad International Reservoir," TWRI Technical Report 292, explores the sources of salinity entering the Pecos and gives insight into their relative contributions as compared to other sources. Additional work related to this subtask included the completion of a reservoir simulation model of Red Bluff Reservoir, streamflow and salt routing simulation using the ROTO model, and completion of riparian zone simulation.

Subtask 1.7 Economic Modeling of the Pecos River Basin and Assessment of Saltcedar Control Activities

Investigator: Bill Thompson

The principal investigator returned from active duty in the military in mid-2007 and resumed work toward the completion of this subtask. Given the extenuating circumstances regarding the delay of activities, work on this subtask will continue well into 2008.

Historical acreage data for the irrigation districts, along with data on the quantity of water released and the quantity billed to the respective irrigation districts was collected. A survey was developed to measure the impact of saltcedar control on rangeland managers whose operation encompassed areas that were treated for saltcedar. The survey was released July 2, 2007 to selected rangeland owners and managers residing within the Pecos River basin who have firsthand knowledge of both the saltcedar control measures, and the long term, often subtle responses of the river. A total of 194 surveys were mailed, with 27 surveys returned as undeliverable. A postcard reminder was then mailed to the survey recipients on July 9, 2007, and a total of 27 responses were returned for a 14 percent response rate. The table below contains the results of how 71% of respondents identified the most common plant type re-vegetating the treated areas.

Returning Plant Types and Species Witnessed in Treated Areas.

Witnessed Plant Type		
Woody Plants	Grasses	Forbs
38% (n=8)	52% (n=11)	10% (n=2)
Witnessed Plant Species		
Willow (2)	Buffalo Grass (1)	N/A
Mesquite(3)	Saltgrass (4)	
Saltcedar(2)	Bermuda (3)	
	Plains Bristle(1)	

Only two respondents (6%) claimed to have experienced a positive net economic value on the change they have seen as a result of saltcedar control measures. Cumulatively, these two respondents claim an economic net benefit of \$545.45 per river mile. Both of these respondents attributed this economic value to recreational activities (hunting and wildlife habitat). The table below summarizes the anticipated changes in the next 5 years resulting from the saltcedar control. Decreases in economic value were attributed to the accumulation of debris.

Expected Change in Economic Value as a Result of Saltcedar Control.

Expected Change in Economic Value	Percent of Respondents
Increase in Economic Value	56%
No Change	38%
Decrease in Economic Value	6%

This survey only looks at a small segment of the agricultural economy of the Pecos River Basin. Irrigation is the largest user of water from the Pecos River and specific studies of the impact of irrigated production on the Pecos River basin economy are in progress as part of this subtask. Work was also begun on the IMPLAN model of the Pecos River basin economy. A first run was completed and adjustments made to accurately represent the impact of some of the higher value horticultural crops produced within the basin (pecans, melons, onions and potatoes).

