

Civil Works Review Board

Santa Cruz River - **Paseo de las Iglesias**, Arizona
Ecosystem Restoration

Welcome

Introductions

Project Briefing

Sponsor Support

MSC Commander Briefing

Policy Review Assessment

CWRB Chair Summary

Lessons Learned

CWRB Action (vote)

Closing Remarks





Santa Cruz River Paseo de las Iglesias, Arizona Ecosystem Restoration Feasibility Study

COL Alex C. Dornstauder
Commander, Los Angeles District

Civil Works Review Board
18 October 2005



Study Area

Santa Cruz River, Paseo de las Iglesias, Arizona



New Mexico



LEGEND

- Study Area Boundary
- City of Tucson Municipal Boundary
- Washes

Paseo de las Iglesias
Pima County, Arizona
Feasibility Study
Figure 2.1

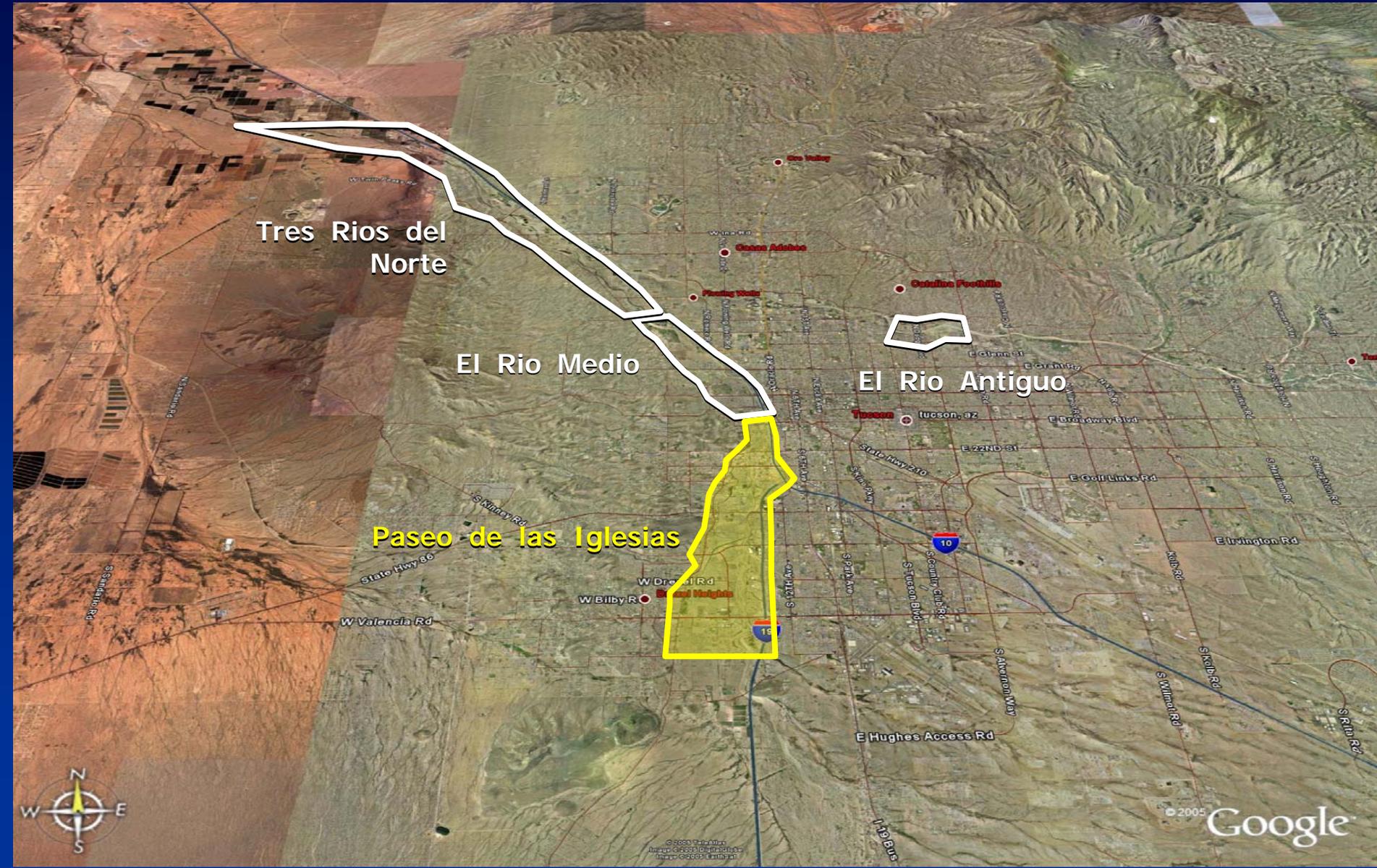


US Army Corps of Engineers
Los Angeles District



Watershed Context

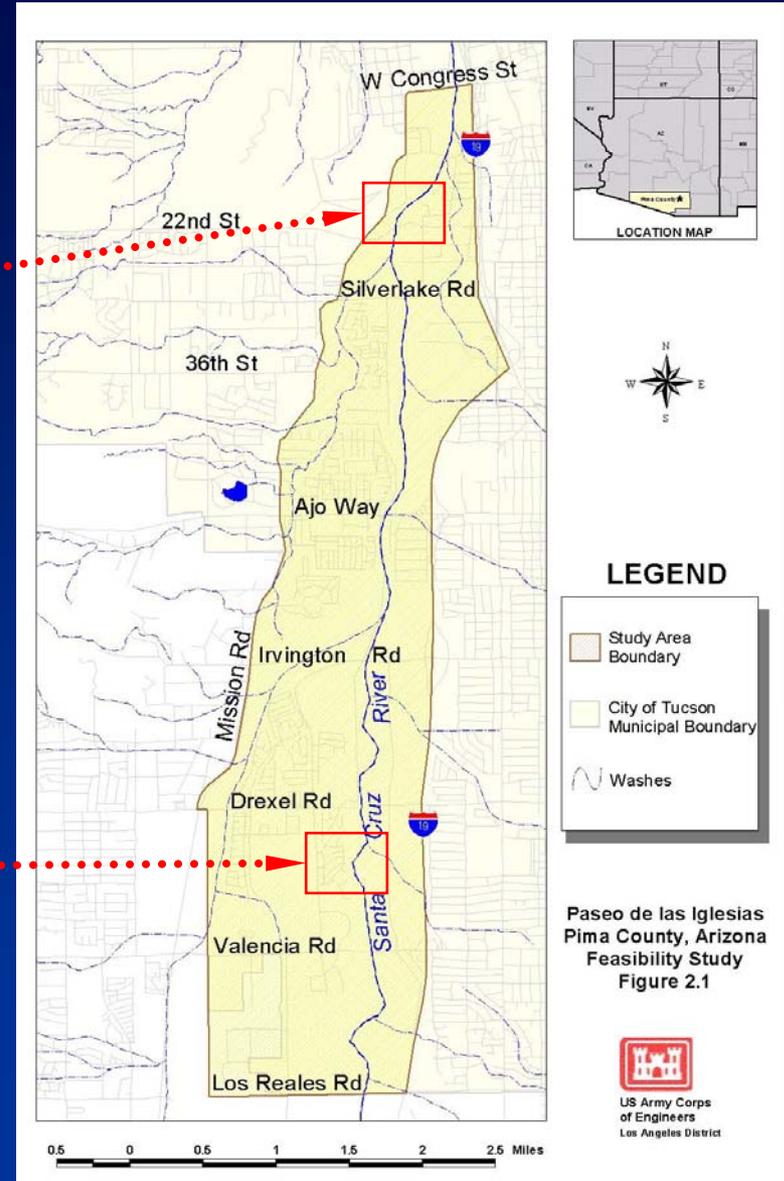
Santa Cruz River, Paseo de las Iglesias, Arizona





