

**Environmental Restoration Projects in Arizona:  
The U.S. Army Corps of Engineers' Approach  
Final Report\*  
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\*\* Sharon Megdal thanks Jennifer Jones and Kelly Mott Lacroix for research assistance and numerous others for comments received on presentations related to this study.

## Introduction

Arizona is a state grappling with rapid population growth and prolonged drought. Historically, projects have been built to address flooding caused by heavy rainstorms. During the periods between rainstorms, rivers and washes are often dry. Controlling property damage due to flooding and meeting current and future water demands have long involved the construction of major public works projects involving federal and local agencies, sometimes along with the private sector. More recently, in order to replenish groundwater tables and store water for future use, public and private entities have become involved in water storage projects.<sup>1</sup> During the same period, environmental restoration projects have been developed. In some instances, multiple purposes, such as replenishment of groundwater aquifers and environmental restoration, have been combined.

Arizona's desert ecosystem and rapid growth have resulted in significant threats to, or diminishment of, riparian areas throughout the state. Projects to improve, restore and/or preserve the environment are important to the quality of human and non-human life in the Sonoran Desert. This report is a component of an effort to understand the purposes of ecosystem restoration projects, their design, including their water requirements and any water quality improvements, and their long-term viability and public benefits. Depending on the nature of and funding for the ecosystem restoration projects, these efforts are typically called ecosystem restoration, or environmental mitigation. In all cases they improve the environment over what it would be if no project were undertaken.

The focus of this paper is on Ecosystem Restoration Projects undertaken in Arizona by the United States Army Corps of Engineers (Corps), under their Civil Works Mission, in conjunction with local governments in the state. It reports on projects in Pima and Maricopa Counties, the two most populated counties in Arizona. By highlighting the purposes and components of the projects, a greater understanding of the development and implementation of such projects, as well as their costs and benefits, will be gained. In addition, a subsequent grant from the U. S. Bureau of Reclamation is supporting an expansion of this examination of ecosystem restoration. The paper briefly addresses the approach to expanding the study of ecosystem restoration and environmental enhancement projects in Arizona.

## U.S. Army Corps of Engineers Civil Works Function and the Environment<sup>2</sup>

The Corps' role in civil works missions has changed as the needs of the country have changed. According to the Corps' website,<sup>3</sup> "Those missions today fall in four broad areas:

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<sup>1</sup> Megdal, Sharon. 2003. "How Water Management in Tucson, Arizona Has Affected the Desert's Landscape." Urban Design in Arid Zones Symposium. Santiago, Chile. Available at <http://www.ag.arizona.edu/AZWATER/presentations/mwdl.pdf>.

<sup>2</sup> This section is based on materials available through the COE web site. U.S. Army Corps of Engineers. 2005. *About the Army Corps*. <http://www.usace.army.mil>.

<sup>3</sup> U.S. Army Corps of Engineers. 2005. *Civil Works Office and Mission*. <http://www.usace.army.mil/public.html#Civil>.

water infrastructure, environmental management and restoration, response to natural and manmade disasters, and engineering and technical services to the Army, DoD [Department of Defense] and other Federal agencies.” Navigation, Flood Damage Reduction, and Environmental Missions are listed as the first three areas of focus. Within the Environmental Missions section, Ecosystem Restoration, Environmental Stewardship and Radioactive Site Cleanup are listed.<sup>4</sup> Funding for the Civil Works programs is authorized through the annual federal Energy and Water budget.

According to the Principles and Guidelines for Civil Works Planning and Policy, a six-step planning process is used to solve problems:<sup>5</sup>

- Identify water resources problems in the study area.
- Collect data on the problems identified.
- Develop alternatives to solve the problems.
- Evaluate the effects of the alternatives.
- Compare alternatives.
- Select a plan for recommendation or decide to take no action. The alternative plan with the greatest net economic benefits consistent with protecting the nation's environment is normally selected. An exception may be granted by the Secretary of the Army.

In 1990, some years after the 1969 passage of the National Environmental Policy Act, environmental protection was established as one of the primary missions of Corps water resources projects, along with navigation and flood control. Its environmental stewardship role includes restoring the environment at projects constructed in the past by ACE.

In 2002, the Corps formalized a set of principles to focus and guide its commitment to the environment. They are as follows:<sup>6</sup>

- Strive to achieve environmental sustainability. An environment maintained in a healthy, diverse and sustainable condition is necessary to support life.
- Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of Corps programs and act accordingly in all appropriate circumstances.
- Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.
- Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.

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<sup>4</sup>Ibid.

<sup>5</sup> U.S. Army Corps of Engineers. 2005. *Principals and Guidelines* [http://www.usace.army.mil/inet/functions/cw/cecwp/cecwp\\_temp/pg.htm](http://www.usace.army.mil/inet/functions/cw/cecwp/cecwp_temp/pg.htm).

<sup>6</sup> U.S. Army Corps of Engineers. 2005. *Environmental Operating Principals*. <http://www.hq.usace.army.mil/cepa/envprinciples.htm>.

- Seeks ways and means to assess and mitigate cumulative impacts to the environment; bring systems approaches to the full life cycle of our processes and work.
- Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.
- Respect the views of individuals and groups interested in Corps activities, listen to them actively, and learn from their perspective in the search to find innovative win-win solutions to the nation's problems that also protect and enhance the environment.

Funding for Corps' Civil Works Environmental Program has increased over the years, growing from \$324 million in 1997 to \$624 million in the fiscal year that ended September 30, 2003.<sup>7</sup> The Corps' environmental work makes up a significant amount of the Corps' Civil Works program. Despite this increase in funding, the general public is likely unaware of the environmental restoration function of the Corps. However, working with the Corps of Engineers Los Angeles District, Arizona has been the beneficiary of Corps' involvement in environmental restoration programs. The next section provides more detailed information about the authorized programs of the Corps.

#### The U.S. Army Corps of Engineers Approach to Ecosystem Restoration

The purpose of ecosystem restoration is to re-establish the attributes of a natural, functioning and self-regulating system.<sup>8</sup> The Corps pursues projects involving environmental restoration under multiple congressional authorities. Through its General Investigations (GI) efforts, the Corps is authorized to participate in individually authorized programs, with the federal investment depending on the nature of the program and the amount appropriated by Congress. Projects discussed in this paper also represent two other avenues for involvement in environmental restoration, namely Sections 1135 and 206 of the Water Resources Development Act (WRDA).<sup>9</sup>

Among the early approved GI environmental restoration efforts are the Everglades and the South Florida Ecosystem Project, the Louisiana Coastal Area Ecosystem Restoration Project, and the Tres Rios, Arizona Project. The Tres Rios Project, which provides for ecosystem restoration of the Salt River, including its confluence with the Gila and Agua Fria Rivers (hence the name), is one of the projects featured in this report.<sup>10</sup>

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<sup>7</sup> U.S. Army Corps of Engineers. 2005. *Army Corps of Engineers Civil Works Environmental Programs Continue to Grow*. [http://www.usace.army.mil/inet/functions/cw/hot\\_topics/coe\\_envgrows.htm](http://www.usace.army.mil/inet/functions/cw/hot_topics/coe_envgrows.htm).

<sup>8</sup> U.S. Army Corps of Engineers. 2005. *Civil Works Office and Mission*. <http://www.usace.army.mil/public.html#Civil>.

<sup>9</sup> Another authority for ecosystem restoration, not represented by any of the projects discussed is U.S. Army Corps of Engineers. Planning and Policy Division. 1992. *Environmental Protection and Restoration, Beneficial Use of Dredged Material*. Section 204, WRDA (P.L. 102-980).

<sup>10</sup> U.S. Army Corps of Engineers. 2005. *Army Corps of Engineers Civil Works Environmental Programs Continue to Grow*. [http://www.usace.army.mil/inet/functions/cw/hot\\_topics/coe\\_envgrows.htm](http://www.usace.army.mil/inet/functions/cw/hot_topics/coe_envgrows.htm).

Section 1135(b) of WRDA of 1986 provided authority for the Corps to “investigate, study, modify, and construct projects for the restoration of fish and wildlife habitats where degradation is attributable to water resource projects previously constructed by the Corps”.<sup>11</sup> The restoration of the Ajo Detention Basin in Pima County, completed and dedicated as the Ed Pastor Kino Environmental Restoration Project in 2002, was the first Section 1135 project for the Corps.<sup>12</sup> Section 206 of WRDA of 1996 provided authority for the Corps to “carry out aquatic ecosystem restoration and protection projects if the project will improve the quality of the environment, is in the public interest, and is cost effective”.<sup>13</sup> The Agua Caliente Spring project in Pima County started as a Section 206 Wetland Restoration project. The only 206 project featured in this report, it did not advance to the construction stage.

The Section 1135 and Section 206 programs each have an annual program limit of \$25 million, and each project under either of these sections is limited to a federal contribution of \$5 million. All projects require a local sponsor. The established processes for GI Studies and Programs and Section 1135 and Section 206 Programs are summarized in Table 1. The projects detailed in the next section are in one of the phases in the table. The letters that are recommended for requesting initiation of a Section 1135 or Section 206 project are included as an appendix.

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<sup>11</sup>U.S. Army Corps of Engineers. 2004. *Project Modifications for the Improvement of the Environment*. Washington: U.S. Army Corps of Engineers. Available at: <http://www.nab.usace.army.mil/whatwedo/civwks/CAP/1135.pdf>.

<sup>12</sup> Pima County Flood Control District. 2002. *Pima County Flood Control District Annual Report, Fiscal Year 2001-2002*. Tucson: Pima County Flood Control District. Available at: <http://www.dot.co.pima.az.us/flood/annrprt/pdfs/fcd0102.pdf>

<sup>13</sup>U.S. Army Corps of Engineers. 2004. *Aquatic Ecosystem Restoration*. Washington: U.S. Army Corps of Engineers. Available at: <http://www.nab.usace.army.mil/whatwedo/civwks/CAP/206.pdf>.

# US Army Corps of Engineers: Civil Works (Water Resource) Mission

## ENVIRONMENTAL RESTORATION

### Authorizations

Individually Authorized Studies and Programs  
(General Investigation/ GI)  
*Congressionally Authorized: No Federal Cost Limitations*

Continuing Authority Programs (CAP)  
WRDA Section 1135 & 206  
*Federal Cost Limited to \$5 million*

#### PROJECT PHASES

**Reconnaissance:** determine if further studies needed or continued Federal interest to proceed to the feasibility phase. 100% Federal Cost (limited to \$100,000)

- *905(b) Analysis*
- *Project Management Plan (PMP)*
- *Feasibility Cost Sharing Agreement (FSCA)*
- *Letter of Intent from Sponsor*

**Feasibility:** analyze water resource problems and select a recommended plan. 50% Federal & 50% non-Federal Cost

- *Chief of Engineers Report*
- *Environmental Impact Statement (EIS)*
- *Congressional Authorization*

**Pre-engineered and Design (PED):** design, construction specs, and studies needed to begin construction. 65% Federal & 35% non-Federal Cost

- *Project Cooperation Agreement (PCA) signed*

**Construction:** project is constructed. 65% Federal & 35% non-Federal Cost

- *Operation & Maintenance Manual (O&M)*

**Operation and Maintenance:** day to day maintenance to make sure the project is operational. 100% non-Federal Cost.

#### WATER RESOURCES DEVELOPMENT ACTS

- Sec. 1135 WRDA of 1986: **Project Modification for Improvement of the Environment.** Total project modifications costs: 75% Federal & 25% non-Federal. 80% of non-Federal share as work-in-kind services.
- Sec. 206 WRDA of 1996: **Aquatic Ecosystem Restoration.** Total project modification costs: 65% Federal & 35 % non-Federal. 100% of non-Federal share as work-in-kind services.

#### PROJECT PHASES

**Preliminary Restoration Plan (PRP):** scope and nature of proposed project. 100% Federal Cost (limited to \$10,000)

**Feasibility Phase** (if Federal Cost exceeds \$1 million): study project and select a plan for approval. Project cost is initially funded by Federal Gov., but if project approved for implementation then nonfederal sponsor is responsible for total project modifications costs, depending on the WRDA.

