

**CORONADO RC&D
ADEQ PROJECT NUMBER 1-004
FINAL REPORT**

Implementation of Best Management Practices to Control Sediment on a Reach of the Santa Cruz River

*This project was funded in part by the Environmental Protection Agency/Arizona Department of Environmental Quality **Water Quality Improvement Program**. Technical assistance was provided by the USDA Natural Resources Conservation Service. None of the assistance provided by this federal agency was used as a matching contribution to this project.*

Matching contributions in the form of labor, materials and funds were provided by:

- *A grant from the Arizona Water Protection Fund (state funds)*
- *Arizona Department of Water Resources-Nogales AMA*
- *The Santa Fe Ranch*
- *Santa Cruz Natural Resource Conservation District*
- *Pima Natural Resource Conservation District*
- *University of Arizona Extension-Santa Cruz County*
- *Santa Cruz County-Flood Plain Management Department*
- *Coronado Resource Conservation & Development Area (RC&D)*

TABLE OF CONTENTS

I	ABSTRACT.....	3
II	GOALS –OBJECTIVES-METHODOLOGY.....	4
III	RESULTS OF THE PROJECT.....	6
IV	IMPLICATIONS AND RECOMMENDATIONS.....	7
V	FISCAL SUMMARY.....	8
VI	APPENDICIES AND ATTACHMENTS	
	A. SITE MAP	
	B. PHOTOS	
	C. MONITORING	
	D. OUTREACH MATERIALS	

I. PROJECT ABSTRACT

Santa Cruz County stretches over 1,346 square miles. One half is classed as forest terrain, the other half as rolling hills, grazing land and river-bottom land. The County takes its name from the Santa Cruz River, which flows all the way across the County from south to north. The headwaters of the river are in the San Rafael Valley in the extreme southeastern part of the County. It flows south into Mexico makes a 40 mile U-turn and re-enters Arizona near the City of Nogales. Historically the river has alternated between a raging torrent to a trickle on the surface with a steady underground flow that has nourished crops and grasslands in the bottomlands.

In 1967 a flood destroyed mature cottonwoods and other riparian vegetation through a 1000-foot area where the river passes through the Santa Fe Ranch. (see map) When large amounts of timber, debris, rock, cobble and other sediments were deposited in the river, the entire channel was directed toward the east bank of the river. This redirection of flood flows undermined and eroded away thousands of tons of top soil and property. Subsequent flood events have had increased velocity and with no vegetation to slow it down, materials are picked up during flood flows on this site and carried downstream degrading the river system with sediment even further. An average of four acres of agricultural land has been lost with each flood event after 1987. Sediment loads have degraded the quality of water, increased scouring and removed acres of riparian habitat along the river. Water quickly leaves the area, reducing recharge possibilities and creating an area devoid of wildlife habitat.

This project is located on property owned by the Santa Fe Ranch and was implemented through a cooperative agreement with the ranch. Best management practices that have proven effective for stream corridor restoration were used to restore this reach of the river to as near natural state as possible. Kellner Jacks designed by NRCS engineers were installed along an 800-foot section of the riverbank. The jacks will stem bank erosion by slowing the velocity of water, and trap debris which will reduce scouring further downstream. A buffer strip of grasses, small shrubs and mesquite planted across the eroded bank will stabilize it further. Native cottonwood and willow have sprouted and established in and around the jack row, which will trap additional sediment and reestablish riparian vegetation in the degraded area. All vegetation planted on the scarp bank will be irrigated for establishment purposes.

Education efforts have targeted the value of natural river systems in the control of non point source pollution, restoration methods and the role of Water Quality Improvement Grants in the quality of our arid river systems.

II. GOALS OBJECTIVES METHODOLOGY

A. Project Goals

The goal of this project was to reduce the detrimental impacts of sediment in the Santa Cruz River by implementing Best Management Practices for erosion control along 1000 feet of channel that runs through the Santa Fe Ranch five miles north of Nogales, Arizona.

B. Objectives

The Santa Fe Ranch had been losing on average, four acres of agricultural land with each flood event since 1987. This had started a chain of erosive events that severely degraded the river itself, deposited sediment and debris downstream and reduced wildlife habitat. To reverse this trend, the following objectives were identified:

- Reduce the amount of sediment that entered the river channel with each storm event.
- Protect the banks of the river that were contributing the sediment.
- Re establish a wildlife corridor/riparian ecosystem
- Establish practices that would remain over the long term and allow water to pass slowly through the area rather than at a destructive velocity.

C. Methodology

The Natural Resources Conservation Service (NRCS) provided engineering assistance to investigate the project. Santa Cruz County Engineer and the Flood Plain Department staff also reviewed the designs and alternatives for the project.

Several alternatives were investigated. One was the placement of rock rip rap along the eroded bank. This alternative was undesirable due to the scour depth of the river bed. Engineers felt that it would not stay in place with a flood event but contribute both sediment and rocks to the river. Small jettys or stream barbs were also considered and were deemed effective in only small flows. Kellner Jacks were decided upon based upon the volume of water that moves through the area in large flows and they had proven effective in other areas of the Santa Cruz with unstable channel features.