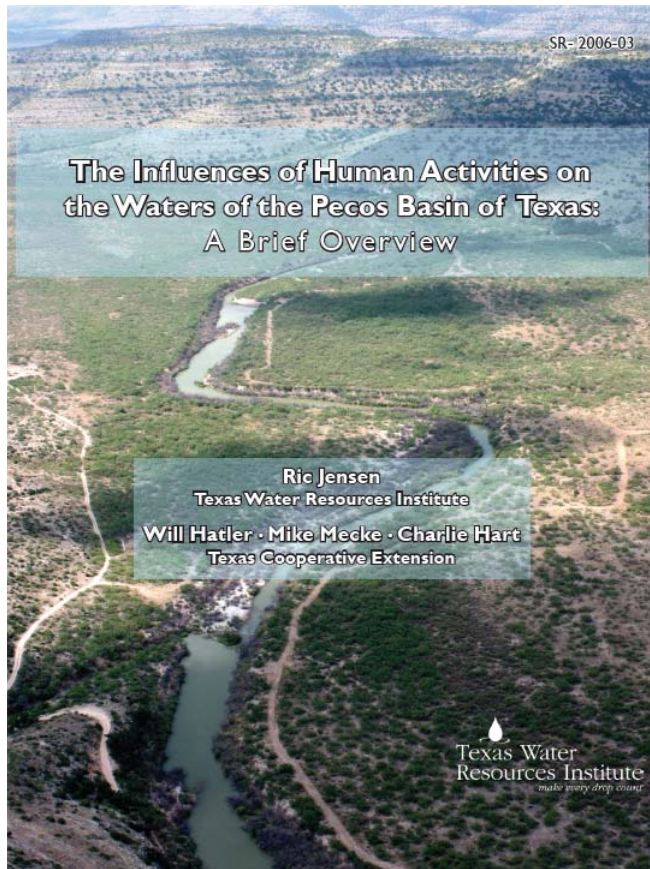
Task 2

Educational Programming

Subtask 2.1 Publish Written Informational Materials to Educate Private Landowners, Stakeholders, and Policy Makers about the Pecos River basin and the Effects of Saltcedar

Investigator: Texas AgriLife Extension

A historical document titled “The Influence of Human activities on the Waters of the Pecos Basin of Texas: A Brief Overview” was finalized, printed as TWRI Scientific Report 2006-03 and distributed at meetings in the watershed. This document includes oral interviews that were conducted with several residents of the region. The purpose of those interviews was to gain knowledge of how conditions in the region have changed over time. In addition, a complementary condensed version of this document titled “Water Issues Facing the Pecos Basin of Texas” was drafted and printed.



Cover of the historical document published as TWRI Scientific Report 2006-03

A letter to landowners and other interested parties and a one-page project publication were drafted during year 3. These documents outlined upcoming project activities and some proposed management measures to be included in the first draft of the WPP, and were mailed to approximately 1,000 recipients throughout the Pecos River Basin in Texas. A WPP information packet containing a power point presentation, FAQ list, and Executive Summary was sent to all County Ag Extension Agents in the Pecos Basin. A letter announcing the public release of the WPP, the WPP FAQ list and Executive Summary were also sent to the same list of landowners and other interested parties in the Pecos Basin. As part of the widespread WPP distribution effort, articles appeared in local newspapers and statewide agricultural news outlets announcing the public release of the WPP.

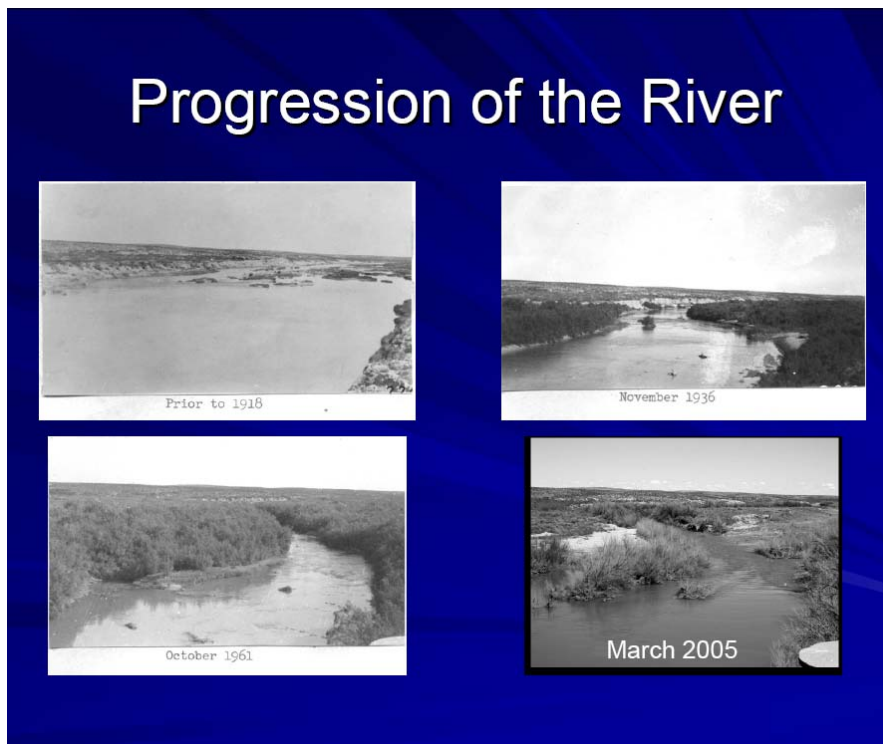
All Project Publications Are Available On The Project Website
<http://pecosbasin.tamu.edu/publications.php>