- *Detailed Project Report (DPR)*
- *Environmental Assessment (EA)*

**Plans and Specs:** design and construction specs of project

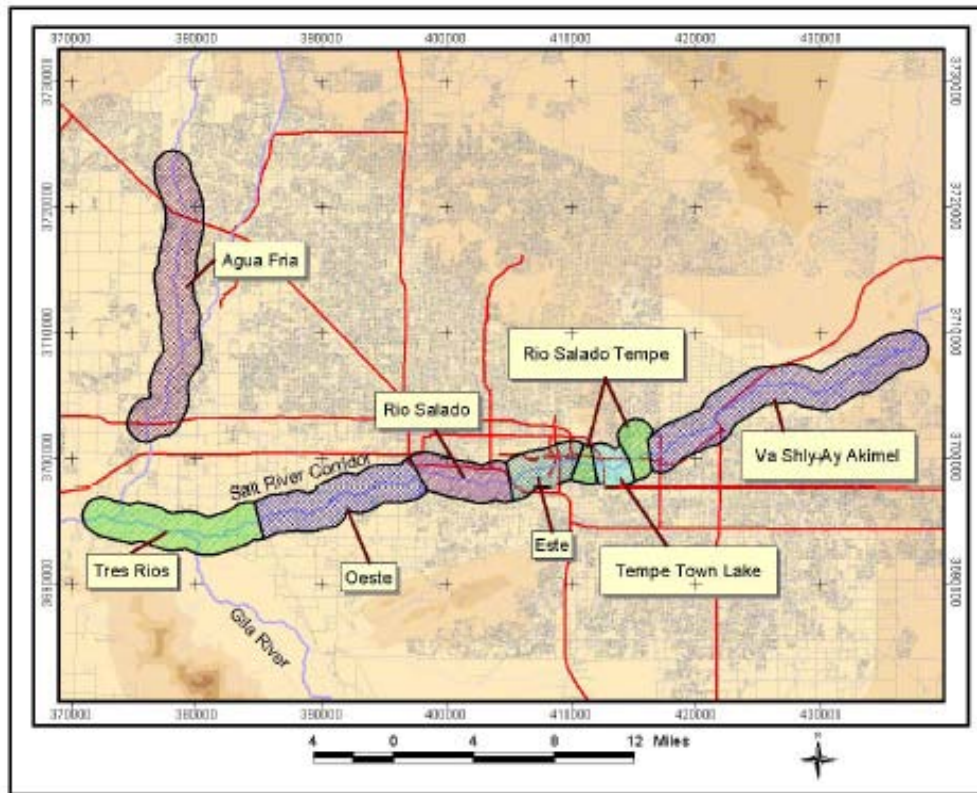
**Construction:** project is constructed

**Operation and Maintenance:** day to day maintenance to make sure project is operational. 100% non-Federal costs.

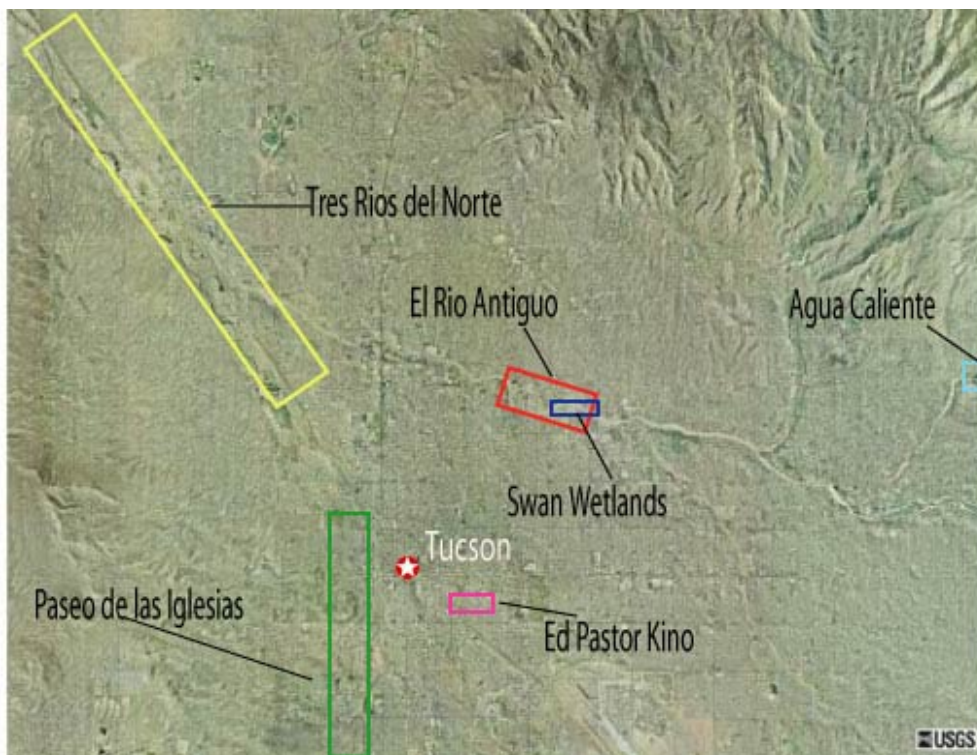
## Projects Included in the Study

This section reports on the Environmental Enhancement Projects included in this study in template form. They were selected based on their status at the time the study was undertaken. The projects are listed in Table 2.

<b>Table 2: Projects Included in Study</b>	
<b>Maricopa County</b>	<b>Pima County</b>
Tres Rios	Paseo de las Iglesias
Rio Salado, Oeste	Tres Rios del Norte
Rio Salado, Phoenix	El Rio Antiguo
Rio Salado, Tempe	Rillito/Swan Wetlands
Va Shly 'ay Akimel	Ed Pastor Kino Environmental Restoration Project
	Agua Caliente Spring



Maricopa County Projects



Pima County Projects



As will become evident in the project descriptions that follow, the water resource elements of the projects included in this study vary substantially. The water components are quite different, for example, depending on whether the project involves an effluent dominated reach or a river or a river bed that is dry except for floods and runoff. The features of each ecosystem restoration project are tailored to the physical as well as human dimensions of the site. Each is unique; each has unique water requirements and features. Each project has its own “story.”

The Salt River is a major tributary to the Gila River in Arizona. Prior to agricultural development and urbanization of the Phoenix metropolitan area, the Salt River was a perennial stream fed by snowmelt from mountains in eastern Arizona. Early in the 20<sup>th</sup> century dams constructed as part of the Salt River Project caused major modifications to the river system. As diversions of water increased for urban and agricultural uses, the river’s perennial flows ceased, causing the water table to drop. Today only small isolated fragments of the natural riparian ecosystem remain. All of the Maricopa County projects involve the Salt River yet the characteristics of those stretches vary significantly. Rio Salado Tempe, Phoenix and Oeste as well as Va Shly ‘ay Akimel are located on the Salt River. Tres Rios restoration project is at the confluence of the Gila, Salt and Agua Fria rivers.

Prior to degradation, the Santa Cruz River flowed year round at San Xavier del Bac and 10 miles north of downtown Tucson. Currently, the Santa Cruz is an ephemeral river, little riparian habitat exists, banks are deeply incised, and groundwater levels are at 150 ft. below surface. The Paseo de las Iglesias project seeks to restore the Santa Cruz from Los Reales Road to West Congress Street, a distance of 7.5 miles. The Tres Rios del Norte project will restore the Santa Cruz from Prince Road to Sanders Road between West Moore Road and West Avra Valley Road for a total distance of 19 miles.

In the past, the Rillito River flowed perennially, meandering and supporting dense vegetation of cottonwood, willows, mesquite bosques, numerous beaver dams, and wetlands. Over the years urbanization and agriculture increased, contributing to a loss in surface water flow, a decrease in the water table, and the need for bank stabilization. Today much of the riparian habitat is degraded. The Rio Antiguo project area covers from Craycroft Road downstream to Campbell Avenue, a 4.8 mile reach. The Swan Wetlands project is contained within El Rio Antiguo and spans from Craycroft Road to Columbus Boulevard.

Not all the projects involve rivers. The Tucson (Ajo) Detention Basin was constructed in 1966 along the Tucson Diversion Channel. The Corps built the basin as a flood control element, which intercepted and reduced peak flows upstream from Tucson Arroyo and Railroad Wash drainage areas. The basin, not aesthetically appealing, had a flat earthen bottom and levee with scrub trees and grasses along the edges. The Ed Pastor Kino Environmental Restoration Project runs along the Tucson Diversion Channel, north of Ajo Way and west of Country Club Road. From 1935 to the 1970’s, the Agua Caliente project area went through a rotation of owners who utilized the property for

ranching and farming. In 1985, Pima County Parks and Recreation purchased the property and opened the park to the public, which was named after Roy P. Drachman Sr., who donated \$200,000. The source of water for this proposed project is an underground thermal spring. Information on the cost of water was not provided in the study.

The following project summaries will include information on water resource requirement and costs, where available, along with the following information:<sup>14</sup>

- Project Title
- Location
- Federal Sponsors and Contacts
- Local Sponsors and Contacts
- History
- Authority
- Planning Objectives
- Phases/Current Phase
- Recommended Plan
- Cost
- Water Source
- Public Outreach
- Notes

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<sup>14</sup>Information included is based on that available at the time of writing.

# PIMA COUNTY PROJECTS

## Ed Pastor Kino Environmental Restoration Project

**Location:** Along Tucson Diversion Channel, Pima County, Tucson; north of Ajo Way and west of Country Club Road (141 acres).

**Federal Sponsors and Contacts:** USACE, Los Angeles District, Ed Louie, is currently the Project Manager for the Kino Environmental Restoration Project (213) 452-4002.

**Non-Federal Sponsors and Contacts:** Pima County Flood Control, Larry Robison (520) 740-6371

**History:** The Tucson (Ajo) Detention Basin, approximately 120 acres, was constructed in 1966 along the Tucson Diversion Channel. The Corps built the basin as a flood control element, which intercepted and reduced peak flows upstream from Tucson Arroyo and Railroad Wash drainage areas. Downstream, flows were released gradually into the Tucson Diversion Channel, which would then merge with the Julian Wash and down to the Santa Cruz River. The basin, not aesthetically appealing, had a flat earthen bottom and levee with scrub trees and grasses along the edges. In 1981, the Corps and Pima County developed a master plan for the Tucson Diversion Channel Recreation Development Program, (Corps Code 710 program -recreation at completed projects- with a cost sharing agreement of 50/50). In 1986, Sam Lena Park, adjacent the basin, was the only portion of the master plan constructed. The master plan was then updated in 1995 to include multi-use trails from Sam Lena Park to I-19. In 1997, baseball field and other public facilities (Kino Sports Complex) were constructed around the basin. The basin took on more runoff and became even more of an eyesore. In early 1997, the Corps initiated a Preliminary Restoration Plan (PRP) to determine the feasibility of modifying the basin features for restoration of riparian habitat. An Ecosystem Restoration Report (ERR) followed and was approved in April 1998. Plans and Specifications were initiated in June 1998. Construction was awarded in July 2000. Modifications were completed in 2002 and the original facility was expanded to 141 acres: 50 acres of wetlands within the basin, including freshwater marsh, riparian habitat. Twelve acres is made up of wildlife and open water areas, and 38-acres are mesquite bosque and ephemeral grassland. A golf course was also an idea at one stage, but was never implemented.<sup>15</sup>

**Authority:** Section 1135 of WRDA of 1986 - Project Modification for Improvement of the Environment

**Planning Objectives:** “Restore wetland and riparian vegetative communities representative of historical/optimal conditions in the region; restore habitats for target/beneficial fish and wildlife species; maximize the acreage of functional wetland habitat within limits of the golf course design; achieve an optimal mix of habitats that supports the greatest diversity of target/beneficial species while promoting the principal fish and wildlife objective proposed by a restoration alternative (balancing of objectives); minimize disturbance-type impacts to restored wetlands from the adjacent golf course and from pedestrian traffic; restore wetlands to be ecologically resilient and self-sustaining; minimize potential for sediment and organic matter accumulation in restored wetlands (low maintenance design); protect restored wetlands from feral predation;

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<sup>15</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 1998. *Tucson (Ajo) Detention Basin, Pima County, Arizona, Final Ecosystem Restoration Report*. Los Angeles: U.S. Army Corps of Engineers.

design for and maintain adequate vector control in restored wetlands; enhance water quality of the reclaimed water source (i.e., water treatment function of restored wetlands); maintain the existing flood protection capacity of the Tucson (Ajo) Detention Basin; accommodate incidental recreational values (e.g., interpretive centers, wildlife viewing, education and research).”<sup>16</sup>

**Operation Objectives:** “Maintain the Flood Control Capacity of the Basin; establish and maintain an ecosystem habitat in a US Corps of Engineers project as part of the Federal Requirements under Sec 1135; maximize use of harvested storm water, and minimize use of reclaimed water; utility reclaimed water as make-up water instead of groundwater; minimize mosquito population and avoid other vector nuisance; meet local, State, and Federal permit requirements; maintain water quality and ensure the public welfare; optimize ecosystem (plant and animals) establishment within an urban area.”<sup>17</sup>

**Current Phase:** Operation and Maintenance - Constructed (2002)

**Phases:** PRP completed in January 1997, ERR May 1998

**Cost:** Total construction award cost approximately \$8,215,444, awarded to Stronghold Engineering, Inc., Riverside, CA. Water cost is estimated to be \$265,000 a year.<sup>18</sup>

**Water Source:** Project uses storm water runoff and reclaimed water. Total water demand is estimated to be 574 acre-feet per year.<sup>19</sup>

**Public Outreach:** The Collins-Peña Firm developed a school program at a local elementary school, where kids created a 9’x 9’ model to present to local community.<sup>20</sup>

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<sup>16</sup> Ibid. p. 3-14

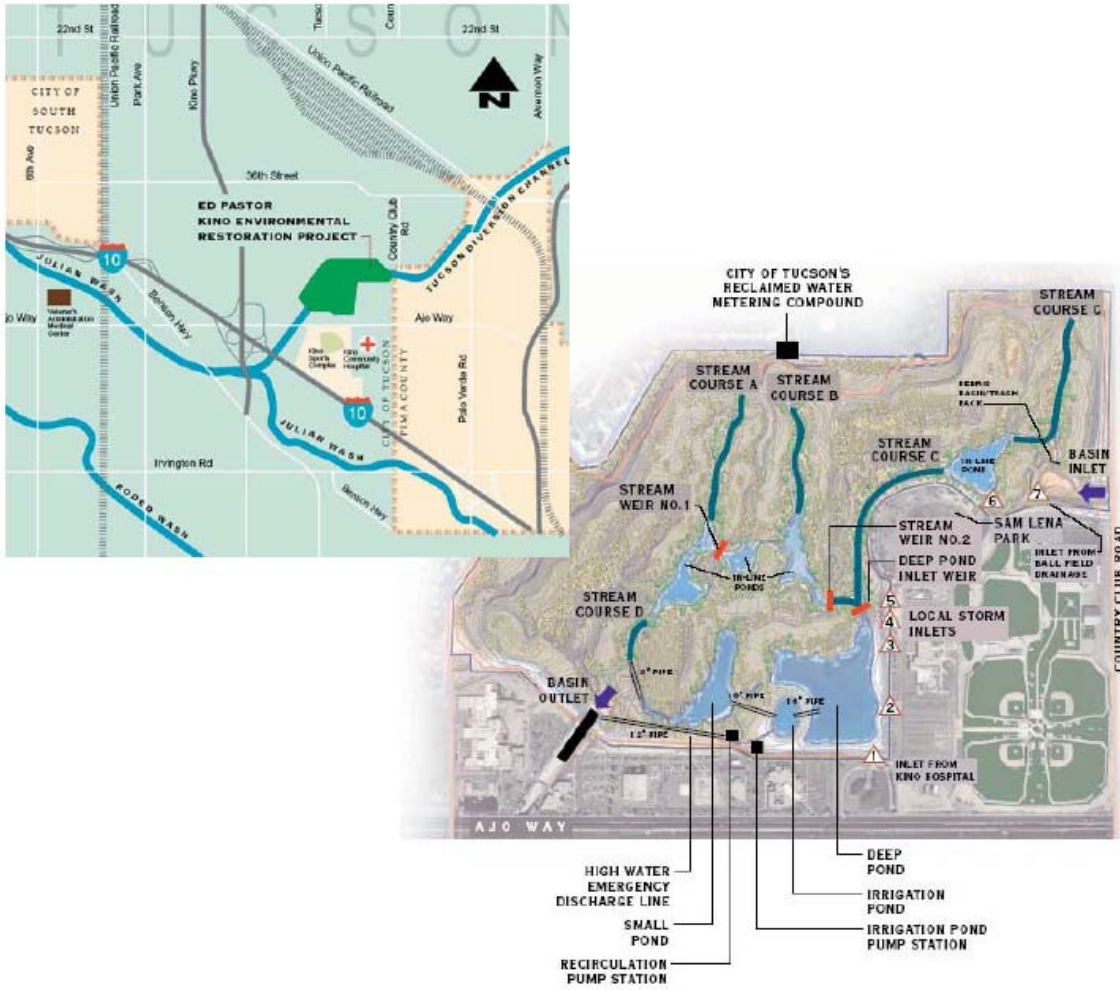
<sup>17</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2003. *Operation and Maintenance Manual: Ed Pastor Kino Environmental Restoration Project*. Tucson: U.S. Army Corps of Engineers. p. 14

<sup>18</sup> This estimate assumes a cost of \$462 per acre-foot. The water will be supplied by the Tucson Water Before the construction phase begins a signed interagency agreement between Pima County and City of Tucson will be required to assure the cost of the water and water availability for the life of the project. U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 1998. *Tucson (Ajo) Detention Basin, Pima County, Arizona, Final Ecosystem Restoration Report*. Los Angeles: U.S. Army Corps of Engineers. p. 5-22

<sup>19</sup> Ibid.

