



Los Angeles District

# **Tres Rios del Norte Feasibility Study**

## **Economics Appendix**

Economic and Social Analysis Section  
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## 1. The Study

### A. Study Area Location

The study area is located in the upper Sonoran Desert in the Santa Cruz River Watershed. The study area is called Tres Rios Del Norte, on the Santa Cruz River, located in Pima County. The City of Tucson and the Town of Marana are both located within boundaries of the study area. The study area stretches from Prince Road in the City of Tucson to Sanders in the Town of Marana.

### B. Study Purpose and Scope

The overall goal of the Tres Rios Del Norte Feasibility Study is to increase the native plant and wildlife habitat values, and maintain flood control along existing protected reaches. Development of alternatives will be based on the following goals:

- Increase native riparian and wildlife habitat values, diversity, and functions in Pima County for a period of 50 years.
- Attract wetland and riparian avian species identified in the draft Sonoran Desert Conservation Plan.
- Facilitate wildlife movements for species identified in the draft Sonoran Desert Conservation Plan.
- Establish the presence of amphibian species, reptilian species, mammalian species, and avian species in the study area.
- Suppress undesirable and nonnative fish and wildlife species.
- Control or manage non-native, invasive plant species in the study area.
- Maintain flood control protection along the existing protected reaches.
- Restore natural flow of Santa Cruz River

### C. Guidance and Regulation

The methodology employed for this economic analysis is in accordance with current Principles and Guidelines (ER 1105-2-100) and standard economic practices. In agreement with these standards, benefits, and costs will be expressed as annual values using the current interest rate, October 2002 price levels, and a 50-year period of analysis. In addition, the environmental restoration analysis will be completed in conformance with IWR Report #95-R-1- Evaluation of Environmental Investments Procedures Manual (May 1995).

## 2. Problems and Opportunities

### A. Environmental Resources

Natural flood events have been drastically reduced due to human alteration of the landscape and with ever increasing of groundwater for irrigation and other human uses,

baseflows have also been significantly reduced. There is also a great deal of habitat modification due to urbanization of the surrounding area. These factors allow non-native species of plants and animals to invade, minimizing and in some cases completely displacing native species. In the future it is expected that without any type of habitat restoration, non-native plants and animals would continue to invade. This would include salt cedar, African sumac, Giant Reed, and other species are tolerant of disturbed conditions.

There is an opportunity to restore the environment through the creation of new water bodies or the take advantage of existing water bodies, in the river and adjacent properties, as potential restoration sites. Also, the restorations projects provide opportunities to utilize discharges from Roger Road and Ina Wastewater Treatment Plants to supplement periodic natural surface water flows and develop continuous restoration corridor along the Santa Cruz River and its tributaries.

#### B. Flood Control

The study area has experienced two major floods in the past twenty years that have caused major damage to the transportation and the infrastructure for water and sewage. Since the last major flood event that occurred in 1993, the area land uses have significantly changed from agriculture to residential. The Continental Ranch Development that is located from Cortaro Road to Avra Road has added almost 3,000 homes in the 500-year flood plain.

Hydraulic and hydrologic analyses are currently being conducted for this feasibility study that will provide an updated depiction of the flooding problem throughout the study area. This analysis will include detailed analysis of the 100-year and 500-year floodplains, in addition to those for more frequent events. The results of this analysis will facilitate the determination of the magnitude of flooding problems in the study area.

#### C. Recreation

Tremendous historical and projected population growth in the Tucson metropolitan area has increased the demand for recreation facilities in the study area. As additional development occurs along the study area, including the conversion of vacant and agricultural lands to residential and commercial uses, development of new recreation will also be essential. As part of a restoration project for Tres Rios del Norte, there is an opportunity to provide complimentary passive recreation facilities, such as multiuse trails for hiking, biking and horseback riding, comfort stations, signage, and environmental education/interpretive centers. The study area location would be ideal for linking recreation facilities with existing and planned facilities located downstream and upstream at the Sweetwater Wetlands and the River Parks along the river.