Study Area

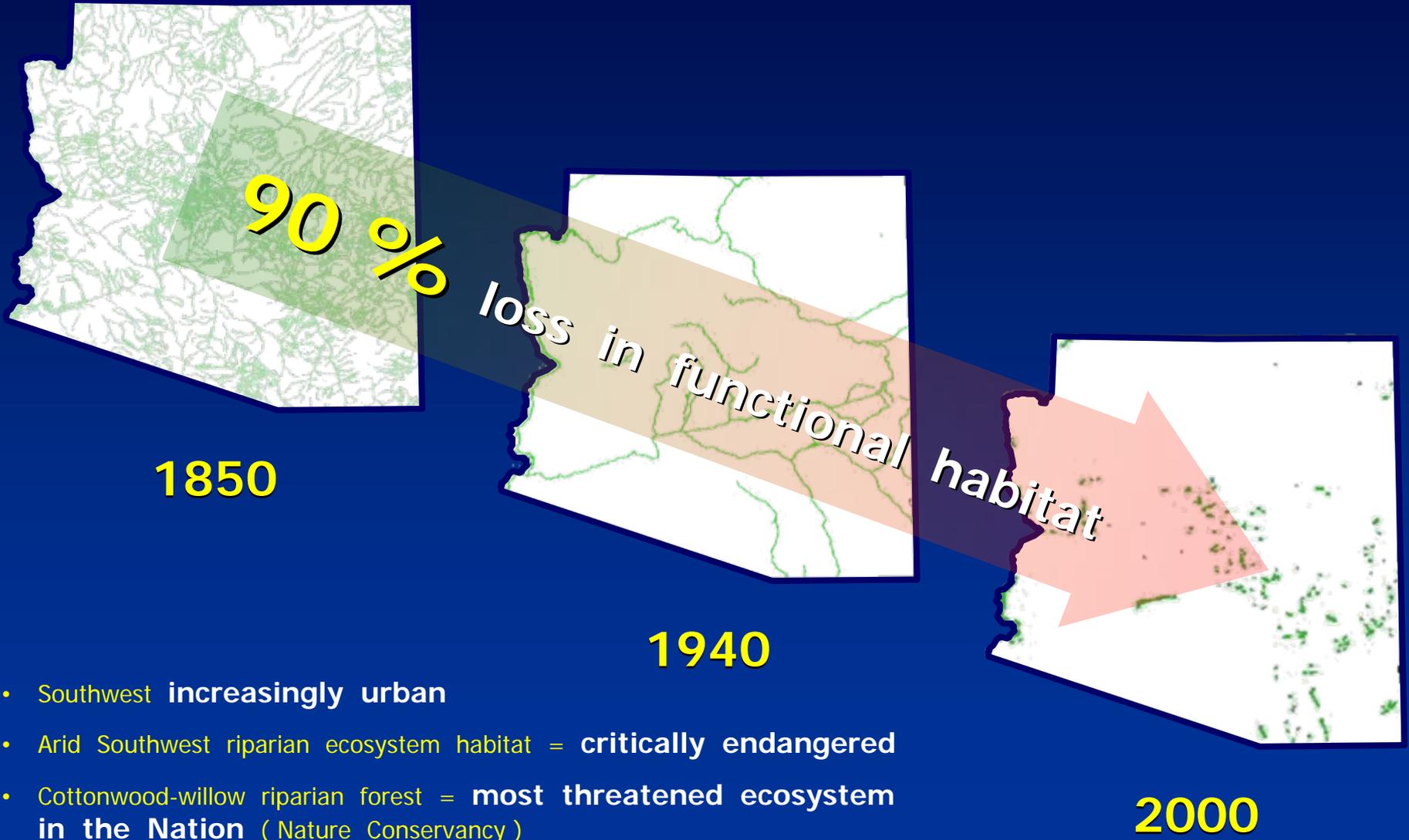
Santa Cruz River, Paseo de las Iglesias, Arizona





Southwestern Riparian Trend

Santa Cruz River, Paseo de las Iglesias, Arizona



- Southwest increasingly urban
- Arid Southwest riparian ecosystem habitat = critically endangered
- Cottonwood-willow riparian forest = most threatened ecosystem in the Nation (Nature Conservancy)



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Los Angeles District

Base of Sentinel Peak 1904

Santa Cruz River, Paseo de las Iglesias, Arizona





Base of Sentinel Peak 2002

Santa Cruz River, Paseo de las Iglesias, Arizona

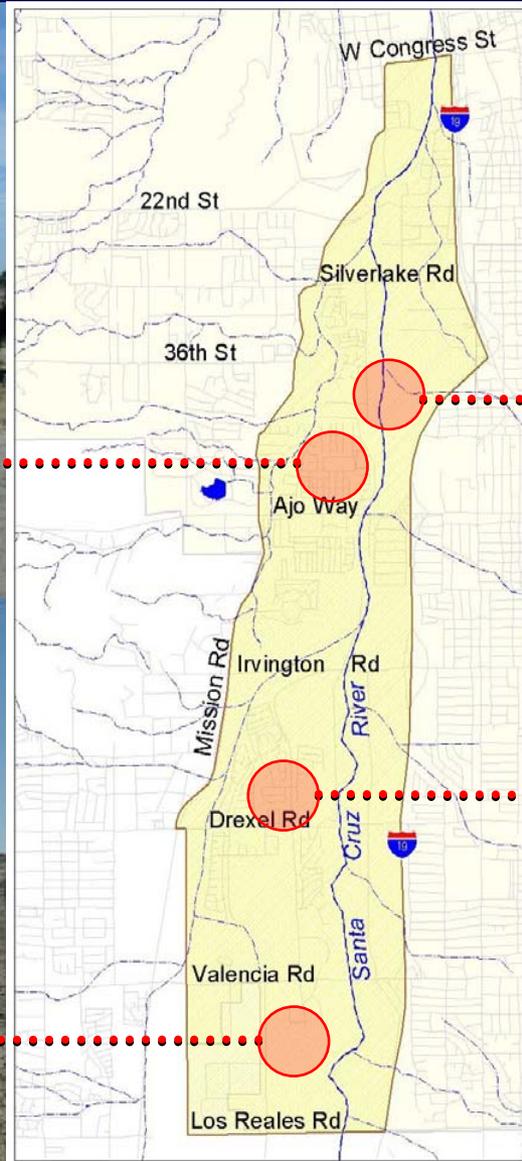


Soil-Cement Banks



Problem Summary

Santa Cruz River, Paseo de las Iglesias, Arizona





- **Restore** riparian vegetative communities to a less degraded, more natural condition
- Increase the acreage of **functional** riparian and floodplain habitat
- Increase wildlife habitat **diversity**
- Provide **passive recreation**
- Reduce **bank erosion and sedimentation**



- Availability of water
- Cultural resources and recreational areas
- No increase in flood levels
- Endangered species (if present)
- Impact of landfills