<sup>20</sup> Bennet, Paul. 2000. “A New Friendlier Corps.” *Landscape Architecture Magazine*. 01/00 Washington, D.C.

# Ed Pastor Kino Environmental Restoration



<b>Ed Pastor Kino Environmental Restoration Cost Estimate</b>	
Construction	\$3,620,891
Contingency (12.5%)	\$451,709
PED	\$265,000
Supervision, Inspection and Overhead (6.5%)	\$264,250
<b>Total First Costs</b>	<b>\$4,594,633</b>
Annual OMRR&R	\$50,000
Annual Cost of Water	\$265,000

## Ed Pastor Kino Environmental Restoration



View to the Deep Pond



Cottonwood Tree at  
Kino Wetlands



Wetland Formation along a Created Pond

Example of  
an In Line  
Pond



## Agua Caliente Spring

**Location:** Roy P. Drachman Agua Caliente Regional Park 12325 E. Roger Road, Pima County, Tucson; Northeast corner of the Tucson Basin at the foot of the Catalina Mountains (101 acres).

**Federal Sponsors and Contacts:** USACE, Study Manager: William Butler, William.O.Butler@spl.usace.army.mil (213) 452-3873; Project Manager: Paul Kerl, Paul.A.Kerl@spl.usace.army.mil

**Non-Federal Sponsors and Contacts:** Pima County Flood Control District: Julia Fonseca (520) 740-6350

**History:** From 1935 to 1970's the project area went through a rotation of owners who utilized the property for ranching and farming (orchards and alfalfa fields). In the 1970's through mid 80's a development company planned to build lake-side homes, but the idea was never implemented. In 1985, Pima County Parks and Recreation purchased the property and opened the park to the public, which was named after Roy P. Drachman Sr., who donated \$200,000.<sup>21</sup>

**Authority:** Section 206 - Aquatic Ecosystem Restoration

**Planning Objectives:** "Improve general ecosystem function; Increase the diversity of native vegetation structure and cover; Create habitat capable of supporting numerous rare native aquatic fish, amphibians, and reptiles; Restore the natural structure and function of the spring over at least a portion of the Park; Improve habitat for local native plant and animal species such as riparian birds; Create educational and recreational opportunities that improve public enjoyment of the Park; Facilitate a deeper public understanding of the plight of native aquatic species and their habitats in the southwest; Increase awareness of the impacts of non-indigenous species; Improve appreciation of biological diversity."<sup>22</sup>

**Phases:** Reconnaissance phase initiated in February 2000 and completed December 2000. After the reconnaissance report, project was then conducted under Sec 206 of WRDA 1996. Feasibility initiated September 2001. Final Detailed Project Report (DPR) October 15, 2002. Completed without recommendation to move forward at County's request due to lack of public support.

**Recommended Plan:** Alternative 2, One Pond and Cienega, (ponds 2 and 3 would be eliminated) was the tentatively selected plan because: "The plan has been determined to be a best buy, cost-effective plan; It represents high biological value and is estimated to result in 57.5 habitat units; It retains Pond 1, the existing spring flow channel and the entire upper Park area of lawn and picnic areas. This is the area most closely associated with the historic ranch buildings and is very popular with Park users. It represents the visual aesthetic that many Park visitors say is the defining character of the Park as they experience it—a restorative oasis in the desert."<sup>23</sup>

**Cost:** Total estimated costs of \$5.15 million.<sup>24</sup>

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<sup>21</sup> Pima County. 2005. *Agua Caliente Ranch*. <http://www.dot.co.pima.az.us/flood/AguaC/ranch/index.html>

<sup>22</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2002. *Agua Caliente Spring Aquatic Ecosystem: Detailed Project Report*. Los Angeles: U.S. Army Corps of Engineers. p. 2-3

<sup>23</sup> Ibid. p. 3-60

<sup>24</sup> Ibid. Appendix A



**Water Source:** Underground thermal spring.<sup>25</sup>

**Public Outreach:** Public outreach on this project was extensive.<sup>26</sup> A Citizen’s Advisory Committee formed to communicate ideas between citizens, sponsors, and Corps. Three public meetings by Corps and Sponsors (January, April, and August of 2002), major concerns were: “limited future public access and recreation opportunities in the Park if restoration is to proceed; loss of Park aesthetics caused by conversion of open water habitats to native cienega-type wetlands; lack of public input into planning process; effect of system alteration on species currently using the Park; risk of increased mosquito populations with creation of native habitats and removal of non-native fishes; and lack of adequate spring discharge to maintain streams that can support the target habitats/species.”<sup>27</sup>

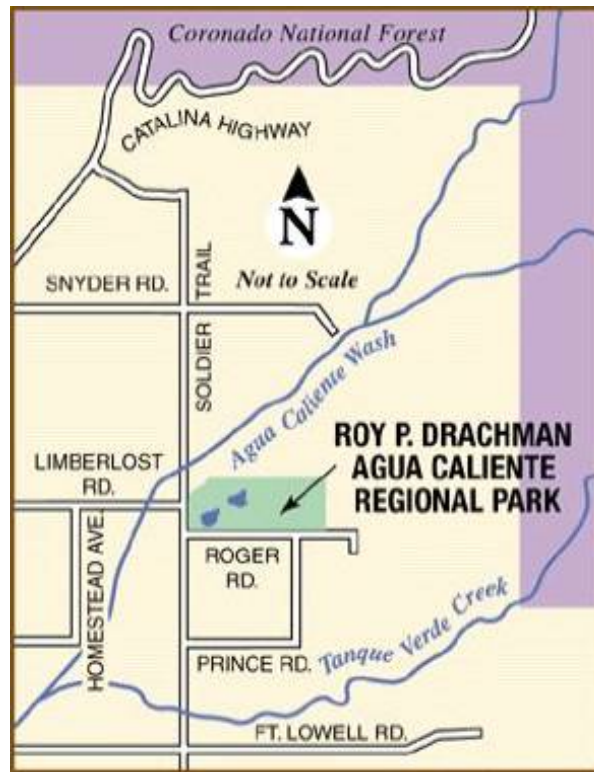
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<sup>25</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2002. *Agua Caliente Spring Aquatic Ecosystem: Detailed Project Report*. Los Angeles: U.S. Army Corps of Engineers.

<sup>26</sup> Ibid.

<sup>27</sup> Ibid.

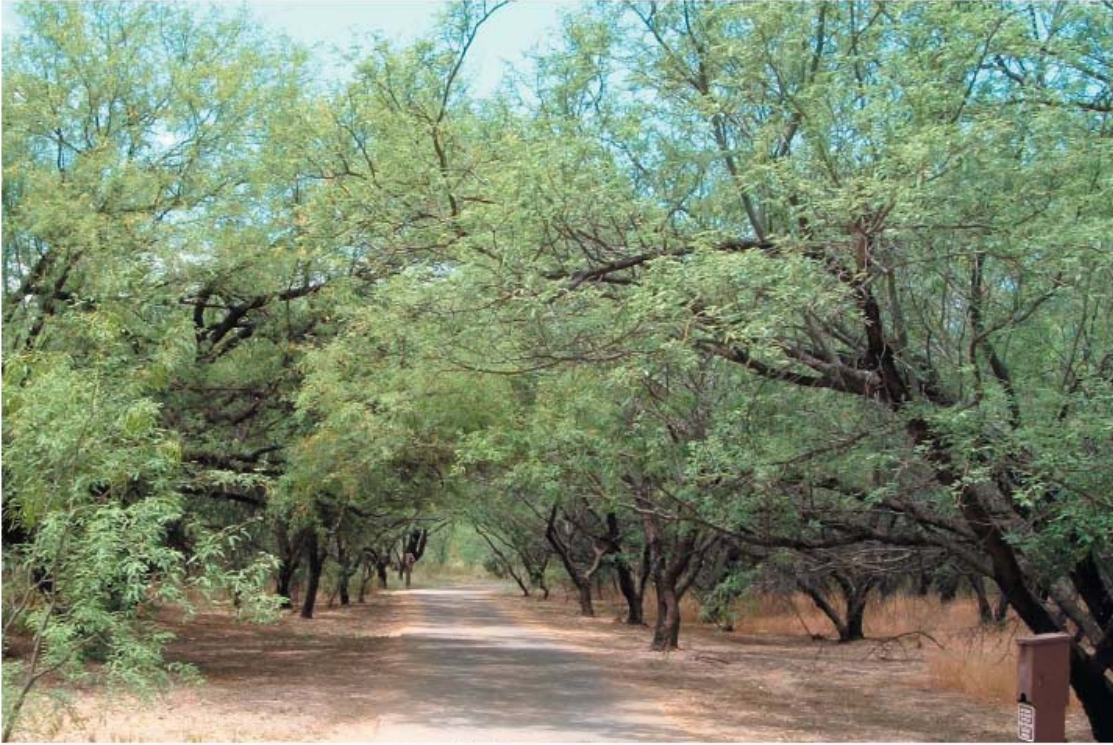
## Agua Caliente



<b>Agua Caliente Cost Estimate</b>	
Construction	\$4,500,000
Plans and Specifications	\$300,000
ER Report	\$350,000
<b>Total</b>	<b>\$5,150,000</b>

Detailed Project Report, Appendix B

## Agua Caliente



Mesquite Bosque, Trail to Pond 2



Pond 2, Agua Caliente

## Rillito River Riparian Area (Swan Wetlands)

**Location:** Rillito River, Pima County, Tucson; South Bank of Rillito River - Craycroft Road (confluence of Tanque Verde Creek with Pantano Wash) to Columbus Boulevard (60.7 acres).

**Federal Sponsors and Contacts:** USACE: Project Manager: Paul Kerl (602) 640-2004 x 281 Study Manager: Tom Keeney

**Non-Federal Sponsors and Contacts:** Pima County Flood Control District: Project Manager: Andrew Wigg, 520-740-6350, andy.wigg@dot.pima.gov

**History:** In the past the Rillito River flowed perennially, meandering and supporting dense vegetation of cottonwood, willows, mesquite bosques, numerous beaver dams, and wetlands. Flows supported agriculture along the river. With growing agriculture, in the 1930's, Finger Rock Wash was cut off from Rillito River and riparian vegetation was removed. Urbanization, along with agriculture, increased and contributed to a loss in surface water flow, a decrease in the water table, and bank stabilization for flood control. Today much of the riparian habitat is degraded.<sup>28</sup>

**Authority:** Section 1135 of WRDA - Modification of existing USACE projects for Ecosystem Restoration: The Rillito River Bank Protection Project was completed in 1996 between USACE and PCFCD.<sup>29</sup>

**Planning Objectives:** "Restore riparian vegetative communities within the river corridor to a more natural state, increase the acreage of functional seasonal wetland habitat within the study area, minimize the potential for sediment and organic matter accumulation in restored areas, increase habitat diversity..., increase recreation and environmental education opportunities within the study area."<sup>30</sup>

**Current Phase:** Contract between Corps and Pima County signed February 15, 2005, construction to begin summer 2005.<sup>31</sup>

**Phases:** Preliminary Restoration Plan approved June 1999; Environmental Restoration Report/ DPR and Environmental Assessment (ERR/EA) completed November 2003.

**Recommended Plan:** Alternative - 1, Riparian/Xeroriparian Terrace "The alternative emphasizes the creation of riparian woodland habitat along created linear wet areas. Xeroriparian habitat would be used in the remaining areas to buffer the riparian habitat from adjacent land uses. The site is divided into distinct areas based on the restoration effort that will occur."<sup>32</sup> "The major factor in selection of this alternative was the desire of the local sponsor to not have surface water conditions that may be a liability concern.

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<sup>28</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2004. *Rillito River, Pima County, Arizona: El Rio Antiguo Draft Feasibility Study*. Los Angeles: U.S. Army Corps of Engineers.

<sup>29</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2003. *Rillito River Pima County Ecosystem Restoration Report and Environmental Assessment*. Los Angeles: U.S. Army Corps of Engineers.