The project design that included Kellner jacks and bank revegetation was reviewed and approved by the US Army Corps of Engineers. The construction of the jacks and the other aspects of the project fell under Nationwide Permit #27 for the restoration of wetlands and riparian areas. The

only stipulation was that anchors for the jacks be placed in the bank and not in the river bed. Anchors were buried in the irrigated pasture area. A local contractor was hired and a total of 56 jacks were installed to protect the river bank. (refer to photos in appendix B)

The Kellner Jacks were designed to trap debris and slow water during major flood events. Additional bank stabilization was added in the form of planting, grass, shrubs and trees on the eroded scarp bank. The original plan called for the planting of cottonwood and willow cuttings in and behind the jacks to catch additional debris and slow water but first a delay due to water rights processing for the supplemental irrigation system and then extreme drought conditions dropping the water table to 24 feet caused the project team to miss the window of opportunity to obtain local cuttings and plant them. However, native cottonwoods and willows have sprouted and established naturally within the jack row and fenced enclosure area making planting unnecessary. Native mesquite trees in one gallon pots were planted in the eroded bank that had been reshaped and in the upper bank area to act as a buffer and additional bank stabilization. A native grass/shrub mix was also seeded in this area. A supplemental irrigation system was installed to provide water needed for establishment.

An Arizona Water Protection Fund (AWPF) Grant was obtained to use as matching funding for this project. AWPf funds were used to purchase materials and install the enclosure fence, supplemental irrigation system and plant materials for revegetation. These funds were also used to implement the outreach and monitoring plans that were components of this project.

Monitoring reports have been submitted to both ADEQ and ADWR/AWPF with the following components:

- Vegetative monitoring using a Daubenmire method to determine vegetation canopy cover, plant populations and survival
- Photo monitoring for visual images of the area over time
- Precipitation- two rain gauges were installed on site to measure rainfall quarterly.
- Irrigation application- A flow meter was installed on the supplemental irrigation system to measure quantity of water applied
- Water Well Level- Water level is measured in the application well monthly and water levels of surrounding wells is measured by ADWR quarterly and reported.
- Geomorphology- Sediment measurements were taken at key points along the jacks quarterly after installation.
- Monitoring cross sections across the Santa Cruz River were installed to record changes in the river bed over time.

III. RESULTS OF PROJECT

Project results are difficult to quantify in terms of effectiveness of established practices at this time due to lack of rainfall. It is estimated that if practices installed are effective, 27,878 tons of soil will be held in place rather than contributed to the river as sediment per flood event. *In 2001, 2 inches of rain on the watershed caused a flood event that sent an area four acres in surface size, four feet deep downstream in the Santa Cruz.*

The following practices are in place as a result of this project:

- 800 feet of Kellner jacks to protect the river bank
- 4 acres of trees, shrubs and grasses to further protect eroded areas
- A supplemental irrigation system to provide for establishment of riparian vegetation
- An enclosure fence to protect the project area from grazing
- A monitoring system that will provide long term data to evaluate the effectiveness of the project.

The following education/outreach activities were completed to highlight the project, the methods used and the Water Quality Improvement Program.

- A field day for the public. A brochure outlining the project was given to each participant. Attendees included staff from the Arizona Department of Environmental Quality, Arizona Water Protection Fund, Santa Cruz County and NRCS. Others in attendance were members of the general public, Coronado RC&D Council, Santa Cruz and Pima NRCD Boards, Tohono O'odham Soil and Water Conservation District Board, U of A Extension staff and Friends of the Santa Cruz River. Individuals reached: 75
- Santa Cruz County Fair: The Santa Cruz NRCD and Santa Cruz County participated in a booth at the Santa Cruz County Fair and used the Mobile River Watershed Trailer to demonstrate the watershed concept, erosion and water quality relations and benefits of riparian restoration. Coronado RC&D supplied a backdrop display, brochures and informational handouts for the booth: Individuals reached: 500
- The Coronado RC&D has published articles and fact sheets on the project and mailed them out with the RC&D newsletter. Individuals reached: 1000
- The educational component of this project involves the development of curricula for use by schools for education related to non point source pollution and riparian restoration. Education consultant Dave Henson developed the materials and worked with the Little Red School House of Nogales to pilot the materials.

- Instructors reached: 10 (this has great potential to expand over time as instructors use the materials to work with children)
- Technical field day was held to familiarize NRCS staff with the project and it's applications. Individuals reached: 7

IV. IMPLICATIONS AND RECOMMENDATIONS

Water Quality Improvement Grants are one of the few sources available to landowners to address erosion that is contributing sediment to Arizona's arid river systems. They compliment very well some of the practices available through the Farm Bill and NRCS Environmental Quality Incentive Program (EQIP). EQIP federal funds cannot be used as a match for Water Quality Improvement Grants but can provide funding for practices that involve an entire Watershed Approach to addressing non point source pollution. Water Quality Improvement projects require a non federal match that cultivates partnerships of local landowners, local units of government and volunteers that are vested in watershed health. Out of these partnerships arises a commitment to education that perpetuates the program and provides information to the public and potential future stake holders.

Addressing watershed issues and implementing Best Management Practices in an arid environment is a challenge as far as measurable results. Practices can be in place but will remain untested until it rains and a flood event occurs. The ideal situation with this particular project would be that it not be tested by a severe flood event until the vegetation has been established for a period of three years. Monitoring during the project implementation phase is too short of a time period to yield data that can be tied directly to practice establishment. NRCS and the Santa Fe Ranch are committed to long term monitoring of the project area which should provide valuable data that can be used after the close of this project.

The project looks very good. Workmanship on the Jacks was excellent, vegetation is becoming established. A delay was experienced in dealing with the technicalities of water rights for establishment of vegetation. The Santa Fe Ranch has ample water rights to irrigate the project, but all of the water rights were for agricultural production which does not cover the establishment use. Staff at the Santa Cruz Active Management Area of the Arizona Department of Water Resources were valuable in researching the water rights and obtaining the legal permission required.