Restoration Measures

- Native plant communities
- Riverbank and terrace treatments
- Invasive species management
- Stormwater harvesting features
- Irrigation of restored areas



Alternative Development Matrix

Santa Cruz River, Paseo de las Iglesias, Arizona

	Active Channel Features	Floodplain Terrace Features	Historic Floodplain Features
<p>No Action* (Without Project)</p> <p>*Listed items are anticipated consequences rather than measures to be implemented as in the other rows.</p>	<ul style="list-style-type: none"> Continued instability of channel due to erosion. Continued refuse dumping. Continued degradation of habitat. 	<ul style="list-style-type: none"> Continued erosion loss of lower terraces creating cliff-like banks. Eventual application of soil cement on unprotected banks armoring entire reach. 	<ul style="list-style-type: none"> With expanded soil cement bank protection, continued historic floodplain encroachment by development.
<p>Xero-Riparian (Establishment and Emergency Irrigation)</p>	<ul style="list-style-type: none"> Construct water harvesting basins upstream of existing and new grade control structures. Divert low flow from New West Branch into remnant headwaters of Old West Branch. Plantings of riparian grasses/shrubs. 	<ul style="list-style-type: none"> Water harvesting from local runoff. Create tributary water harvesting basin deltas with two-tiered water harvesting basins. Plantings on terraces and water harvesting basins. 	<ul style="list-style-type: none"> Amend soil with nutrients, moisture trapping, contouring. Water harvesting from local runoff. Replace steep banks with stabilized planted terraces.
<p>Meso-Riparian (Irrigation)</p>	<ul style="list-style-type: none"> Construct and provide supplemental irrigation to water harvesting basins upstream of existing and new grade control structures. Introduce periodic flow into the Old West Branch just upstream of its confluence with the Enchanted Hills Wash and on other tributaries downstream of that point. Plantings of riparian grasses. 	<ul style="list-style-type: none"> Create tributary single-tiered water harvesting basin deltas. Irrigate and plant terraces with mesquite along upper terrace. Stabilize active channel banks by establishing thickly rooted mesquite at the edge of the lower terraces. 	<ul style="list-style-type: none"> Amend soil with nutrients, moisture trapping, contouring. Plant and irrigate historic floodplain. Replace steep banks with stabilized planted terraces.
<p>Hydro-Riparian (Perennial Flow with Irrigation)</p>	<ul style="list-style-type: none"> Restore perennial flow with multiple points of distribution into the main Santa Cruz and tributary channels. Plant cottonwood-willow bundles at edges of perennial flow where erosion protection needed. Construct perennial channel features (for example, pools, runs, and riffles). 	<ul style="list-style-type: none"> Create tributary water harvesting basin deltas with hydraulic link to perennial flow. Irrigate and plant low terraces with riparian grasses to maintain flood conveyance and discourage colonization by invasive species. Irrigate and plant upper terraces with mesquite / cottonwood-willow. 	<ul style="list-style-type: none"> Hydro Riparian plants do not occur in areas of the floodplain that are not subject to frequent inundation. Even so, feature 3 from the mesoriparian floodplain is carried forward to mitigate greater erosion risks associated with increased channel roughness in combinations where "No Action" is paired with Perennial Flow.



- Overall **48** alternatives
- Alternatives eliminated that:
 - were not consistent with **natural vegetation patterns,**
 - failed to produce sufficient **habitat diversity, or**
 - **reduced flood conveyance**
- This left **15** alternatives, including the “no action” alternative



- State and Federal Agencies
- Sponsors
- Academia
- USACE / ERDC
- **Multi-disciplinary model developed specifically for Arizona**
- Measures the **functionality** of riparian ecosystems
- Previous models based on attracting specific species
- Already used for **two (2) AZ studies** waiting WRDA authorization



- Functional habitat value determined,
- Cost estimation,
- CE / ICA analysis, and
- Two (2) “Best Buy” plans were carried forward.



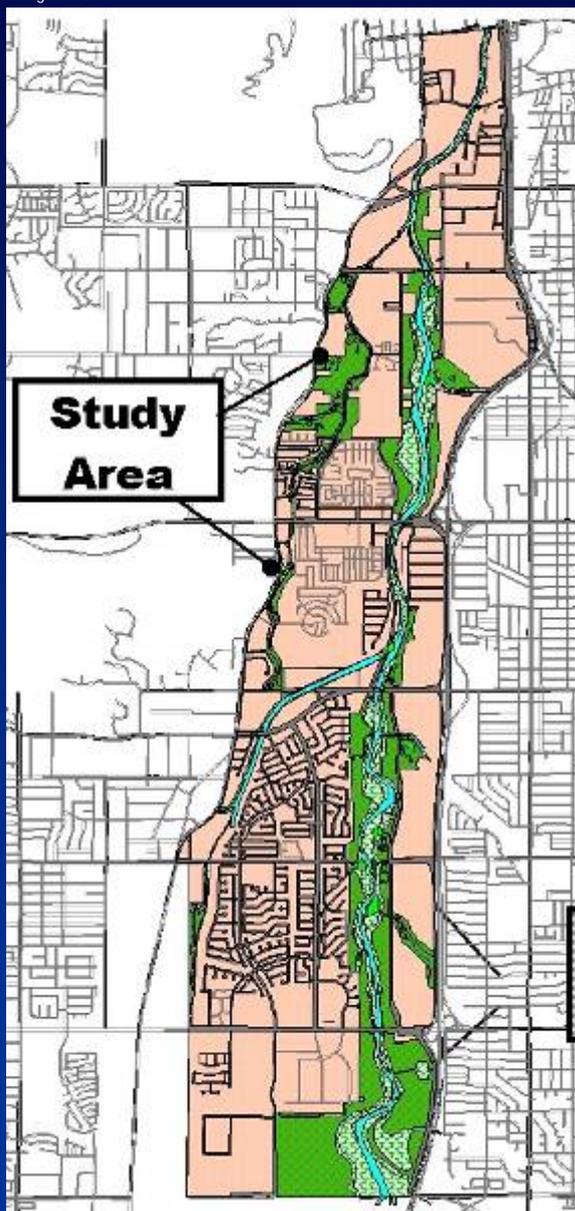
Functional Riparian Habitat Restored (acres)

	Mesquite (acres)	Shrub (acres)	Cottonwood- Willow (acres)	Emergent Marsh (acres)	Functional Capacity Units	Water Demand (ac-ft/yr)
3E	718	356	18	6	454	1,925
2A	252	867	0	6	402	253
No Action	-	-	-	-	32	N/A



Recommended Plan - Alternative 3E

Santa Cruz River, Paseo de las Iglesias, Arizona



- Irrigated plantings of mesquite and riparian shrub on terraces above the low flow channel and in the historic floodplain
- Small areas of emergent marsh and cottonwood-willow habitat at water harvesting features
- Mesquite (718 acres), riparian shrub (356 acres), cottonwood-willow (18 acres), and emergent marsh (6 acres)
- Subsurface water harvesting basins
- Permanent irrigation systems
- Cutting back steep eroded banks