<sup>30</sup> Ibid. p. 2-2

<sup>31</sup> Davis, Tony. 2005. "Rillito restoration green lighted." *Arizona Daily Star*. Feb. 16.

<sup>32</sup> See *Rillito River Pima County Ecosystem Restoration Report and Environmental Assessment*. p. 3-6 for more information.

A contributing factor in the selection of this alternative is its design compatibility with the existing multi-use trail.”<sup>33</sup>

**Cost:** Total first costs are \$2.7 million.<sup>34</sup> Under the recommended plan of USACE needs 349 acre-feet of water per year, at approximately \$230 per acre-foot, for costs of approximately \$81,000 per year.<sup>35</sup>

**Water Source:** Reclaimed water from City of Tucson’s Roger Road Wastewater Treatment Plant for temporary irrigation and two artificial streams. Water will also come from harvesting storm water runoff, mainly water from Alamo Wash and seasonal snowmelt.<sup>36</sup> Water use is estimated at 349 acre-feet per year.

**Public Outreach:** Public Workshop Jan 6, 2000; Draft of ERR/EA March 21, 2003 - April 21, 2003 for public comment; PCFCD Open House May 2004.

**Notes:** There is a landfill in study area, called Columbus Landfill; El Rio Antiguo ER project is adjacent to study area. Interest in El Rio Antiguo and Swan Wetlands were simultaneous, Swan Wetlands should be completed first as it is a CAP 1135.<sup>37</sup>

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<sup>33</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2003. *Rillito River Pima County Ecosystem Restoration Report and Environmental Assessment*. Los Angeles: U.S. Army Corps of Engineers. p. 3-24

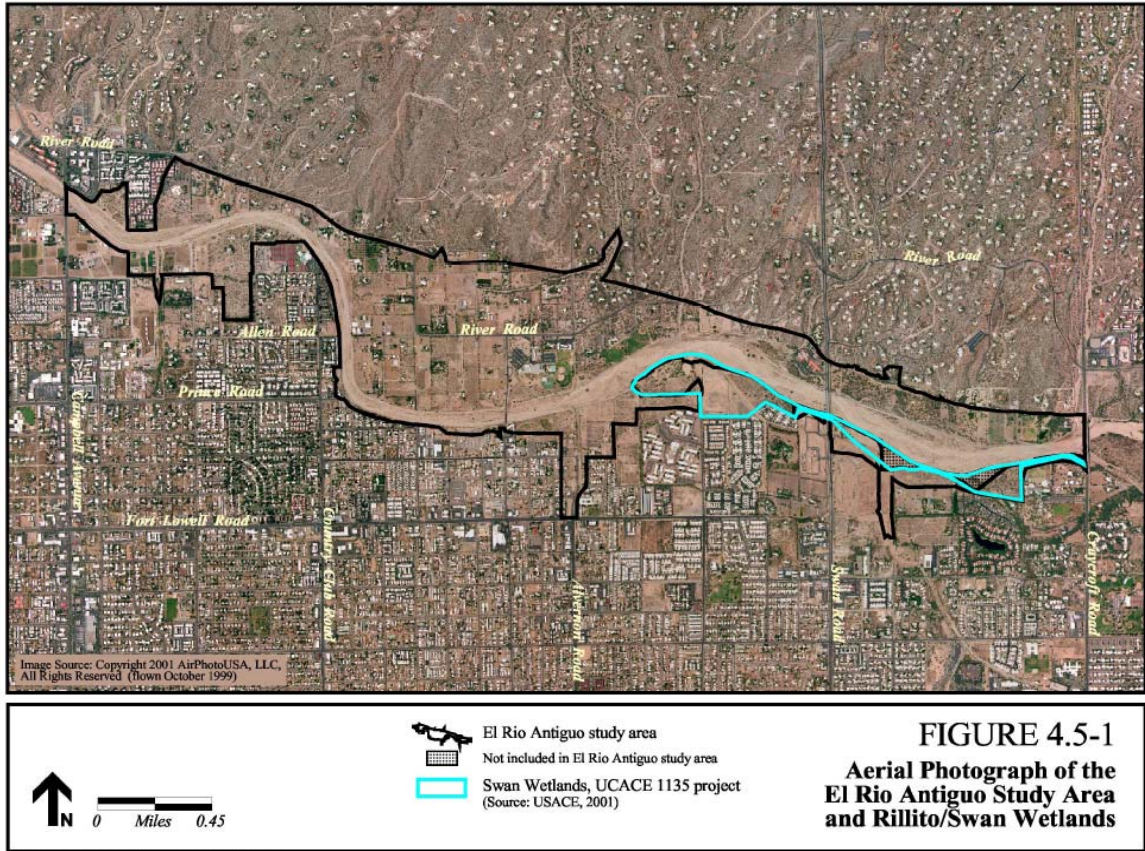
<sup>34</sup> Ibid. See table p. 3-29

<sup>35</sup> The \$230 per acre-foot charge is based on the cost to obtain the water from the Tucson Water Department. Ibid. p. 3-14.

<sup>36</sup> Ibid.

<sup>37</sup> Bergmann, Kathy. 2004. Personal communication with the author, August, 23.

## Rillito River Riparian Area (Swan Wetlands)



M:\job\230407\env\gis\F4\_cbt-nov03.apr\Fig4.5-1 (swan wet) 11/17/03

<b>Swan Wetlands Cost Estimate</b>	
DPR/EA	\$400,000
Construction	\$1,659,043
Contingency	\$359,468
PED	\$198,752
Supervision, Inspection and Overhead	\$142,108
<b>Total First Costs</b>	<b>\$2,759,370</b>
Total Annual OMRR&R	\$124,000
Annual Cost of Water	\$81,000

Rillito River ERR/EA, p. 3-14

## Rillito River Riparian Area (Swan Wetlands)



South Bank of Rillito River, East of Swan Road.



South Bank of Rillito River, West of Swan Road.

## Paseo de las Iglesias

**Location:** Santa Cruz River, Pima County, Tucson; Los Reales Road to West Congress Street and West Branch of Santa Cruz River (7.5 miles and 5,005 acres) Name: “Walk of Churches” - adjacent San Xavier Mission, San Agustin Mission, to the Convento site at the base of Sentinel Peak.

**Federal Sponsors and Contacts:** USACE, Project Manager: John Drake, Study Manager: Kim M. Gavigan, Kim.M.Gavigan@usace.army.mil (602) 640-2015 x 251

**Non-Federal Sponsors and Contacts:** Pima County Department of Transportation and Flood Control District, Project Manager : Tom Helfrich, Tom.Helfrich@dot.pima.gov; Contact: Jennifer Becker, Jennifer.Becker@dot.pima.gov

**History:** Prior to degradation, the Santa Cruz (SC) River flowed year round at San Xavier del Bac and 10 miles north of downtown Tucson. SC River was a shallow stream with a wide flood plain, containing cottonwoods, willows, and mesquite bosques. A wetland at former confluence of West Branch and SC River was turned into a lake during the Spanish/Mexican period and in 1874 became Warner’s Lake (approximately 50 acres) which was used for a mill. Later the area was converted into a resort named Silverlake. In the 1900’s, the Tohono O’odham Nation at San Xavier and Tucson farmers diverted surface water, then later groundwater, for irrigation of crops. In 1915 the West Branch of SC River was diverted to the East Branch to prevent flooding of crops, leaving the current remnants of riparian habitat along the West Branch. In 1935 the WPA straightened the East Branch channel, known today as main channel of SC River, from San Xavier downstream to Congress Street. Between 1950 and 1960, one million tons of garbage was dumped in and around SC River, artificially narrowing the channel. Construction of I-10 and I-19 helped to further channelize the river, as did the addition of soil cement in portions of the SC River to reduce bank erosion and flood damages. Currently, the SC is an ephemeral river, little riparian habitat exists, banks are deeply incised, and groundwater levels are at 150 ft. below surface. Today 1/2 of the groundwater pumped in Tucson comes from wells near SC River.<sup>38</sup>

**Authority:** General Investigation - Ecosystem Restoration

**Planning Objectives:** “Increase the acreage of functional riparian and floodplain habitat within the study area; increase wildlife habitat diversity by providing a mix of riparian habitats within the river corridor, riparian fringe and historic floodplain; provide passive recreation opportunities; provide incidental benefits of flood damage reduction, reduced bank erosion and sedimentation, and improved surface water quality consistent with ecosystem restoration goal; integrate desires of local stakeholders consistent with Federal policy and local planning efforts.”<sup>39</sup>

**Current Phase:** Corps is finalizing feasibility, PED in 2005, Construction 2008.

**Phases:** Draft Feasibility (AFB) Report December 2003; Draft Feasibility Report July 2004

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<sup>38</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2003. *Santa Cruz River, Paseo de las Iglesias Pima County, Arizona Draft Feasibility Study Report Alternative Formulation Briefing*. Los Angeles: U.S. Army Corps of Engineers.

<sup>39</sup> Ibid. p. V-I



**Recommended Plan:** 3E (mesoriparin)<sup>40</sup> “Alternative 3E is characterized by irrigated plantings of mesquite and riparian shrub on terraces above the low flow channel and in the historic floodplain with small areas of emergent marsh and cottonwood-willow habitat located at water harvesting features scattered throughout the project. The construction and planting of subsurface water harvesting basins would occur at the confluences of 8 tributaries and upstream of 6 existing grade control structures. A variety of methods would be used to provide permanent irrigation systems for all planted areas including the basins.”<sup>41</sup>

**Cost:** “The total first cost of the recommended plan is \$92,058,546 and the total operation and maintenance costs including water are \$1,906,221. The Federal share of the recommended plan is \$59,666,768 and the non-Federal share is \$32,391,778.”<sup>42</sup> The cost of providing water for the project is an associated non-Federal cost, and 100 percent of these costs will be paid by the non-Federal sponsor. These costs are currently estimated at \$1,099,175 annually.<sup>43</sup>

**Water Source:** Water harvesting and reclaimed water from the City of Tucson, “For as long as the project remains authorized, the non-Federal sponsor must provide sufficient water for construction, operation and maintenance of the project. Tertiary effluent accessed from reclaimed water mains will be distributed through an irrigation system in the restored areas. The annual water budget for the tentatively recommended plan is estimated at 1,925 acre-feet per year.”<sup>44</sup>

**Public Outreach:** Notice of Intent April 2001; Public Scoping March 31, 2001 with tour of site; Open House by PCFCD January 22, 2004. “Public comments specific to the Old West Branch suggested: developing plans which serve multiple objectives; incorporating more permaculture techniques in water harvesting, planning, design, and implementation; and incorporating civic amenities such as a self-guided historic walk with benches and written information, shade and benches; trails, picnic areas and ramadas with BBQs.

None of the participants expressed support for flood damage reduction efforts in the study area. Because of the public interest evidenced during the initial meeting, further meetings were scheduled to establish a process for development of public involvement in planning for restoration of the Santa Cruz River in the study area. The principal participants in this public workshop planning process were representatives from federal, state, and local agencies, and citizens from the local area.

Two smaller workshops were held on March 21, 2002 and again on April 9, 2003. In each case, representatives of local agencies, citizens from the local area and other stakeholders were convened to solicit input regarding restoration measures and desired

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<sup>40</sup> Endorsed by Pima County, recommended plan by Corps was not acceptable to Pima County due to excessive amount of water used, therefore a change in alternative. The Corps are finalizing the Feasibility Study Report for public release in October 2004.

<sup>41</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2003. *Santa Cruz River, Paseo de las Iglesias Pima County, Arizona Draft Feasibility Report*. Los Angeles: U.S. Army Corps of Engineers. p. iii

<sup>42</sup> Ibid. p. iv

<sup>43</sup> Ibid. p. VI-4

<sup>44</sup> Ibid.

outputs. In addition, a public open house to discuss preliminary findings was conducted by Pima County on January 22, 2004.”<sup>45</sup>

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<sup>45</sup>Ibid. p. II-4

## Paseo de las Iglesias



<b>Paseo de las Iglesias Cost Estimate</b>	
Construction and Real Estate	\$72,828,371
Adaptive Management	\$1,870,205
Contingency (15%)	\$6,967,940
PED (10%)	\$4,659,627
EDC (1%)	\$465,863
Construction Management (6.5%)	\$3,482,323
Monitoring	\$623,304
<b>Total First Costs</b>	<b>\$90,916,632</b>
Annual OMRR&R	\$770,785
Annual Cost of Water	\$1,099,175

Draft Feasibility Report, p. VI-5

## Paseo del las Iglesias



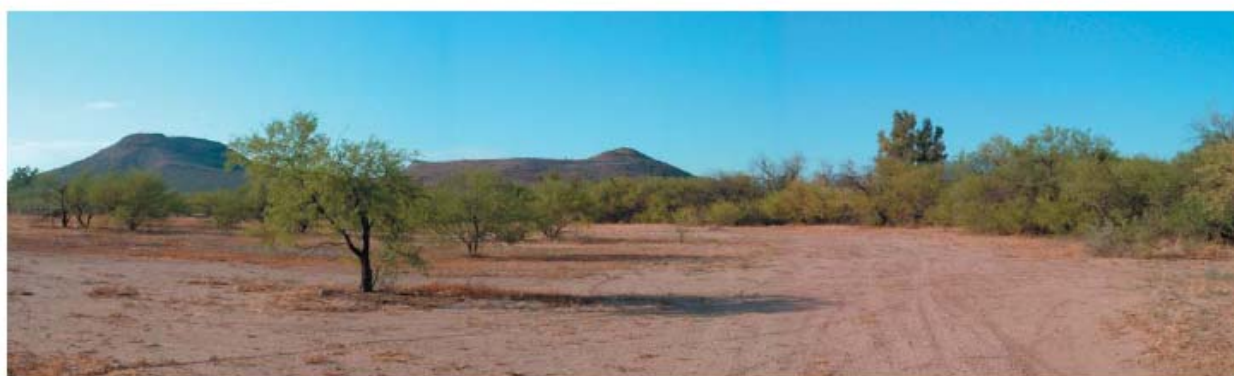
View North to Silverlake Rd Bridge, Santa Cruz River



West Branch of the Santa Cruz, South of Silverlake Road



Recreation: Riding Along the Santa Cruz River



Mesquite Bosque Adjacent West Branch of Santa Cruz River, and South of Silverlake Road.