Subtask 2.2 Educational Meetings of Interested Parties for Input and Organizational Support

Investigator: Texas AgriLife Extension

Much of the year 3 activity related to this subtask was focused on planning and conducting public meetings to present and receive comments on the first draft of the WPP. The meetings were held October 2-5 in Mentone, Pecos, Imperial, Iraan and Del Rio with a total of 78 individuals attending. Special presentations were also made at the Crockett, Devil's River, Rio Grande-Pecos River, Sandhills, Trans Pecos, and Upper Pecos SWCDs in November. These meetings were used to further explain the WPP and to seek their support for implementing the plan. Throughout this process numerous oral comments regarding the first draft of the WPP were received and noted, and a total of 15 written comment forms were submitted either in person or online via the project website. Thirteen of the individuals (81%) who submitted written comments identified themselves as landowners in the Pecos Basin. Of these 13 landowners, 57% indicated they would be willing to participate in implementation of the WPP, 21% would not participate and 21% did not answer. Some of the specific comments received regarding the first draft of the WPP are listed below. The entirety of comments received will be included in a separate publication.

A presentation was also given to a group of approximately 55 attendees at a non-traditional Pecos River conference held in San Marcos at the River Systems Institute on March 9th. Topics for the conference ranged from ancient history, to current activities on the river to the Pecos in films and folklore.



Slide included
in a
presentation
given at the
River
Systems
Institute

Subtask 2.3 Develop a Website for Dissemination of Information

Investigators: Texas AgriLife Extension
Texas Water Resources Institute

The project website, <http://pecosbasin.tamu.edu>, was continually maintained and updated throughout 2007. The most notable updates during the year were the addition of a Current Events page where ongoing news and events related to the Pecos River are posted and the addition of links to downloadable real-time Pecos River monitoring stations. The WPP was also made available for download, and an opportunity to submit comments online was added. The website also includes a user-friendly version of the project work plan, project documents, biographical sketches of project leaders, and links to related information. All project reports, publications and activities are also posted on the website.

Task 3

Establish a Monitoring Program

Subtask 3.1 Develop a QAPP for Sampling Protocol

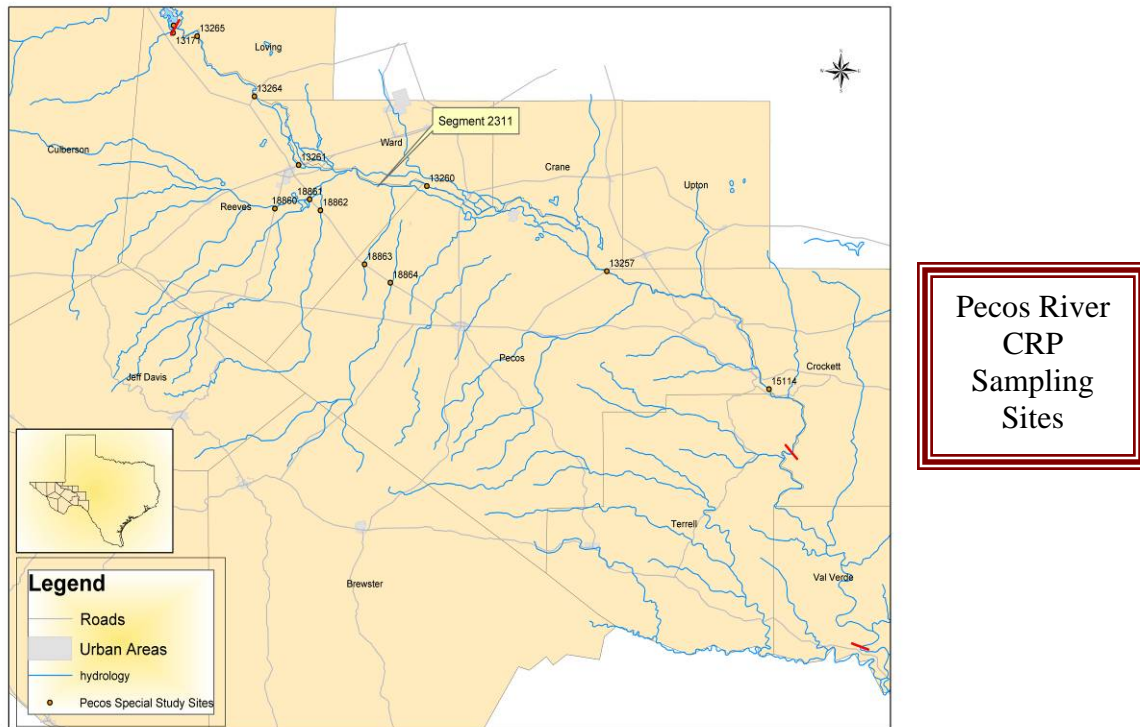
Investigators: Wayne Belzer and Kevin Wagner