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Functional Riparian Habitat

Santa Cruz River, Paseo de las Iglesias, Arizona

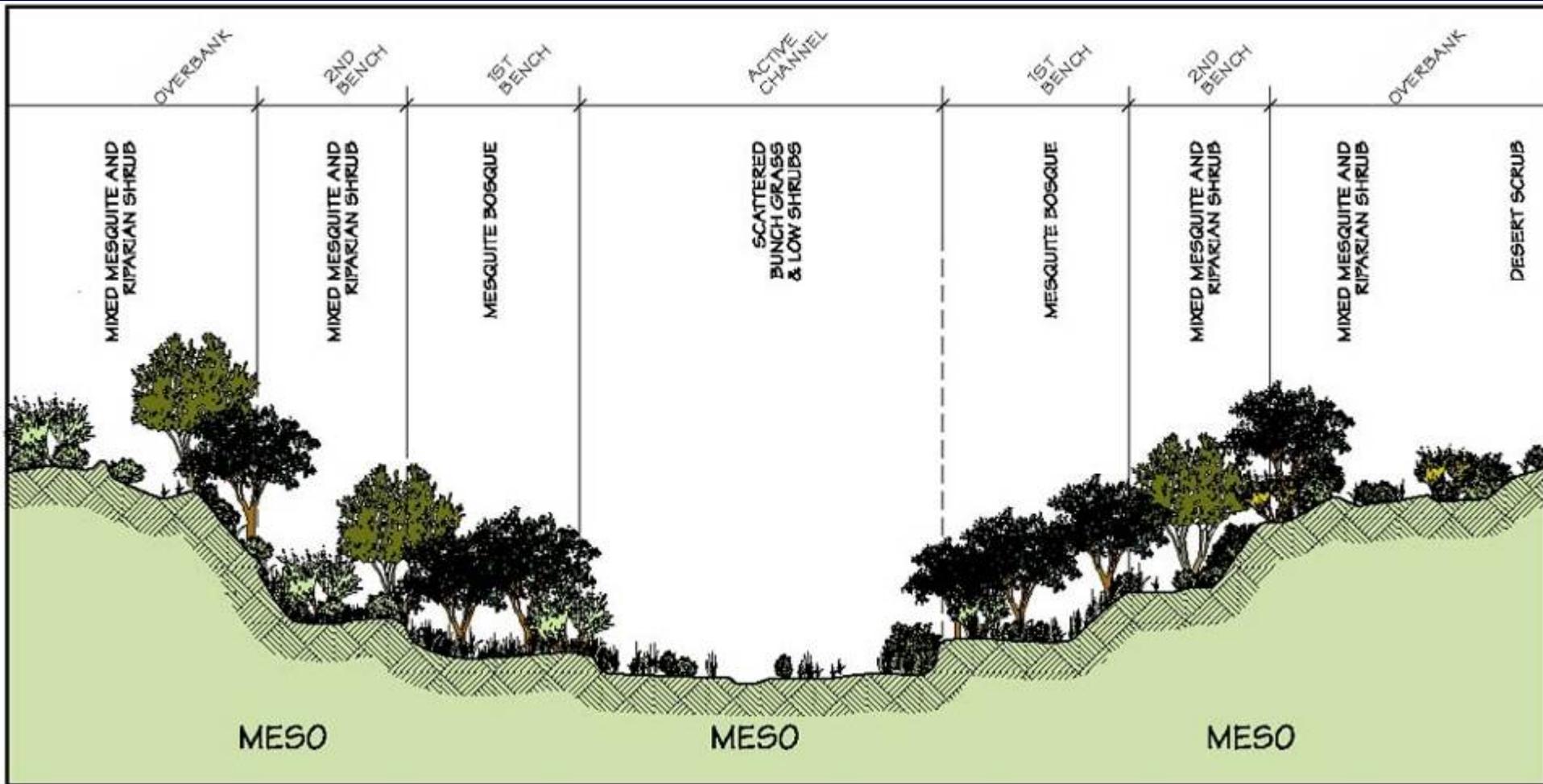


Healthy Mesquite Bosque (Forest) along Desert Wash



Typical Cross Section

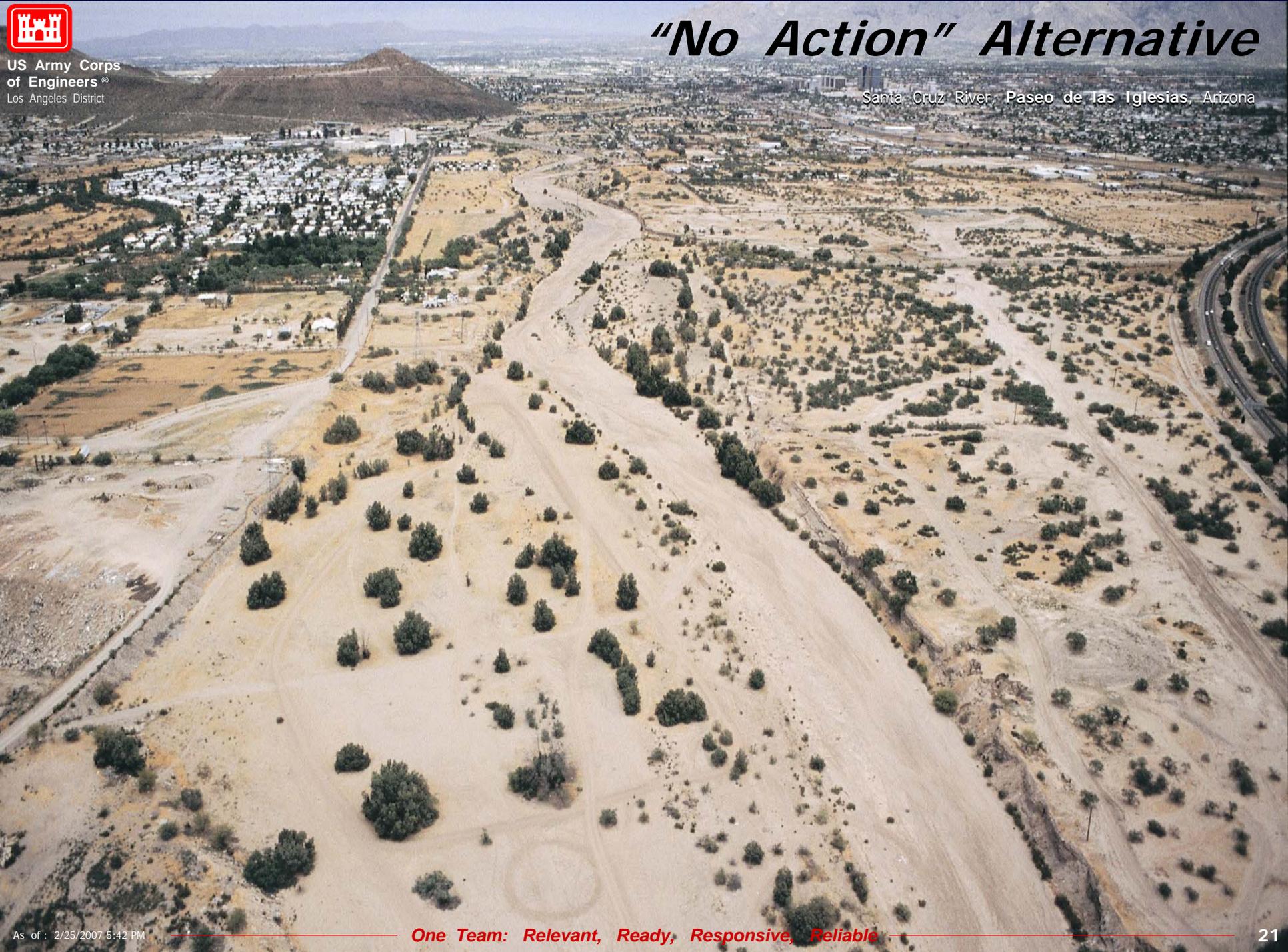
Santa Cruz River, Paseo de las Iglesias, Arizona