## El Rio Antiguo

**Location:** Rillito River, Pima County, Tucson; Craycroft Road downstream to Campbell Avenue (4.8 mile reach and 1,066 acres). El Rio Antiguo is the “Old River” in Spanish

**Federal Sponsors and Contacts:** USACE: Project Manager: John Drake, Study Manager: Kathleen Bergmann (602) 640-2004 x250

**Non-Federal Sponsors and Contacts:** Pima County Flood Control District: Project Manager: Carla Danforth, Caral.Danforth@dot.pima.gov

**History:** In the past the Rillito River flowed perennially, meandering and supporting dense vegetation of cottonwood, willows, mesquite bosques, numerous beaver dams, and wetlands. Flows supported agriculture along the river. With growing agriculture, in the 1930’s, Finger Rock Wash was cut off from Rillito River and riparian vegetation was removed. Urbanization, along with agriculture, increased and contributed to a loss in surface water flow, a decrease in the water table, and bank stabilization for flood control. Today much of the riparian habitat is degraded.<sup>46</sup>

**Authority:** General Investigation - Ecosystem Restoration

**Planning Objectives:** “Restore riparian vegetative communities within the river corridor to a more natural state; increase the acreage of functional seasonal wetland habitat within the study area; increase habitat diversity by providing a mix of habitats within the river corridor including the riparian fringe and buffer; provide incidental flood control through ecosystem restoration to the extent that it does not impact the restoration object; increase recreation and environmental education opportunities within the study area.”<sup>47</sup>

**Current Phase:** Feasibility Complete. In October 2004 under WRDA of 2004, Corps will ask Congress for funding for Pre-Engineering Design Phase.

**Phases:** Reconnaissance Report completed September 2001; Draft Feasibility Report Study published October 2003 and May 2004, Draft EIS Nov 2003.

**Recommended Plan:** Alternative 2H– 1 Terrace without buffer “A set of terraces in the area known as the “Bend;” Cottonwood/willow, mesquite, shrub and grasses planted in the channel, in tributary mouths, and in water harvesting basins on the tributaries; A culvert and pipeline from upstream will allow water to flow behind the soil cement in 2-year and higher events to provide water to riparian plant communities along the north bank in the upstream portion of the study area; A high and low flow channel created to support a mesquite community and connect the Finger Rock Wash to the Rillito River; Water harvesting basins at each upstream tributary mouth; and A distribution system for effluent supporting planted vegetation until established and in dry periods.”<sup>48</sup>

**Cost:** Total First Cost is \$66,657,000. Current annual water cost to Non-Federal sponsor is approximately \$852,000.<sup>49</sup>

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<sup>46</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2004. *Rillito River, Pima County, Arizona: El Rio Antiguo Draft Feasibility Study*. Los Angeles: U.S. Army Corps of Engineers.

<sup>47</sup> Ibid. p. V-1

<sup>48</sup> Ibid.

<sup>49</sup> Ibid. p. VI-13

**Water Source:** Water harvesting, temporary effluent irrigation (Roger Wastewater Treatment Plant) until vegetation established, and reclaimed water from existing waterlines for flood irrigation (terraces).<sup>50</sup> The recommended plan requires 1,490 acre-feet of water per year.<sup>51</sup>

**Public Outreach:** During the planning process, public opinion was solicited from a variety of sources. The El Rio Antiguo Work Group, facilitated by Novak Inc. and initiated on May 8, 2002, included 7 months of field trips and meetings. Concerns of group included: “access to Rillito River and existing trails; use of native vegetation for restoration; wise use of water; providing wildlife habitat; visual impact of project; using interpretive signage; and working with surrounding neighbors.”<sup>52</sup> January 28, 2004 was final Corps public meeting on feasibility stage.

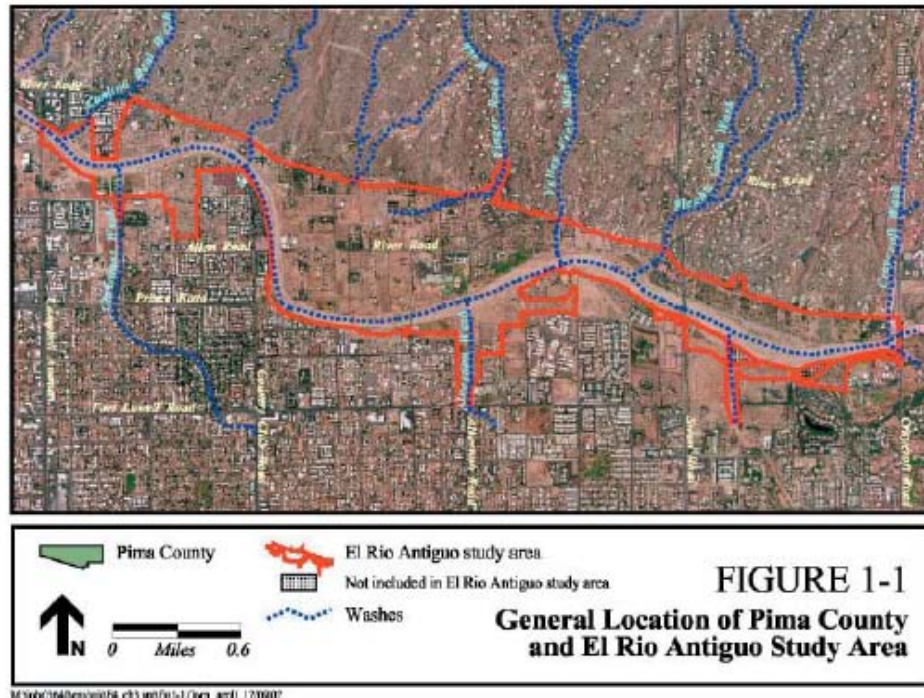
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<sup>50</sup> Ibid.

<sup>51</sup> Ibid. Appendix C

<sup>52</sup> Ibid. p. VIII-2

# El Rio Antiguo



<b>Rio Antiguo Cost Estimate</b>	
Construction and Real Estate	\$48,546,500
Adaptive Management (3%)	\$1,868,000
Contingency (25%)	\$6,611,500
PED (10%)	\$4,150,000
EDC (1%)	\$527,500
Construction Management (6.5%)	\$2,149,000
Recreation First Costs	\$2,804,500
<b>Total First Costs</b>	<b>\$66,657,000</b>
Annual Cost of Water	\$851,932
Annual OMRR&R	\$391,425
<b>Total Annual Cost</b>	<b>\$1,243,357</b>

Draft Feasibility, p. VI-13

## El Rio Antiguo



View of Rillito River from Swa



View of Rillito River from Campbell Road looking East



**Existing Condition**



**Future with Implementation of the Recommended Plan**



## Tres Rios del Norte

**Location:** Santa Cruz River, Pima County, Tucson; Prince Road to Sanders Road, West Moore Road, and West Avra Valley Road. (19 miles)

**Federal Sponsors and Contacts:** USACE: Project Manager: John Drake, Study Manager: Bill Miller

**Non-Federal Sponsors and Contacts:** Pima County Flood Control: Project Manager: Tom Helfrich, Tom.Helfrich@dot.pima.gov, Town of Marana: Jennifer Christelman (520) 382-2600 j.christelman@marana.com, City of Tucson: Ralph Mara from Tucson Water.

**History:** Prior to degradation, SC River flowed year round at San Xavier del Bac and 10 miles north of downtown Tucson. The SC River was a shallow stream with a wide flood plain, containing cottonwoods, willows, and mesquite bosques. Riparian forests were found near Marana. Agriculture previously dominated northern portion of Tres Rios del Norte, in Avra Valley west of SC River. Sand and gravel mining began in 1970's and 80's near Ina and Cortaro Roads and continues today. Due to past agriculture and current municipal use, groundwater levels today are approximately 100 to 250 feet below surface. Only effluent discharge from Roger and Ina Wastewater Treatment Plant (plus storm water runoff) supports vegetation. Currently, effluent water flow is variable and is not available throughout the entire study area. Future use of effluent discharge is currently not reliable as other purposes, such as irrigation of golf courses, may have a higher priority than discharge. (See Institutional Framework Studies: Basic Principles of Arizona JJ010.C)<sup>53</sup>

**Authority:** General Investigation: Ecosystem Restoration

**Planning Objectives:** "Restoring wetland and riparian vegetative communities within the river corridor to a more natural state; increasing the acreage of functional seasonal wetland habitat within the river corridor; minimizing disturbance-type impacts to restored wetlands; minimizing the potential for sediment and organic matter accumulation in restored wetlands; increasing habitat diversity by providing a mix of habitats both in the river corridor and along the riparian fringe and buffer; reducing potential flood damages in specified areas"<sup>54</sup> Current Phase: F4a milestone completed, waiting on funding to continue. City of Tucson may add to water supply/quality (constructed recharge in riverbed to get 100% credit) as a new project purpose/objective. Sponsors want to finalize water resource planning issues before public review.<sup>55</sup>

**Phases:** Reconnaissance Report initiated February 2000 and completed December 2000 (Sec 6 of Flood Control Act of 1938); Feasibility F4A Milestone (AFB) January 2004.

**Current Phase:** F5 – Draft Feasibility Report

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<sup>53</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2004. *Tres Rios del Norte – Pima County, Arizona Ecosystem Restoration Feasibility Study F4A Milestone - Alternative Formulation*. Briefing Report Los Angeles: U.S. Army Corps of Engineers.

<sup>54</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2003. *Preliminary Draft Environmental Impact Statement, Tres Rios del Norte Feasibility Study*. Los Angeles: U.S. Army Corps of Engineers.

<sup>55</sup> Christleman, Jennifer. (City of Marana). 2004. Personal interview with author, September.

**Tentative Plan:** Alternative B – High Mesquite-Woodland habitat restoration<sup>56</sup> The Tentative Plan, referred to as “Plan B – High” in the report, is a comprehensive alternative designed to restore nineteen miles of degraded habitat along the Santa Cruz River and its adjacent floodplains. The restoration would vastly improve mesquite, cottonwood-willow, and emergent wetland habitats to a condition supportive of wildlife, and for the benefit of residents and visitors to the area.<sup>57</sup>

**Cost:** “The Tentative Plan is currently estimated at a construction cost of approximately \$292 million. The Federal share of construction is currently estimated at approximately \$170 million, and the non-Federal share at \$117 million.”<sup>58</sup> The annual cost of water is estimated to be \$5,334,630.<sup>59</sup>

**Water Source:** Currently, effluent discharge flows perennially from Roger Road and Ina Road Wastewater Treatment Plant. Tentative Plan includes piped delivery of tertiary reclaimed water and in channel effluent flows, requires approximately 9,000 acre-feet in water annually.<sup>60</sup> “Supplemental water would be provided throughout the study area to nourish the restored vegetated areas. The water distribution system required for sustenance of the restored areas includes delivery of tertiary reclaimed water and the use of in-channel effluent. Site work would include micro-grading for individual tree basins, flood irrigation, bubblers, drip irrigation, and implementation of micro- and macro-scale storm water-harvesting features. The Tentative Plan requires approximately 9,000 acre-feet in water, currently planned to be obtained from effluent and/or tertiary-treated sources. This will result in over 3,000 acres of watered and storm water-nourished habitat.”<sup>61</sup>

**Public Outreach:** Unknown, to be included in F5 report.

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<sup>56</sup> The chosen alternative may change if new objective is added to project.

<sup>57</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2004. *Tres Rios del Norte – Pima County, Arizona Ecosystem Restoration Feasibility Study F4A Milestone - Alternative Formulation*. Briefing Report Los Angeles: U.S. Army Corps of Engineers. p. iii

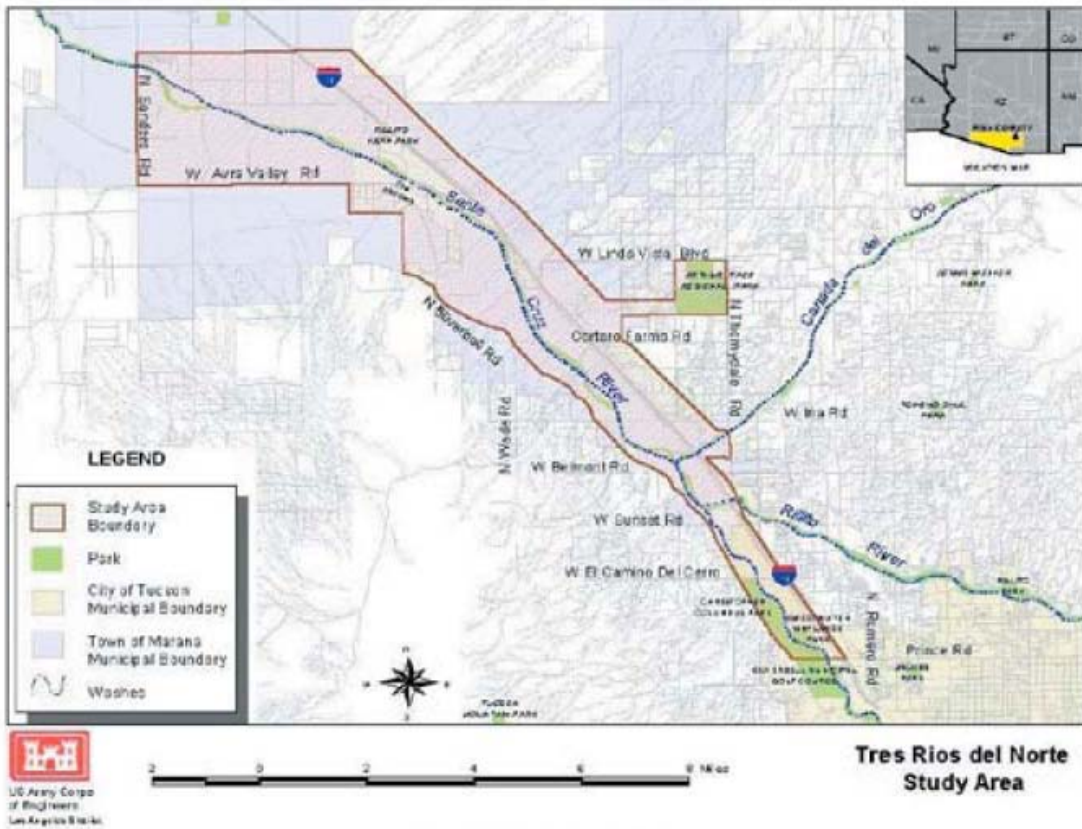
<sup>58</sup> Ibid. p. iv

<sup>59</sup> According to the F4A Feasibility report water will cost \$105 per acre-foot at the assumed source. Ibid. p. 6-14

<sup>60</sup> Ibid.