### 3. Demographics and Land Use

#### A. Population

The study area is included in the Tucson-Pima County Metropolitan Statistical Area (MSA). According to the 2000 Census, the Tucson-Pima County MSA population was 843,746 (16.81% of Arizona population). This population figure for 2000 was 26.5 percent larger than the 666,880 residents in 1990 (18.9% of Arizona Population). During the previous decade, the county and MSA increased by 25.5 percent from 531,443 in 1980. In fact, Tucson-Pima County MSA has been growing at an average annual compound rate of about 2.60 compared to the national average of 1.1 percent. Table 1 is summary of population data for the study area.

Year	Town of Marana	% Change	City of Tucson	% Change	Pima County	% Change
1980	1,647	43%	330,537	26%	531,445	51%
1990	2,187	33%	405,390	23%	666,880	25%
2000	13,556	520%	486,699	20%	843,756	27%
2010	46,078	240%	540,307	11%	1,031,627	22%
2020	76,553	66%	589,899	9%	1,206,246	17%
2030	99,328	30%	631,889	7%	1,372,320	14%
2040	117,900	19%	663,542	5%	1,522,616	11%
2050	124,232	5%	683,037	3%	1,671,182	10%

#### B. Land Use

##### *Reach 1*

Reach 1 begins at Prince Road in City of Tucson and ends at Ina Road in Town Marana. The major land uses in this reach include recreational uses on the west bank and industrial uses on east bank. On the west bank the recreational facilities include the Silverbell Golf Course and Christopher Columbus Park. The Silverbell Golf Course is an 18-hole course that features 9 lakes. The Christopher Columbus Park is a park in the City of Tucson that has lake and over 300 acres. The industrial uses along the east bank include industrial parks, sewage plants and gravel mines. The sewage plants include the Roger Road Plant and Ina Road Plant. Also, the east bank includes the Sweetwater Wetland and Ted Walker Sportpark. The Sweetwater Wetland is a restored riparian habitat. The Ted Walker Sportpark has significant facilities for baseball and soccer.

### *Reach 2*

Reach 2 begins at Ina Road and ends at Cortaro Road in Town of Marana. The land uses on east bank of Santa Cruz include industrial uses and gravel mines. The vacant land is located on the west bank of Santa Cruz. A major retail and commercial center is being developed at Cortaro Road.

### *Reach 3*

Reach 3 begins at Cortaro Road and ends at Continental Narrows. The Continental Ranch Development is located on the east bank of Santa Cruz. This development is largest housing development in Town Marana. Majority of 13,556 residents in Town Marana lives in the Continental Ranch Development. On the east bank of the Santa Cruz the major land uses include commercial development, gravel mining and a golf course.

### *Reach 4*

Reach 4 begins at Continental Narrows and ends at Sanders Road. The majority of land uses in this rural and agriculture. Also, the reach includes the old section of the Town Marana. The old section of Town Marana includes Ora Mae Harn Park that has baseball and soccer fields. The Marana Northwest Regional Airport a small regional airport is located in Reach 4.

## C. Employment and Economy

Three primary areas of employment in Pima County are in education, government, and military. First, sources of employment in the educational sector include the University of Arizona, Pima County Community College, and the Tucson Unified School District. Second, government offices offer employment in the state, county and city level. Third, two military establishments listed as follows provide further employment opportunities. They are Davis-Monthan Air Force Base and Raytheon Missile Systems Company. All three areas of employment require a higher likelihood of professional and technical skill as well as some collage education that account for some of the 24.70% of professional and technical occupations within Pima County.

This demand for higher paying jobs may account for the reason why Pima County has enjoyed a low employment rate sometimes as much as 1.4 and 1.8 percentage point behind the Arizona and the United States. In 1998, unemployment was 2.7 compared with Arizona at 4.1 and the United States at 4.5. Table 2 shows major employers, employment type, and number of employees within Pima County

Table E2 Tres Rios Del Norte Employment Data for Pima County		
Employer	Employment Type	Number of Employees
University of Arizona	Education	10,520
State of Arizona	Government	9,694
Davis-Monthan Air Force Base	Military	8,352
Tucson Unified School District	Education	8,187
Raytheon Missiles Systems Co.	Military Manufacturing	7,700
Pima County	Government	7,028
City of Tucson	Government	5,497

#### Housing Units and the Low Cost of Housing

To accommodate the population expansion in the area, about 348,508 housing units were constructed in Pima County in 1999. This figure is up from 298,207 in 1990. According to the 1999 American Community Survey Profile for Pima County, Arizona, about 21 percent of the current housing stock has been built in past ten years. Most of the newer homes, constructed in master planned communities, are reasonably priced compared to other metropolitan areas. The average cost of a new single family home is about \$109,102, and this is a primary factor making the overall cost of living in Pima County among the lowest of major US metropolitan areas.