"No Action" Alternative

Santa Cruz River, Paseo de las Iglesias, Arizona





Recommended Plan - Alternative 3E

Santa Cruz River, Paseo de las Iglesias, Arizona



Mesquite bosque
with understory

Emergent marsh

Cottonwoods and Willows

Mesquite bosque
with understory

Riparian shrub mix



Recommended Plan - Estimated Costs

Santa Cruz River, Paseo de las Iglesias, Arizona

Construction and Real Estate	\$ 72,829,000
Recreation	1,142,000
Contingency @ 15%	6,988,000
Preliminary Engineering Design @ 10%	4,659,000
Engineering During Construction @ 1%	466,000
Construction Mgmt @ 6.5%	3,482,000
Adaptive Management	1,870,000
Monitoring	623,000
Total First Cost	\$ 92,059,000
Average Annual Cost	5,766,000
Annual Operation & Maintenance (O & M)	771,000
Annual Water Costs	1,099,000
Total Average Annual Cost	\$ 7,636,000



Cost Sharing - Ecosystem Restoration

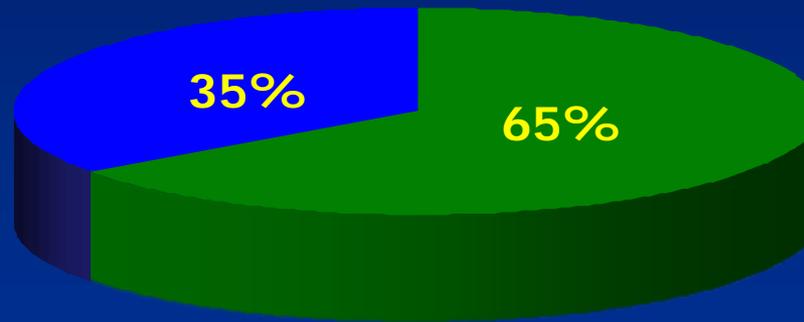
Santa Cruz River, Paseo de las Iglesias, Arizona

Total Project Cost

\$ 90,917,000

Non-Federal *
\$ 31,821,000

* includes **\$ 26,242,000**
estimated cost for LERRDs
and **\$ 5,599,000** cash



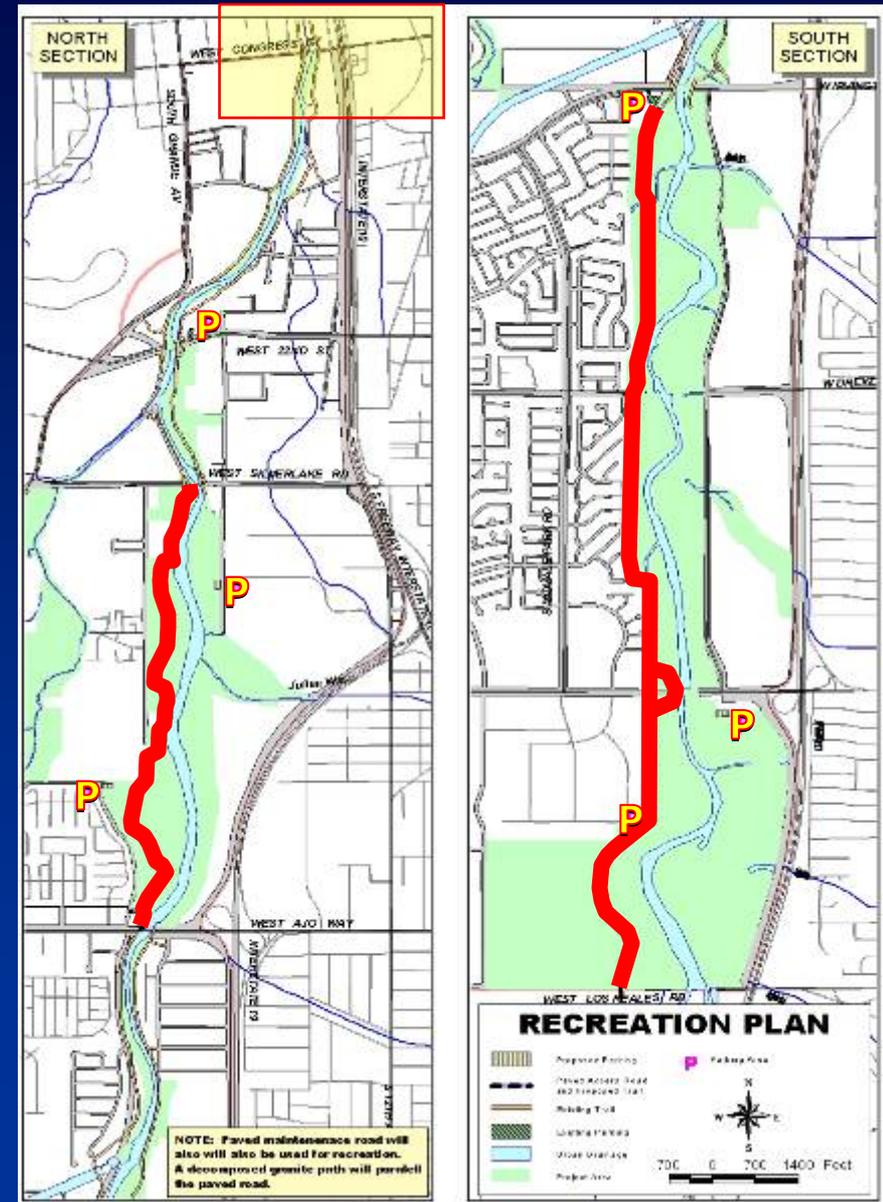
Federal
\$ 59,096,000



Recreation Plan

Santa Cruz River, Paseo de las Iglesias, Arizona

- Multipurpose trails
- Six (6) parking facilities
- Connects to Santa Cruz River Park at Congress
- Fills gaps in Juan Bautista de Anza National Historic Trail