<sup>61</sup> Ibid. p. iv

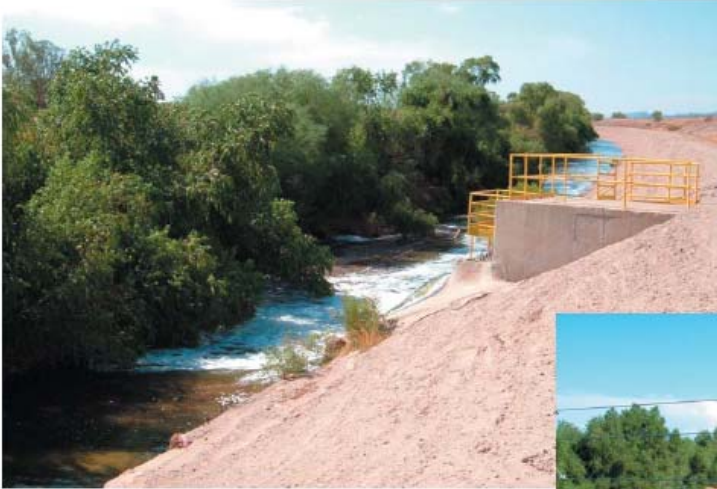
## Tres Rios del Norte



<b>Tres Rios del Norte Cost Estimate</b>	
Construction (Construction, S&A, PED/EDC, Contingency)	\$224,948,000
Adaptive Management and Monitoring (1st yr.)	\$115,000
Escalation	\$36,831,000
Construction LERRDs (Lands, Easements, Rights-of-Way, Relocations, Disposal Sites)	\$25,076,000
<b>Total First Cost, Construction plus Real Estate (rounded)</b>	<b>\$286,970,000</b>
Interest During Construction	\$25,295,000
Annual Investment Cost	\$19,467,000
Annual Cost of Water	\$5,334,630
Total Annual OMRR&R	\$11,661,000
<b>Total Annual Cost</b>	<b>\$31,128,000</b>

F4A Feasibility January 2004, pg iv

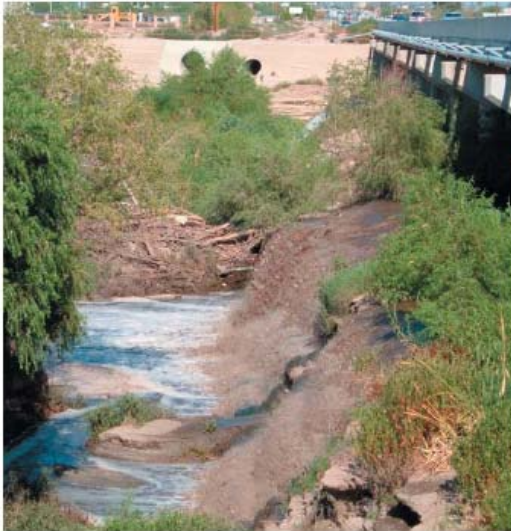
## Tres Rios del Norte



Roger Rd. Waste Water Treatment Plant  
Outfall into the Santa Cruz River.



Effluent Water from Roger Rd WWTP in  
the Santa Cruz River, looking South on  
Ina Road Bridge.



Ina WWTP Outfall in Background and  
Ina Rd. Bridge. Effluent Water From  
Roger Road WWTP.



Santa Cruz River: View to the North from Ina  
Rd. Bridge

# MARICOPA COUNTY PROJECTS

## Va Shly 'ay Akimel

**Location:** Salt River, Maricopa County, Phoenix; Granite Reef Dam to Loop 101 Bridge (14 mile reach and 17,435 acres).

**Federal Sponsors and Contacts:** USACE: Project Manger: Mike Ternak, mike.ternak@usace.army.mil; Study Manager: Kayla Eckert (602) 640-2001

**Non-Federal Sponsors and Contacts:** City of Mesa: Senior Engineer: Gordon Haws (480) 644-3380, Assistant to City Manager Jim Huling 480-644-5796; Salt River Pima-Maricopa Indian Community (SRPMIC): Cultural and Environmental Services: Marilyn Ethelbah (480) 850 – 4157

**History:** “The Salt River is a major tributary to the Gila River in Arizona...Before agricultural development and urbanization of the Phoenix metropolitan area, the Salt River was a perennial stream fed by snowmelt from mountains in eastern Arizona. In the early part of the 20<sup>th</sup> century, major modifications to the river system occurred as part of the Salt River Project, which placed several dams along the Salt River to allow diversions of water for agricultural and urban uses. Sand and gravel mining operations and other activities along the river induced additional changes to the river channel and hydrology. As diversions of water increased, the perennial flows in the river ceased, causing the groundwater table to drop. These changes in hydrological conditions caused the natural riparian ecosystem to decline to the point at which only small, isolated fragments of this former habitat remain. The changes in hydrology have also allowed saltcedar, an invasive nonnative plant species with minimal habitat value, to become established in the region.”<sup>62</sup>

**Authority:** General Investigation - Ecosystem Restoration

**Planning Objectives:** “Restore the riparian ecosystem to the degree that it supports native vegetation and wildlife through the Salt River from immediately downstream of the Granite Reef Dam to the Pima Freeway (SR 101); Establish a functional floodplain in unconstrained river reaches of the study area that is ongoing and mimics the natural processes found in other naturalized riparian corridors in Arizona; Provide passive recreation opportunities for visitors of all ages, abilities, and backgrounds that are in harmony with the SRPMIC’s management of its culture and native ecology; Create awareness through ongoing educational opportunities of the significance of the cultural resources relating to the Salt River; Create awareness through ongoing education opportunities of the significance of the Salt River ecosystem; Create awareness through ongoing educational opportunities of the ecological connection between other ongoing riparian restoration projects along the Salt River.”<sup>63</sup>

**Current Phase:** F7 Feasibility Review Conference

**Phases:** Reconnaissance initiated November 2000, Feasibility initiated August 2001, Final EIS submitted September 2004.

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<sup>62</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2004. *Va Shly' ay Akimel Salt River Ecosystem Restoration Feasibility Study, Final Environmental Impact Statement*. Phoenix: U.S. Army Corps of Engineers. p. 2-1

<sup>63</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2004. *Va Shly' ay Akimel Draft Salt River Ecosystem Restoration Study*. Los Angeles: U.S. Army Corps of Engineers. p. V-6

**Recommended Plan:** Alternative O is the recommended plan and includes vegetation of large portions of the project area and minimal support for flood control structures. The restoration includes: Cottonwood-Willow (883.4 acres), Mesquite Woodlands (379.7 acres), River Bottom (425.1 acres), and Sonoran Desert Scrub Shrub (23.6 acres).<sup>64</sup>

**Cost:** “The ecosystem restoration component of the Tentatively Recommended Plan would require \$76,143,600 in construction costs, \$19,035,900 in contingency costs, \$7,614,400 in Pre-construction Engineering and Design, \$761,400 in Engineering during Construction, and \$4,949,300 in Supervision and Administration, for a total construction cost of \$108,504,600.” Operations, Maintenance, Rehabilitation and Repair for the ecosystem restoration component has been estimated at \$131,000 per year. Associated costs for water supply are currently estimated at \$1,283,000 per year.<sup>65</sup>

**Water Source:** Water for the project will be supplied by surface water and groundwater from the SRPMIC (30,000 acre-feet/year) and effluent from the City of Mesa Wastewater Treatment Facility.<sup>66</sup> Eight new irrigation diversion structures and one new well will be used to deliver the water to the project. Annual water demand is 8,550 acre-feet.<sup>67</sup>

**Public Outreach:** A series of six scoping meetings were held with SRPMIC and the City of Mesa between January 24, 2002 and April 1, 2003. The purpose of these meetings was to introduce the project to the public, give individuals and agencies an opportunity to identify issues for consideration in the EIS, and to solicit input on the project. News articles related to the project were also published. The draft EIS was also available for public review and comment.<sup>68</sup>

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<sup>64</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2004. *Va Shly' ay Akimel Salt River Ecosystem Restoration Feasibility Study, Final Environmental Impact Statement*. Phoenix: U.S. Army Corps of Engineers. p. 5-28

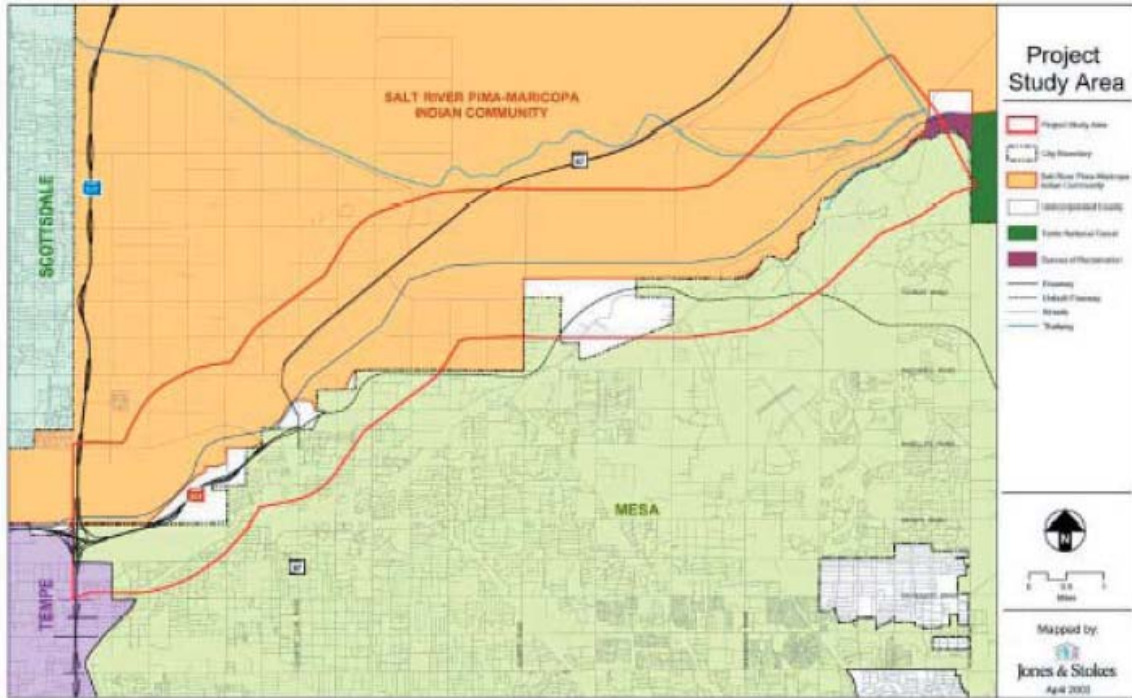
<sup>65</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2004. *Va Shly' ay Akimel Draft Salt River Ecosystem Restoration Study*. Los Angeles: U.S. Army Corps of Engineers. p. VI-6

<sup>66</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2004. *Va Shly' ay Akimel Salt River Ecosystem Restoration Feasibility Study, Final Environmental Impact Statement*. Phoenix: U.S. Army Corps of Engineers. p. 3-7

<sup>67</sup> Ibid. p. 3-23

<sup>68</sup> Ibid. p. 11-2

## Va Shly 'ay Akimel



<b>Va Shly 'ay Akimel Cost Estimate</b>	
Habitat Restoration	\$76,143,600
Contingency Costs	\$19,035,900
PED	\$7,614,400
EDC	\$761,400
Supervision and Administration	\$4,949,300
<b>Total Construction</b>	<b>\$108,504,600</b>
Monitoring and Adaptive Mgt	\$4,340,000
Real Estate	\$24,949,400
<b>Total First Cost*</b>	<b>\$137,794,000</b>
OMRR&R (Habitat)	~\$131,000
Water supply	~\$1,283,000
*Cost estimates for recreation range from \$1,351,000 to \$3,217,000.	

Draft Feasibility Study, VI-6



**Va Shly ‘ay Akimel**



Water Seepage from Granite Reef Dam



Wetlands Downstream of Granite Reef Dam



Salt River at Alma School Road

## Rio Salado - Tempe Reach

**Location:** Salt River, Maricopa County, Phoenix; McClintock to Priest Drive (except Tempe Town Lake in the Middle) and McKellips Rd. south to Tempe Town Lake (150 acres)

**Federal Sponsors and Contacts:** USACE, Project Manger: Mike Ternak, mike.ternak@usace.army.mil

**Non-Federal Sponsors and Contacts:** City of Phoenix; Karen Williams (602) 262-4717; City of Tempe Chris Anaradain (City of Phoenix is not a contact for PED and Construction Phase)

**History:** In the past, the area encompassed by the Tempe Reach contained abundant mesquite trees and high quality mesquite bosque riparian habitat. At the confluence with the Salt River, Indian Bend Wash entered at an upper terrace of the river. Today the bed of the wash is nearly 30 feet higher in elevation than the Salt River.<sup>69</sup>

**Authority:** General Investigation - Ecosystem Restoration

**Planning Objectives:** “Restoration of threatened and endangered species habitat; Restoration of the Study Area to a more natural condition through the installation of plant species that are native to, and occurred historically, in riparian streams and washes in the region; an increase of recreation opportunities.”<sup>70</sup>

**Current Phase:** Currently under Construction

**Phase:** Reconnaissance Study completed in 1994 for 33 mile reach, Feasibility Report and EIS completed April 1998.

**Recommended Plan:** Alternative T5 - mesquite, cottonwood willow, wetland, strand scrub, and open edge habitat. This alternative was selected because it closely follows the planning objectives.<sup>71</sup>

**Cost:** Total gross investment is \$6,171,000 and total annual cost is \$684,000, includes operation and maintenance which is approximately \$230,000 per year.<sup>72</sup>

**Water Source:** Proposed source of water is 1 to 2 new water supply wells and water from Indian Bend Wash. A pump house upstream Tempe Town Lake will pump water downstream, just south of the town lake. Water demand is approximately 1,690 acre-feet per year.<sup>73</sup>

**Public Outreach:** Typical Corps public outreach process during reconnaissance and feasibility stages.

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<sup>69</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 1998. *Rio Salado Salt River, Arizona Feasibility Report and Environmental Impact Statement*. Los Angeles: U.S. Army Corps of Engineers. p. IV-2

<sup>70</sup> Ibid. p. VI-1

<sup>71</sup> Ibid.