#### 4. Without Project Conditions

##### A. Without Project Conditions

Without Project Conditions are those conditions projected to prevail over the 50-year period of analysis in the absence of any management designed to address the problems and opportunities outlined earlier in this report. They serve as the basis for comparison to determine the benefits of proposed management measures. Hence, without-project conditions must first be calculated in order to ascertain the potential benefits that may result from implementing alternatives.

##### B. Environmental Resources

Natural flood events have been drastically reduced due to human alteration of the landscape and with ever increasing of groundwater for irrigation and other human uses, baseflows have also been significantly reduced. There is also a great deal of habitat modification due to urbanization of the surrounding area. These factors allow non-native species of plants and animals to invade, minimizing and in some cases completely displacing native species. In the future it is expected that without any type of habitat restoration, non-native plants and animals would continue to invade. This would include

salt cedar, African sumac, Giant Reed, and other species are tolerant of disturbed conditions.

### C. Hydro-Geomorphic Model Description

The value of the limited amount of habitat existing in the study area has been assessed using a Hydro-Geomorphic Modeling (HGM) process. HGM is an evaluation methodology in which the environmental impacts of projects are measured in ecological, rather than monetary terms. As a result, it is not possible to perform a direct benefit/cost analysis. Rather, the focus of HGM analysis, as well as other non-monetary evaluation techniques, is to determine the most cost-effective way to provide an array of environmental outputs. This is typically completed through an incremental cost analysis in which the marginal cost providing environmental outputs is determined.

The U.S. Army Engineer Waterways Experiment Station has developed HGM for purpose of assessing wetland functions. Wetland functions are a result of the interaction between the structural components of wetlands, such as soil, plants, and animals, and the physical, chemical and biological processes that occur in wetlands. The assessment phase of the procedure is to measure the ability of a wetland is determined using a functional capacity index (FCI).

In HGM, an FCI model is a quantitative estimate of the functional capacity for a wetland. The ideal goal of an FCI model is to quantify and produce an index that reflects the functional capacity at the subject site. The results of an FCI analysis can be quantified on the basis of a standard zero to one scale, where 0.00 represents the lowest functional capacity for the wetland, and 1.0 represents the highest function capacity for the wetland. FCI model can be defined in words or mathematical equations that clearly describe the rules and assumptions necessary to combine functional capacity indices.

Functional Capacity Units (FCU's) are a quantitative environmental value, considered to be the biological currency in the HGM methodology. FCUs are calculated by multiplying the area of available wetland (quantity) by the quality of the wetland based on functionality, which is represented by values derived from the FCIs.  $FCU = \text{Area} \times \text{FCI}$ . Changes in FCUs represent potential impacts or improvements of proposed actions.

### D. HGM Results – Without Project Conditions

FCI functions have been developed specifically for the desert southwest ecosystem along the Santa Cruz River. These functions have been applied to the existing areas of habitat throughout the study area to derive estimates of FCUs, both for existing and future without project conditions. The results are as follows:

Insert without project FCU's

## E. Flooding Problems

The study area covers approximately 19 miles of the Santa Cruz River, which extends from Prince Road in City of Tucson to Sanders Road in the Town of Marana.

Approximately four miles from the upstream end at Sanders Road, the Santa Cruz River meets the Rillito Creek one of its major tributaries in the study area. About a mile downstream, the Canada del Oro Wash, the second major tributary, joins the Santa Cruz River. Based on a preliminary hydraulic evaluation, it was observed that the levees were not able to contain the 500-year flood at several locations.

## F. Historical Flooding

The study area has experienced two major flood events in last twenty years.

In 1983, flooding on Santa Cruz River caused severe erosion damage and damage to property along the Santa Cruz River. Other flood event that occurred in 1993 caused extensive damage to agriculture and closed Sanders Road.