Cost Sharing - Recreation Plan

Santa Cruz River, Paseo de las Iglesias, Arizona

Total Project Cost

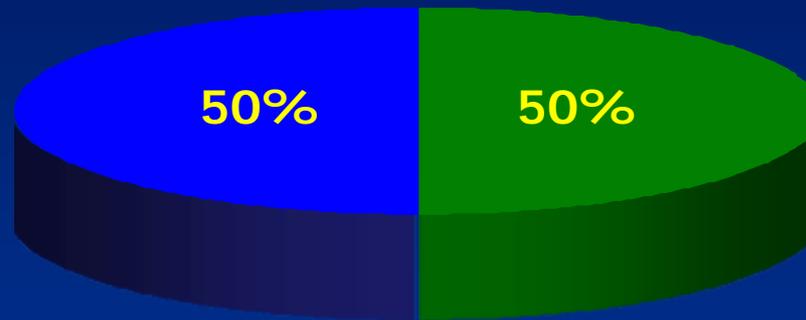
\$ 1,142,000

Non-Federal

\$ 571,000

Federal

\$ 571,000



Benefit - Cost Ratio = **1.29**

Annual expected recreation benefits = **\$ 30,000**

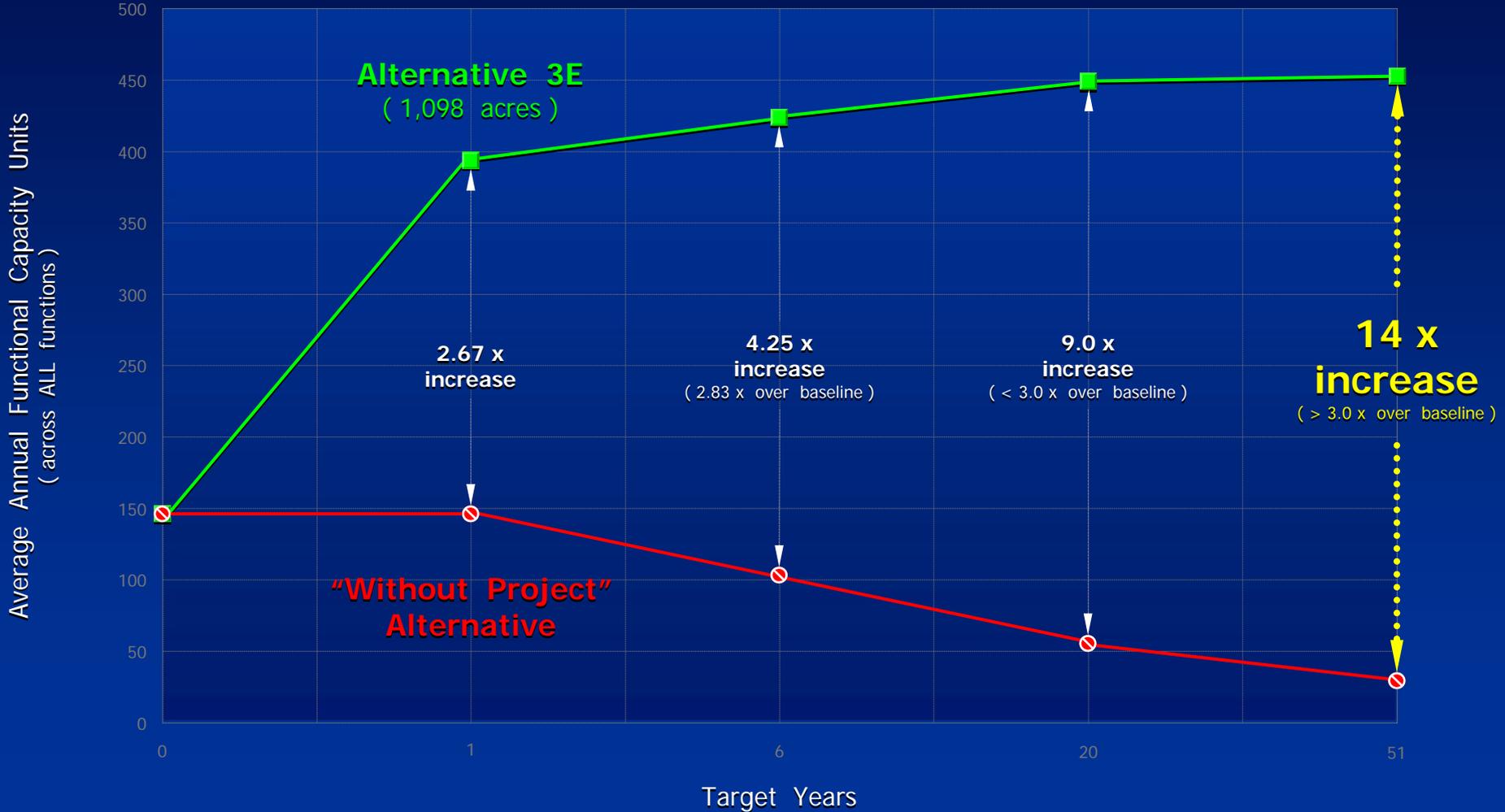
Annual O & M = **\$ 36,000**



Functional Habitat Benefits

Santa Cruz River, Paseo de las Iglesias, Arizona

Trend in Average Annual Functional Capacity Units (AAFCU)
(for Alternative 3E and "Without Project" Alternative)





- Federal Threatened or Endangered Species Migration
- Seven (7) species of local concern
- Expected to benefit both local and Pacific Flyway migratory wildlife species



Issue / Concern: **Flood Damage Reduction (FDR) as a project purpose**

Reason / Basis: The ITR team requested additional information on how FDR was eliminated as a project purpose

Significance: Impacts whether or not there is a combined NED / NER plan developed

Resolution: Measures and alternatives were developed and analyzed. **No alternatives were justified.**

Resolution Impact: **The issue is resolved.**



**PGM has been finalized
and all issues are resolved**



• Department of the Interior

Consider use of 28,200 acre-feet of effluent managed by Bureau of Reclamation under Southern AZ Water Rights Settlement Act.

• Environmental Protection Agency

Consult with Tohono O'odham and Pascua Yaqui Tribes on cultural resources.

• Stakeholder support received from:

- U.S. Fish and Wildlife Service
- Arizona Game and Fish Department
- Center for Biological Diversity
- Tucson Herpetological Society
- Santa Cruz River Alliance

Done
Done



Achieve Environmental Sustainability

O&M and stormwater harvesting

Consider Environmental Consequence

More natural system that will support riparian life

Seek Balance and Synergy

Wildlife corridor and ecosystem benefits within urban areas

Accept Responsibility

Compliance with National Environmental Policy and Endangered Species Acts

Mitigate Impacts

Minimize impacts during construction

Understand the Environment

Multi-stakeholder, scientific, and economic approach

Respect Other Views

Listened to and incorporated the views of others

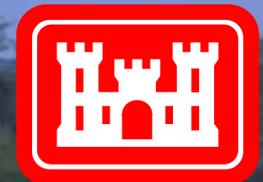
Paseo de las Iglesias

Local Context and Community Support

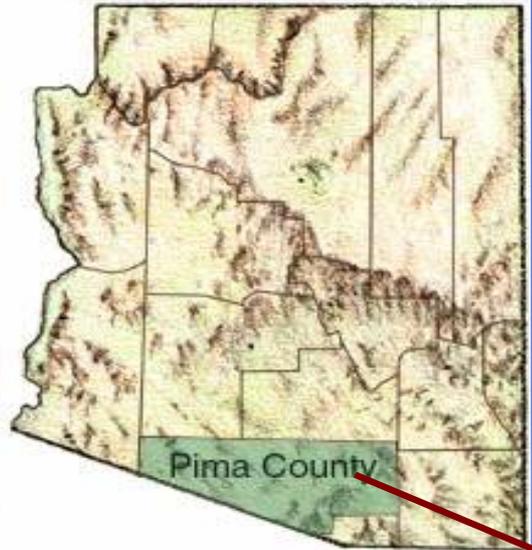
Pima County Regional Flood Control District
in Partnership with the US Army Corps of Engineers