<sup>72</sup> Ibid. p. VI-4, Table 6.3

<sup>73</sup> Ibid. p. VI-2

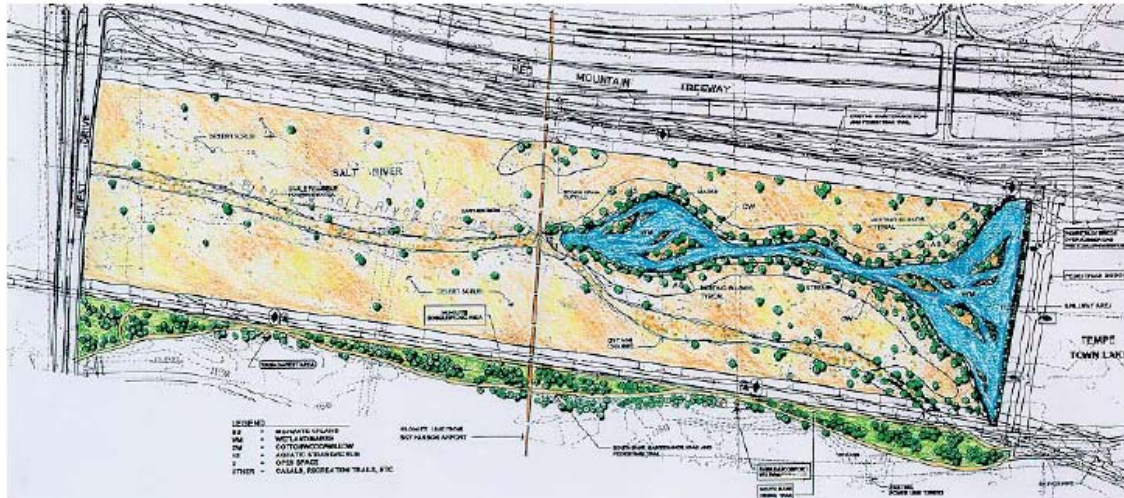
**Note:** There are 3 different “sections” of the Tempe Reach, two to the East of Tempe Town Lake and one to the west of Tempe Town Lake

# Rio Salado – Tempe Reach

Upstream



Downstream



<b>Rio Salado Tempe Reach Cost Estimate</b>	
Infrastructure	\$2,310,800
Habitat Restoration	\$1,261,400
Water Supply (2.85 MGD)	\$703,000
Contingency (20%)	\$855,000
PED (7%)	\$359,000
Supervision and Administration	\$375,000
<b>Total First Cost – Construction (Rounded)</b>	<b>\$5,846,000</b>
Monitoring and Adaptive Mgt.	\$116,000
Real Estate	\$0
<b>Total First Cost</b>	<b>\$5,962,000</b>
Interest During Construction	\$209,000
Annual Cost (50 yrs, 7 1/8%)	\$454,000
Associated Non-federal Annual Cost	\$154,000
Annual OMR&R	\$76,000
<b>Total Annual Cost</b>	<b>\$684,000</b>

Feasibility Report, p. VI-4, Table 6.3



Indian Bend Wash Construction



Indian Bend Wash Restoration June 2004



Indian Bend Wash Restoration April 2004

## Rio Salado - Phoenix Reach

**Location:** Salt River, Maricopa County, Phoenix; I-10 to 19th Avenue (5 miles and 580 acres).

**Federal Sponsors and Contacts:** USACE: Project Manager: Mike Ternak

**Non-Federal Sponsors and Contacts:** City of Phoenix: Project Coordinator at City Managers Office: Karen Williams (602) 262-4717; City of Tempe Chris Anaradian (Note: Tempe is not a part of the PED and Construction Phase)

**History:** Dams, water diversion, groundwater pumping, sand and gravel mining has led to a degraded riparian system.

**Authority:** General Investigation - Ecosystem Restoration

**Planning Objectives:** “Restore riparian habitat in and around the Salt River within the Cities of Phoenix and Tempe; Create a complete and diverse riparian system...; The restored habitat areas should incorporate a diverse mix of riparian habitat types including mesquite, cottonwood/willow, wetland march, aquatic strand/scrub, open water, and open edges; Increase environmental education and passive recreation opportunities incidental to the restoration effort.”<sup>74</sup>

**Current Phase:** Currently under Construction

**Phases:** Reconnaissance Study completed in 1995 for 33 mile reach of Salt River, Feasibility Report and EIS April 1998.

**Recommended Plan:** “Low-flow channel in river bottom, open-water, wetland marsh, cottonwood willow, open edges, and mesquite habitat in the river bottom and on the banks and over banks of the Salt River. Series of shallow pools in the low flow-channel connected by a perennially flowing stream. Three parking areas for public access to restoration project.”<sup>75</sup>

**Cost:** Gross investment is \$82,406,000 and total annual cost is \$7,857,000 which includes operation and maintenance which is approximately \$1,971,000 per year.<sup>76</sup> Current Estimated Total Cost by 2005 approximately \$99 million.<sup>77</sup>

**Water Source:** Distribution of groundwater from 5 production wells with a capacity of one million gallons a day a piece. One well serves as a backup. There are two known contamination plumes in the area, currently monitored by City of Phoenix. The project also uses six irrigation pump stations, one at each well, for irrigation of specified areas.

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<sup>74</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 1998. *Rio Salado Salt River, Arizona Feasibility Report and Environmental Impact Statement*. Los Angeles: U.S. Army Corps of Engineers. p. V-2

<sup>75</sup> Ibid. p. VI-5

<sup>76</sup> Ibid. p. VI-11

<sup>77</sup> Arizona Department of Water Resources. 2004. ADWR Brown Bag Luncheon, Fact Sheet. Phoenix, June.

Water demand is approximately 6,519 acre-feet per year.<sup>78</sup> There is groundwater exchange for effluent recharge credits, as per conversation at ADWR brown bag luncheon.<sup>79</sup>

**Public Outreach:** Rio Salado Update Newsletter published by the City of Phoenix; Rio Salado Citizens Advisory Committee, established by the City of Phoenix as a way for the community to be informed and become an active part of the restoration process; Rio Salado Beyond the Banks Area Plan developed by the Citizens Advisory Committee to look at changing/halting negative types of developments beyond the Corps restoration project; Audubon Educational Center to be built in the next two years (located off Central Avenue) aimed at environmental education.<sup>80</sup>

**Note:** There is a study gap between this project (from Priest Drive to I-10) and the Rio Salado Tempe reach due to Airport interference. Rio Salado Phoenix is also subdivided into three phases.

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<sup>78</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 1998. *Rio Salado Salt River, Arizona Feasibility Report and Environmental Impact Statement*. Los Angeles: U.S. Army Corps of Engineers. p. VI-8

<sup>79</sup> Rossi, Steve. 2004. Comment at Arizona Department of Water Resources Brown Bag Luncheon. Phoenix, June.

<sup>80</sup> City of Phoenix. 2004. *Rio Salado Update Newsletter*. Phoenix, Arizona. Vol. 8, Issue 1.

# Rio Salado – Phoenix Reach



<b>Rio Salado Phoenix Reach Cost Estimate</b>	
Infrastructure	\$37,145,400
Habitat Restoration	\$3,441,000
Water Supply (5.82 MGD)	\$13,332,500
Contingency (20%)	\$10,884,000
PED (7%)	\$4,571,000
Supervision and Administration	\$4,542,000
<b>Total First Cost – Construction (Rounded)</b>	<b>\$74,416,000</b>
Monitoring and Adaptive Mgt.	\$1,488,000
Real Estate	\$3,714,000
<b>Total First Cost</b>	<b>\$79,618,000</b>
Interest During Construction	\$2,788,000
Annual Cost (50 yrs, 7 1/8%)	\$6,066,000
Associated Non-federal Annual Cost	\$1,017,000
Annual OMR&R	\$774,000
<b>Total Annual Cost</b>	<b>\$7,857,000</b>

Feasibility April 1998, VI-11



## Rio Salado – Phoenix Reach



Construction of Low Flow Channel



Tires in the River



Low-flow channel

Photos courtesy of Karen Williams, City of Phoenix

## Rio Salado Oeste

**Location:** Salt River, Maricopa County, Phoenix; 19th Ave. west to 83rd Ave. (8 miles)

**Federal Sponsors and Contacts:** USACE: Project Manager: Mike Ternack, Study Manager: Scott Estergard, Environmental Coordinator: Mr. Rey Favre (213) 452 - 3864; Planning Project Manager: Valerie Swick

**Non-Federal Sponsors and Contacts:** City of Phoenix: Karen Williams (602) 262-4717

**History:** Dams, water diversion, groundwater pumping, sand and gravel mining has led to a degraded riparian system.

**Authority: General Investigation** - Ecosystem Restoration

**Planning Objectives:** “Restore native riparian and wetland habitat, and adjacent vegetation communities between 19th Avenue and 83rd Avenues for a period of 50 years; Attract wetland and riparian avian species in the study area; Establish the presence of amphibian species, reptilian species, mammalian species, and avian species in the study area; Suppress undesirable fish and wildlife species; Manage undesirable invasive plant species in the study area; Increase passive recreational and environmental education opportunities for visitors, which are linked to the restoration project in the study area; Reduce flood damages to structures and infrastructure within the 100 and 500 year floodplain between 19th and 83rd Avenues.”<sup>81</sup>

**Current Phase:** Pre F4 - Alternative Review Conference

**Phases:** Reconnaissance completed September 2000, F3 milestone May 2002.

**Tentative Plan:** TBD

**Cost:** Total cost is unknown until a recommended plan is chosen.

**Water Source:** Possible storm water runoff, flood flows, groundwater, effluent and reclaimed water from 23rd Ave Wastewater Treatment Plant.<sup>82</sup>

**Public Outreach:** Once the Rio Salado Project is near completion then the City of Phoenix and Community Advisory Committee will direct the public’s attention toward Oeste.<sup>83</sup>

**Note:** “40% of feasibility study is related to flood control elements of the project.”<sup>84</sup>

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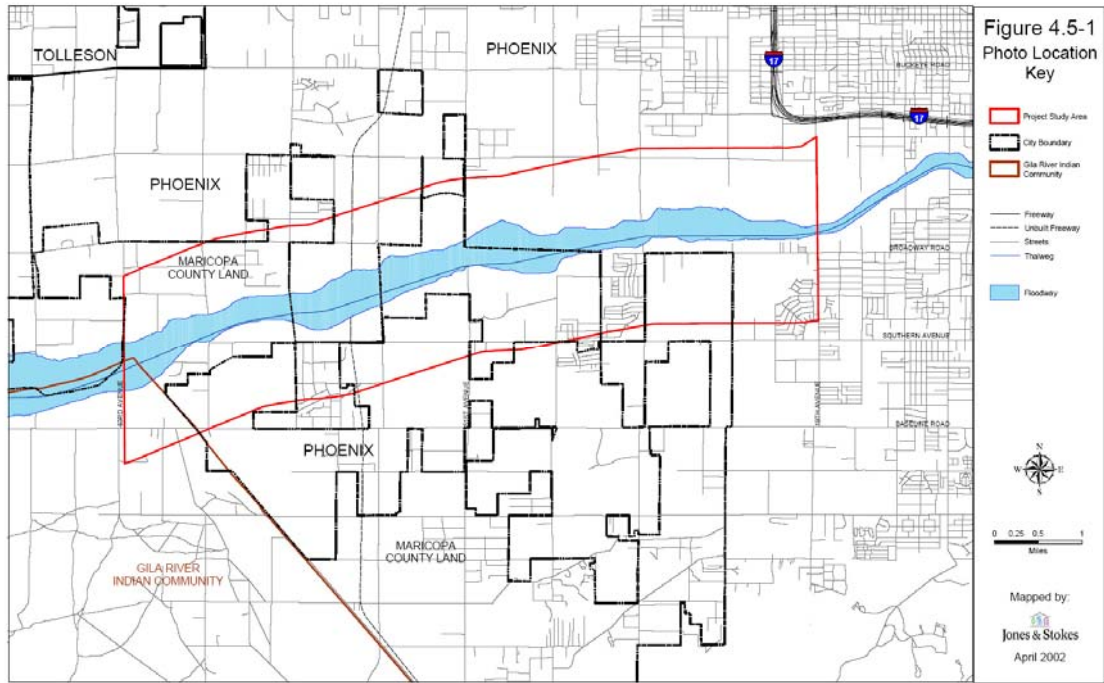
<sup>81</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2002. *Rio Salado Oeste, Salt River Arizona Interim Feasibility Report F3 Milestone-Without Project Conditions*. Los Angeles: U.S. Army Corps of Engineers. p. V-4

<sup>82</sup> Ibid.

<sup>83</sup> Williams, Karen. 2004. Personal communication with author, August.