The flood event for the 1983 was estimated to be in excess of a 100-year event. Massive flood damages occurred to public facilities which include washed out bridges, damaged flood control works, wash out and damaged highways, and utilities such as sewer, water, electric and gas lines. Also, the Federal Emergency Management Agency estimated that in the Santa Cruz River Basin 154 residential units were destroyed, 160 residential units suffered major damage, and 222 residential units received minor damage. Furthermore, an estimated 19 businesses had major damage while 22 incurred minor damage. More tragically, 13 lives were lost, 221 people were injured and 11 were hospitalized in Arizona, with most victims in Pima and Pinal Counties. In the Town of Marana, approximately 20 residences were destroyed by erosion along Cortaro Road. Also, the flooding in the old section Town of Marana by Sanders Road damaged private structures, private businesses, and agricultural crops.

During the height of flooding in Santa Cruz River Basin, 35 to 42 major bridges were closed. Fifteen bridges suffered sufficient damage to remain closed traffic from a few days to a few weeks. The bridges at Ina Road, Cortaro Road, Avra Valley Road, and Sanders Road were damaged in this flood event.

Also, during the 1983 flood event, severe damage occurred to sanitary sewer interceptor lines ranging in size from 27 inches to 15 inches. Over 8,000 feet of sewer main was washed out resulting in a discharge of 1.5 million gallons of sewage per day into the river system. Minor damage also occurred to the Marana wastewater treatment facilities. Also, the Ina Road landfill was severely damaged.

Table E3 Tres Rios Del Norte Flood Damages in Study Area 1993 Flood Event October 2002 Price Level	
Ina Road Bridge	\$4,650,000
Cortaro Bridge	\$4,500,000
Avra Valley Bridge	\$2,250,000
Tangerine Landfill Protection	\$750,000
Sanders Bridge	\$1,800,000

In 1993 the flood event was significant smaller than the 1983 event. The flooding caused damages to the public infrastructure and agriculture crops. The sand and gravel pits at Ina Road experienced some damages due to seepage and overflows.

Table E4 Tres Rios Del Norte Flood Damages in Study Area 1983 Flood Event October 2002 Price Level	
Ina Road Bridge	\$12,700
Sanders Road	\$6,600
Twin Peak Road	\$4,600
Avra Valley	\$337,200
Cortaro Bridge	\$49,700

#### G. Floodplain Delineation

A preliminary hydraulic evaluation was completed for the baseline conditions. The evaluation shows almost no commercial or residential development is in the 100-year floodplain. The 100-floodplain covers mostly recreational facilities and vacant land. However, the evaluation shows that the delineation of the 500-year flood would cover an area that includes about 3,000 homes, industrial parks, and major transportation links like Interstate 10. The hydraulic evaluation has not been completed the future conditions for the F3 milestone. Based on assumptions for the engineering division, the future conditions are expected change slightly from the present conditions.

## H. Recreation

The town of Marana as well the entire Tucson metropolitan area has experienced rapid population growth. As the Tucson MSA population has now expanded to over 800,000 people, so has the demand for both passive and active recreation opportunities. Envisioned recreational opportunities coinciding with habitat restoration projects for the study area consist primarily of passive recreation, such as bird watching, walking, jogging, hiking, bike riding, horse-back riding, picnicking, and other passive uses of open space. Also, the habitat restoration projects are expected improve the overall quality of recreation for the other recreational facilities along the Santa Cruz River.

The governmental agencies located in the study area have developed specific planning guides to manage the development of recreation resources along the Santa Cruz River. The Department of Transportation and Flood Control District for Pima County has developed the *Pima County River Parks Master Plan* which outlines the development of continuous river trails system along the approximately 100 linear miles of river corridors that exist in the Santa Cruz River, Rillito Creek, Tanque Verde Creek, Panano Wash and Canada del Oro Wash. Also, the development of recreational resources in City of Tucson will be based on the guidelines in the *City Tucson Parks and Recreation Strategic Service Plan 2010*. The *Santa Cruz River Corridor Plan* is planning guide for developing recreational facilities within the Town of Marana.

## I. Existing Recreation Resources in Market Area

Based on conversations with Town of Marana and federal agencies the proposed habitat and recreation features would attract visitors throughout the Tucson metropolitan area. The county and cities in study area have shown strong interest in developing these types of projects. The local and federal government agencies supported the construction of the Sweetwater Wetlands a restoration project for riparian habitat that encompasses passive recreational features.