The QAPP for the project was reviewed and approved by the EPA during year 2 of the project. As such, there was no activity related to this subtask during 2007.

Subtask 3.2 Water Quality Monitoring, including Total Dissolved Solids (TDS), Total Suspended Solids, Potential Hydrogen (pH), Dissolved Oxygen (DO), and Electrical Conductivity (EC)

Investigator: Wayne Belzer

Routine water quality samples have been, and continue to be collected at established locations along the Pecos River as part of the Clean Rivers Program, which is administered by the Texas Commission on Environmental Quality and the U.S. International Boundary and Water Commission. These data have been used for analyses conducted under other subtasks of this project and may be downloaded by following the corresponding links at the project website. Water quality sampling will continue for the duration of the project.



Subtask 3.3 Quantity and Fate of Water Salvage as a Result of Saltcedar Control

Investigators: Dr. Charles Hart, Dr. Zhuping Sheng,
Alyson McDonald

The majority of 2007 activities related to this subtask involved preparing the final report, although some final field work and data analyses were conducted during the first few months of the year. Additional slug tests of monitoring wells were conducted to determine subsurface hydraulic conductivity. Land surface and monitoring wellhead elevation were verified and additional hydrological profile data was collected. The Bouwer and Rice method was used to analyze slug test data and calculated saturated hydraulic conductivity, and groundwater surface profile data was evaluated and interpreted. This study concluded in 2007 with publication of the results as “Quantity and Fate of Water Salvage as a Result of Saltcedar Control on the Pecos River in Texas,” TWRI Technical Report 304. This report is available for download at the project website.

Task 4

Watershed Protection Plan

Subtask 4.1 Develop Annual Reports and a Final Report Summarizing Basin Assessment, Educational Programming, and Monitoring

Investigator: Texas AgriLife Extension
Texas Water Resources Institute

The annual report summarizing activities for year three (2007) has been completed and will be submitted to the TSSWCB for their review and approval. The final project report will contain a compilation of highlighted activities throughout the entire assessment phase of the project, and will be drafted in 2008.

Subtask 4.2 Produce the Final Watershed Protection Plan for the Pecos River Segments 2312, 2311, and 2310

Investigator: Texas AgriLife Extension
Texas Water Resources Institute

The first draft of the *A Watershed Protection Plan for the Pecos River in Texas* was completed and released to the public for review and comment in 2007. The document includes a detailed plan for addressing overall water quality and quantity, and biological diversity. Suggestions for changes received during the comment period were incorporated into the document, and the second draft will be released for comment in early 2008.

Water quality issues identified for the Pecos include salinity, depressed dissolved oxygen, sediment, golden algae and nutrient levels. Saltcedar and upland brush control are addressed in the WPP as being a suitable management measure to increase biodiversity and reduce water losses due to evapotranspiration. To adequately provide the level of detail needed to effectively manage these issues, the WPP follows EPA's nine elements of watershed protection planning which include:

- ❖ Causes and Sources of Non-Point Source Pollutants
- ❖ Estimate of Expected Load Reductions
- ❖ Management Measures Needed
- ❖ Estimated Technical and Financial Assistance Needed
- ❖ Education and Outreach
- ❖ Implementation Schedule
- ❖ Implementation Milestones
- ❖ Criteria for Assessing Success
- ❖ Long-Term Monitoring



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