<sup>84</sup> Maricopa County Flood Control Advisory Board. 2003. Meeting Minutes. Phoenix, AZ. October 22.

# Rio Salado - Oeste



*Low flow channel with wetland vegetation, immediately upstream of 51<sup>st</sup> Avenue Bridge.*

## Tres Rios

**Location:** Salt River and Gila River, Maricopa County, Phoenix; Beginning at 83rd Ave. to the confluence with Agua Fria River (9.2 miles and 5,600 acres).

**Federal Sponsors and Contacts:** USACE: Project Manager: Mike Ternak, Study Manager: Scott Estergard

**Non-Federal Sponsors and Contacts:** City of Phoenix: Project Manager: Alice Brawley-Chesworth alice.brawley-chesworth@phoenix.gov.

**History:** In the past, gallery forest of cottonwoods and willows covered hundreds of miles along the lower reaches of the Salt and the Gila rivers. Before Roosevelt Dam was constructed, the Lower Salt River was a perennial stream with an average annual discharge of approximately 1,250,000 acre-feet. At the confluence of the Gila and the Salt, the “Salt River’s clear, streaming waters contrasted with the muddy, sluggish Gila River.” The rivers had many channel meanders, sand bars and backwater that were conducive to riparian growth. Today the perennial and high winter flows that existed historically are no longer because of dams upstream and diversions for urban and agricultural use.<sup>85</sup>

**Authority:** General Investigation - Ecosystem Restoration

**Planning Objectives:** Provide sustainable and diverse native riparian habitat in and around the Tres Rios area; Reduce flood damages to the Holly Acres community, surrounding development, and agricultural areas; Increase environmental education and recreation in the study area.” (Feasibility, April 2000, V-2)

**Phases:** Tres Rios Reconnaissance completed April 1, 1997; Feasibility Report and Final EIS April 2000.

**Current Phase:** 90% of Design done, project has been authorized with construction to begin January to March 2005, waiting on City of Phoenix to purchase remaining real estate.

**Recommended Plan:** Alternative 3.5 includes: “pump station facility; regulating wetland for treatment plan discharge; the creation of linear, constructed wetlands along the north over bank; a pipeline from the over bank wetland leading to Cottonwood/Willow corridors west of El Mirage Road; open water/marsh areas within the channel west of El Mirage Road; south side distribution of dewatering well water and large open water/marsh creation areas; a flood control levee to protect Holly Acres as well as other surrounding residential commercial, industrial buildings, and farmland.”<sup>86</sup>

**Cost:** Total first cost is \$99,321,000 with a total annual cost of \$9,722,100 which includes operation and maintenance which is approximately \$2,414,150 per year (includes annual cost of water at \$1,221,150).<sup>87</sup>

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<sup>85</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2000. *Tres Rios, Arizona, Feasibility Report*. Los Angeles: U.S. Army Corps of Engineers. p. IV- 1-4.

<sup>86</sup> Ibid. p. VI-1

<sup>87</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2000. *Tres Rios, Arizona, Feasibility Report, Summary*. Los Angeles: U.S. Army Corps of Engineers. p. 3

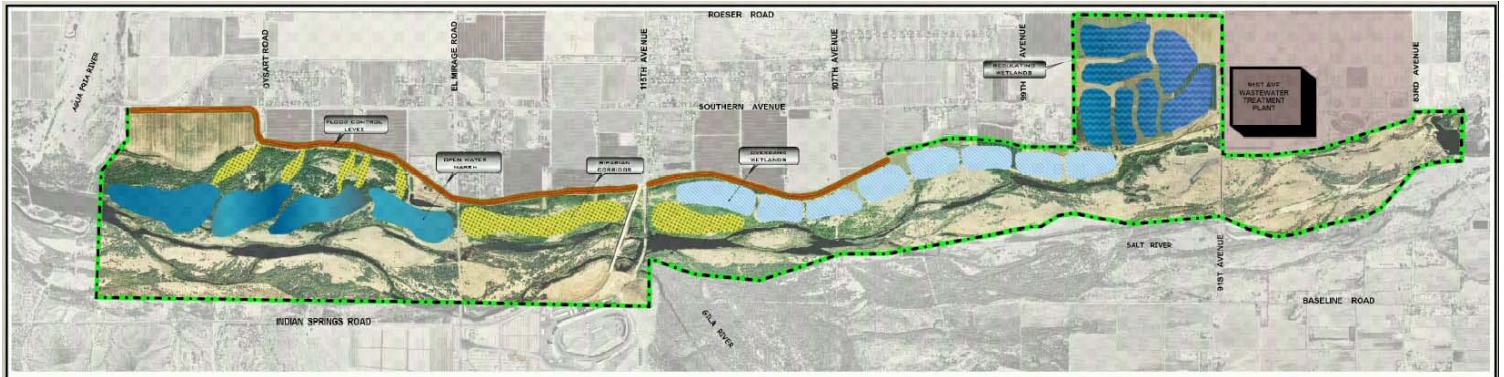
**Water Source:** Main sources are 91st Avenue Wastewater Treatment Plant effluent and existing dewatering wells from within the treatment plant. Water demand is 24,423 acre-feet per year.<sup>88</sup>

**Public Outreach:** 1995 Tres Rios Steering Committee (includes city, county, state and federal government officials) formed Tres Rios Public Involvement Subcommittee, which help to facilitate public involvement and dialogue with the Corps (for more info see Feasibility April 2000, VIII-3).

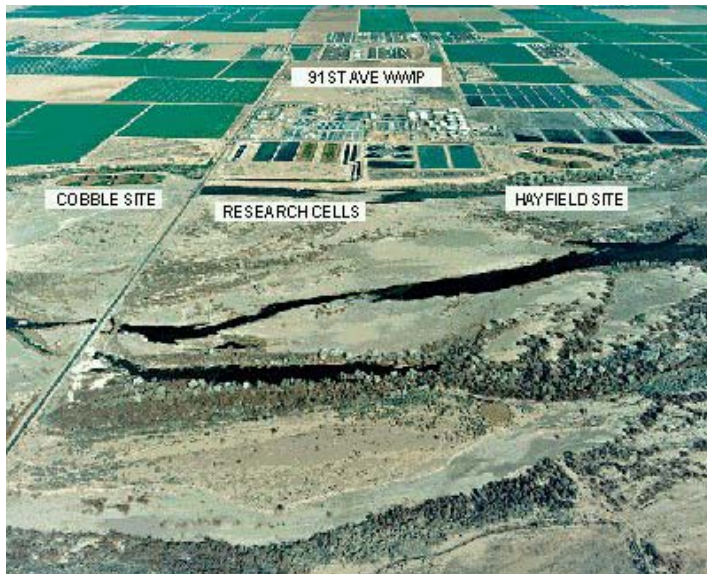
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<sup>88</sup> U.S. Army Corps of Engineers, Los Angeles District, South Pacific Division. 2000. *Tres Rios, Arizona, Feasibility Report*. Los Angeles: U.S. Army Corps of Engineers. Table VI-2

# Tres Rios



<b>Tres Rios Cost Estimate</b>	
Construction (Construction, S&A, PED/EDC, Contingency)	\$74,747,000
Construction LERRDs (Lands, Easements, Rights-of-Way, Relocations, Disposal Sites)	\$19,214,000
Recreation Costs	\$4,860,000
Cultural Resources Mitigation	\$500,000
<b>Total First Costs</b>	<b>\$99,321,000</b>
Interest During Construction	\$6,055,000
Annual Investment Cost	\$7,307,950
Annual Cost of Water	\$1,221,150
Total OMRR&R Annual Costs	\$2,414,150
<b>Total Annual Costs</b>	<b>\$9,722,100</b>



Tres Rios Demonstration Wetland & Salt River



Tres Rios Demonstration Wetland



91st WWTW Outfall into Salt River



Wildlife at Tres Rios Demonstration Wetland  
 Pictures - (<http://phoenix.gov/TRESRIOS/photogalmenu.html>)



Tres Rios Demonstration Wetland

# CONCLUSIONS



## Next Steps

Each of the projects presented has an interesting story to it. Each represents an effort to improve on extant environmental conditions. They are examples of barren locations being brought back to life, and/or areas that, without intervention, will deteriorate. The Rio Salado projects represent an effort that came back to life after the public failed to approve a tax to support a large-scale project. On the other hand, the proposed Agua Caliente project is unlikely to move forward due to local concerns. Perhaps not coincidentally, the site is already a beautiful area that is highly valued by the community. Tres Rios in Phoenix is a large-scale project that is moving forward with the involvement of many local partners. Development of the Tres Rios del Norte in Tucson, also with multiple local sponsors, is ongoing.

Private as well as public organizations are involved in these projects. For example, the Audubon Society is building a major center at the Rio Salado, Phoenix project. Indian Nations are involved in Tres Rios and Va Shly 'ay Akimel.

The Army Corps process requires significant study and public airing of options. The projects are like most major public works projects; they take significant time from conception to design to construction. And, even after project construction/implementation, it will take time to see the results. Over time, the landscapes are likely to look very different as a result of these projects.

While the project participants are heavily involved in the projects, the public in general is often not aware of these efforts and their benefits. If aware of the efforts, they may not be aware of the role of the participants, including the federal government. If the projects do not require a revenue source or financing that must be approved by the public, they may not be aware of the costs.

However, there is high interest in assisting the public in becoming informed. This study is one such example. As part of a companion study, the author is examining environmental enhancement projects throughout Arizona. The first major step of that project involved holding two stakeholder meetings to discuss the project and solicit input regarding projects to study. A wide variety of projects in locales throughout the state has been suggested for inclusion. In addition, the University of Arizona Water Resources Research Center, which sponsors an annual conference on a water issue of statewide importance, focused its Spring 2005 conference on "Water and the Environment: The Role of Ecosystem Restoration." Interest in the conference, which attracts a broad array of attendees, was high, the conference attracted over 300 registrants. Likewise, at the national level, the Universities Council on Water Resources (UCOWR) and the National Institutes for Water Resources (NIWR) joint summer 2005 conference is entitled "River and Lake Restoration: Changing Landscapes."

Additional analysis and information dissemination will assist the public in understanding the public benefits – and costs – of environmental restoration projects. A

key constraint to development ecosystem restoration projects is financial. In Arizona, restoring funding for the Arizona Water Protection Fund Commission has been a priority for many. Many of the projects suggested for inclusion in the companion study have been funded in part by the Arizona Water Protection Fund.

It is clear that the interest in ecosystem restoration is high. With better public information and involvement, this interest may translate into more project activity throughout Arizona, the southwest region, and the nation.

APPENDIX: SAMPLE LETTERS TO INITIATE PROJECTS UNDER SECTIONS 206  
AND 1135 (b) OF THE WATER RESOURCES DEVELOPMENT ACT

**SAMPLE LETTER OF REQUEST**

(Type on Letterhead Paper)

(DATE)

District Engineer  
.....

Dear Sir:

In accordance with the provisions of Section 206 of the Water Resources Development Act of 1996, which authorizes the Federal government to carry out aquatic ecosystem restoration and protection projects to improve the quality of the environment, the *[cooperating agency]* makes formal application for a study of *[waterway or locality, County, State]*.

*[Insert paragraph giving a brief description of problem].*

The *[cooperating agency]* understand(s) that the investigation will result in the preparation of an Ecosystem Restoration Report, the cost of which will be shared between the *[cooperating agency]* and the Corps of Engineers. The *[cooperating agency]* must provide 35 percent of the project cost. *[Cooperating agency]* may provide its entire share in in-kind services.

The *[cooperating agency]* can provide the following local cooperation and participation:

1. Provide without cost to the United States all lands, easements, rights-of-way, and relocations, (LERR), as determined by the Federal government to be necessary for the construction of the project. The value of LERR will be included in the total project costs and credited towards the sponsor's share of project costs, as defined in the project cooperation agreement.
2. Hold and save the United States free from claims for damages that may result from the construction and subsequent maintenance of the project, except damages due to the fault or negligence of the United States or its contractors.
3. Assume responsibility for all costs in excess of the Federal cost limitation of \$5 million.
4. Ensure maintenance and repair of the project during the useful life of the works as required to serve the project's intended purpose, with no additional cost to the Federal government.
5. If the value of the sponsor's contribution above does not exceed 35 percent of the project cost, provide a cash contribution to make the sponsor's total contributions equal to 35 percent.

*SIGNATURE OF COOPERATING AGENCY*

*Revised January 2000*

## SAMPLE LETTER OF REQUEST

(Type on Letterhead Paper)

(DATE)

District Engineer

Dear Sir:

In accordance with the provisions of Section 206 of the Water Resources Development Act of 1996, which authorizes the Federal government to carry out aquatic ecosystem restoration and protection projects to improve the quality of the environment, the [cooperating agency] makes formal application for a study of [waterway or locality, County, State].

[Insert paragraph giving a brief description of problem].

The [cooperating agency] understand(s) that the investigation will result in the preparation of an Ecosystem Restoration Report, the cost of which will be shared between the [cooperating agency] and the Corps of Engineers. The [cooperating agency] must provide 35 percent of the project cost. [Cooperating agency] may provide its entire share in in-kind services.

The [cooperating agency] can provide the following local cooperation and participation:

1. Provide without cost to the United States all lands, easements, rights-of-way, and relocations, (LERR), as determined by the Federal government to be necessary for the construction of the project. The value of LERR will be included in the total project costs and credited towards the sponsor's share of project costs, as defined in the project cooperation agreement.
2. Hold and save the United States free from claims for damages that may result from the construction and subsequent maintenance of the project, except damages due to the fault or negligence of the United States or its contractors.
3. Assume responsibility for all costs in excess of the Federal cost limitation of \$5 million.
4. Ensure maintenance and repair of the project during the useful life of the works as required to serve the project's intended purpose, with no additional cost to the Federal government.
5. If the value of the sponsor's contribution above does not exceed 35 percent of the project cost, provide a cash contribution to make the sponsor's total contributions equal to 35 percent.

SIGNATURE OF COOPERATING AGENCY

Revised January 2000