John M. Bernal
Deputy County Administrator

Suzanne J. Shields, P.E.,
Director of Regional Flood Control District

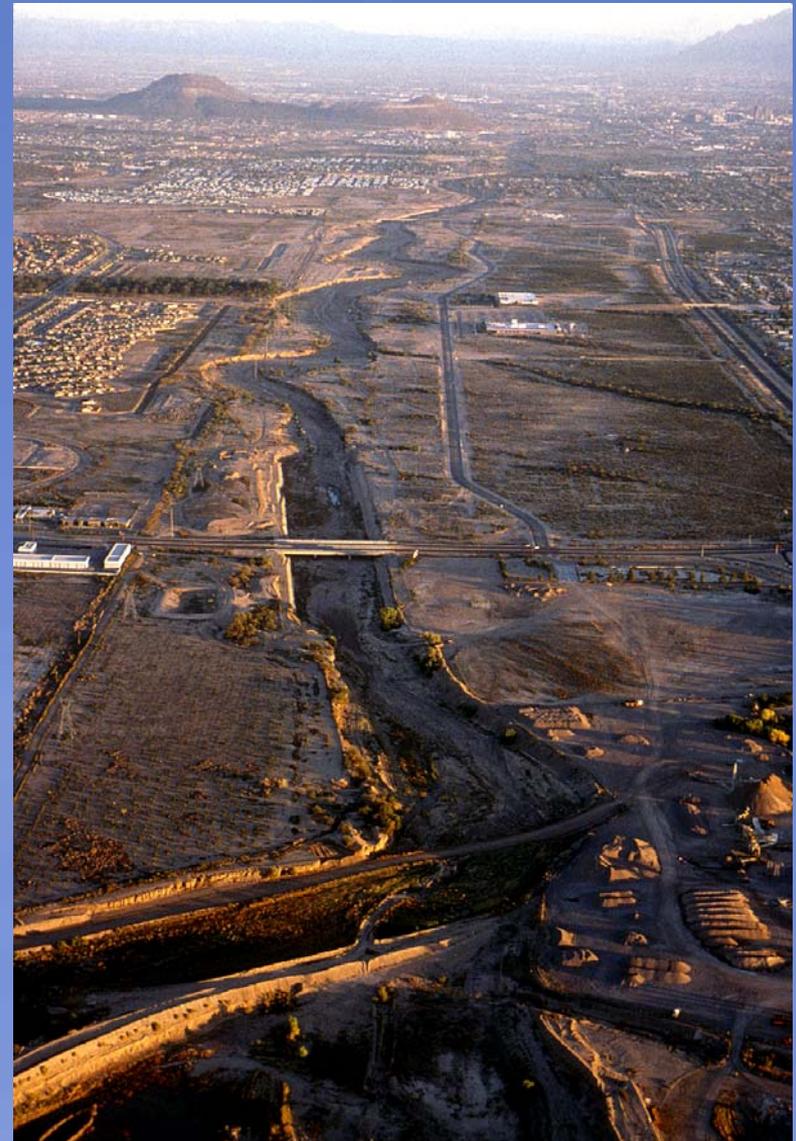


Project Location



Santa Cruz River: The Heart of Tucson

- 2,200 square mile watershed
 - 400 square miles in Mexico
- Continuously inhabited by indigenous people for >4,000 years



Paseo de las Iglesias - Upstream

San Xavier District,
Tohono O'odham Nation

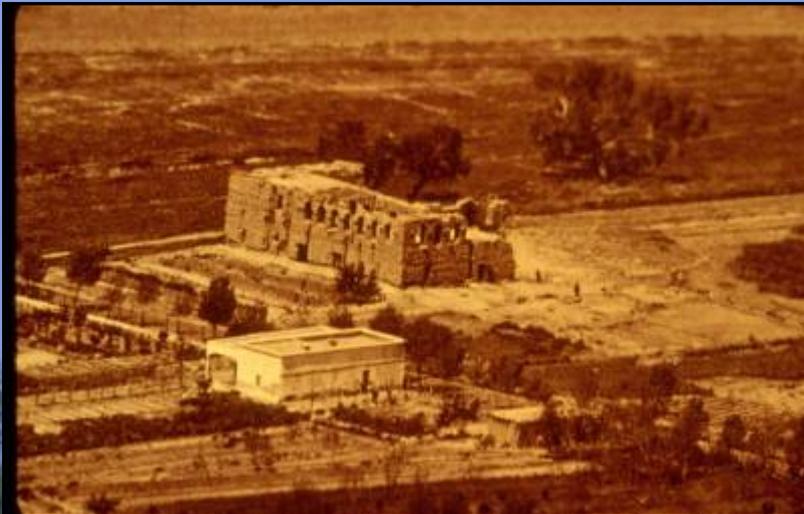
- Cultural Heritage
- Farming
- Tourism



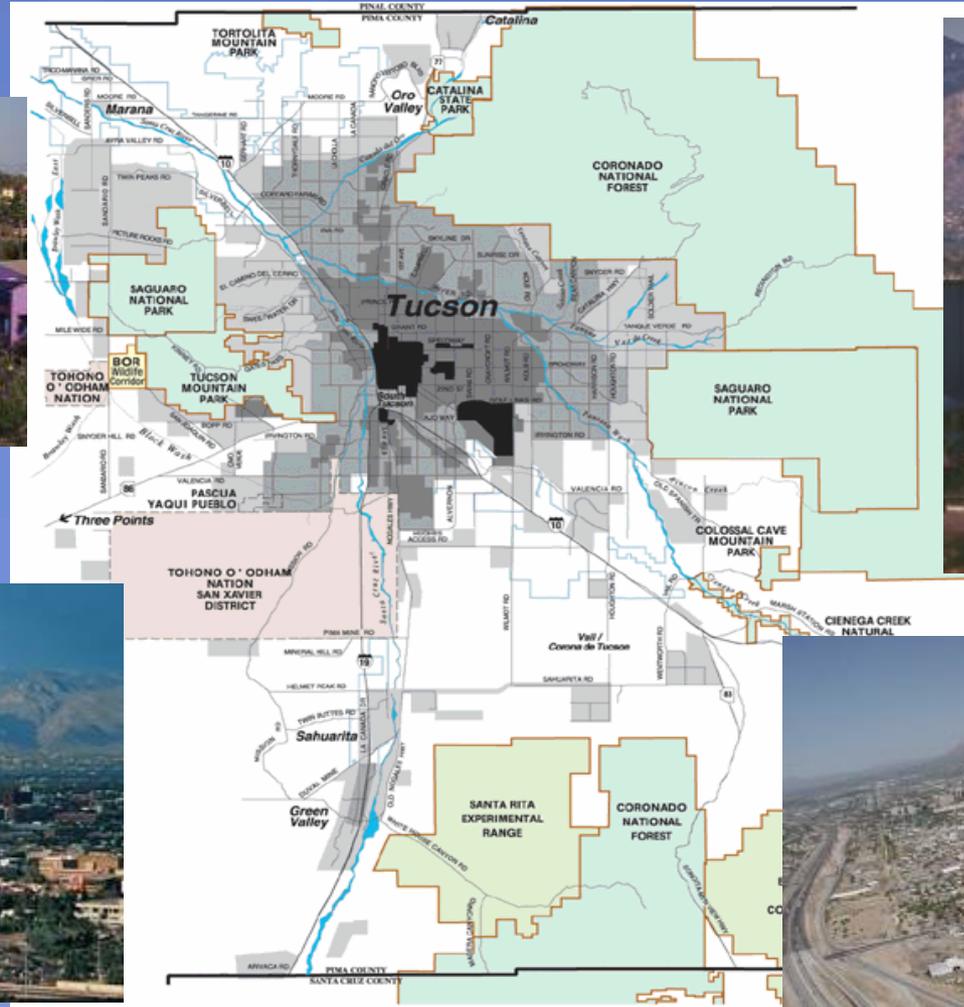
Paseo de las Iglesias - Downstream

Downtown Tucson Rio Nuevo Project

- Downtown Revitalization
- Economic Development
- Cultural Heritage
- Recreation / Tourism