The following presents the primary recreation sites in the study area.

### Parks

*Ora Mae Harn Park* - The park facilities provide following activities: baseball fields, soccer fields, picnic armadas, tennis courts, basketball court, swimming pool, playground areas, community center.

*Christopher Columbus Park* - The park facilities provide following activities: boating, fishing, model airplane facility, picnic ramadas, and playground.

*Ted Walker Sportspark* - The park has the following activities: baseball, soccer, saguaro garden.

*Sweetwater Wetland* - Sweetwater Wetland is an artificial wetland area located on the east bank of the Santa Cruz River near Prince Road. It was built in 1996 under the direction of a committee with representatives from the US Fish and Wildlife Service, US Forest Service, Arizona Game and Fish Department, City Parks and Recreation Department, the University of Arizona and many local environmental education and wildlife organizations. The fully accessible site features paved trails, a shaded viewing pavilion, interpretive signage, public restrooms. The wetlands were recently featured on the PBS series *Birdwatch*.

**Future Parks**

The Town of Marana is expecting increasing demand for recreational facilities since the town is expected to have additional 32,000 residents by 2010. Also, Pima County and City Tucson have proposed additional recreational facilities in study area. Table 5 list the proposed parks in the Study Area

Table E5 Tres Rios Del Norte New Recreational Facilities	
Park Name	New Park/Additional Facilities
Santa Cruz Park	Additional Facilities
EL Rio Neighborhood Park	New Park
Santa Cruz Multi-Use Path	New Park
Continental Ranch Community Park	New Park
Continental Reserve Neighborhood Park	New Park
Cortaro/Silverbell Park	New Park
Saguaro Springs Park	New Park
Twin Peaks Elementary School Park	New Park
De Anza National Historic Park	New Park
Coyote Trail Park	New Park
Christopher Columbus Park	Additional Facilities

Golf Courses

*The Links at Continental Ranch* – The Links at Continental Ranch is an 18-hole golf course on west bank of Santa Cruz.

*Silverbell Golf Course* - The Silverbell Golf Course was built along west bank of Santa Cruz in 1978. The course features nine lakes on 18-hole layout.

The following presents the primary recreation areas that are outside the study area that offer similar recreational activities that could be offer from a proposed restoration project. The Southeastern Arizona Bird Observatory was source for selecting these parks.

*Empire-Cienega Resource Conservation Area* - The wildlife area is located on 45,000 acres of Bureau of Land Management (BLM) in southwestern Pima County and northeastern Santa Cruz County. Also, this conservation area offers recreation activities with low environmental impact that includes the following activities: hiking, camping, horseback riding, photography, painting, bird watching, biking, and picnicking

*San Pedro Riparian Conservation Area* - The conservation area is located on 58,000 acres of Bureau of Land Management (BLM) in Cochise County, Arizona. The area is a rare remnant of the desert riparian ecosystem that once existed throughout the southwest. Birders will find that half the known breeding species in North America have been spotted at San Pedro. Besides birdwatching, this conservation area offers the following activities: hiking, camping, wildlife viewing, photography, seasonal hunting, horseback riding, nature study, and environmental education.

*Coronado National Forest* - The Coronado National Forest covers 1,780,00 acres of southeastern Arizona and southwestern New Mexico. Elevations range from 3,000 feet to 10,720 feet in twelve widely scattered mountain ranges that rise dramatically from the desert floor, supporting plant communities as biologically diverse as those encountered on a trip from Mexico to Canada. The Southeastern Arizona Bird Observatory has recommended the following areas within Coronado National Forest for viewing birds: Mount Lemmon and Sabino Canyon. Mount Lemmon is located in Catalina Mountains north of Tucson. Sabino Canyon is located on the northeastern corner of Tucson in the foothills of the Santa Catalina Mountains.

*Saguaro National Park* - The Saguaro National Park is located west of Tucson. The park encompasses over 71,400 acres. The Southeastern Arizona Bird Observatory has recommended the Arizona-Sonora Desert Museum and Tucson Mountain Park within the Saguaro National Park for birdwatching.

*Tohono Chul Park* - The park is a private sanctuary on the northwest side of Tucson on Inca Road. Volunteers offer bird walks on the 48-acre site.