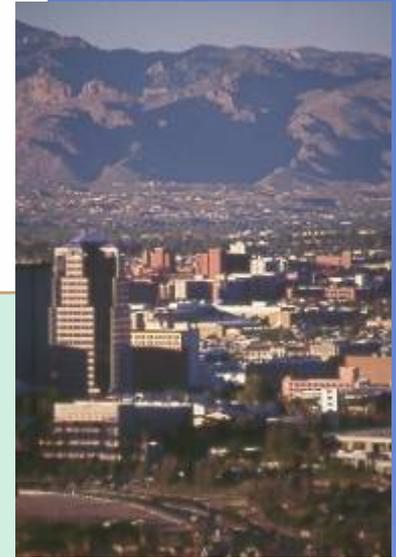


Rapid Growth & Development in Eastern Pima County, Arizona



Urban Expansion in the Metropolitan Tucson Area

1940 1960 1985 1990



Community Planning Supports Natural Resource and Cultural Preservation

- Sonoran Desert Conservation Plan
- Santa Cruz River Watershed Management Plan
- Riverine Restoration Projects
- Urban Planning
- River Park and Trails



Biology Based Planning for Urban Growth

Conservation Lands System - Unincorporated Pima County

LEGEND

	Parcel Base
	Incorporated Areas
	Important Riparian Areas 249 mi ² C1 UG1
	Biological Core 1,217 mi ² C2 UG2
	Scientific Research 5 mi ² C3 UG3
	Multiple Use or Recovery Mgmt. Areas 1,572 mi ² C4 UG4
	Agriculture within Recovery Mgmt. Areas 6 mi ² C5 UG5
	Existing Development within Conservation Lands System 14 mi ² C5 UG5
TOTAL 3,063 mi²	

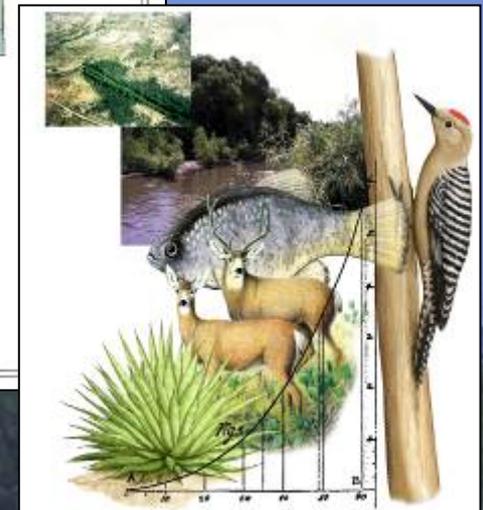
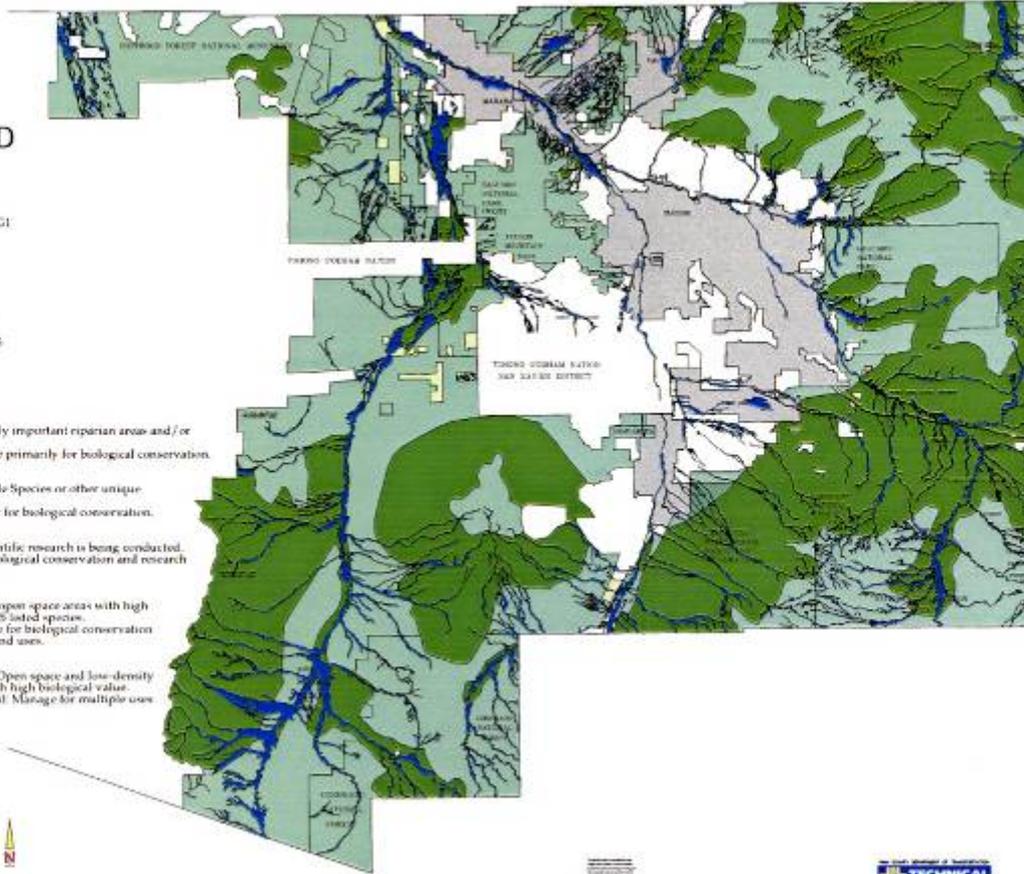
C1 = Important Riparian Areas Criteria: Intrinsically important riparian areas and / or riparian linkages between existing reserves.
UG1 = Important Riparian Areas Use Goal: Manage primarily for biological conservation.

C2 = Biological Core Criteria: 3+ Priority Vulnerable Species or other unique biological features.
UG2 = Biological Core Use Goal: Manage primarily for biological conservation.

C3 = Scientific Research Criteria: Areas where scientific research is being conducted.
UG3 = Scientific Research Use Goal: Manage for biological conservation and research value.

C4 = Multiple Use or Recovery Criteria: Primarily open space areas with high biological value and value to recovery of USFWS listed species.
UG4 = Multiple Use or Recovery Use Goal: Manage for biological conservation and species of concern but may include other land uses.

C5 = Existing Development/ Agriculture Criteria: Open space and low-density existing development, agriculture and areas with high biological value.
UG5 = Existing Development/ Agriculture Use Goal: Manage for multiple uses that maintain biological values.



Santa Cruz River Watershed Plan

GILA RIVER, SANTA CRUZ RIVER WATERSHED
PIMA COUNTY, ARIZONA



Final Feasibility Report



Pima County
Arizona



U.S. Army Corps of Engineers
Los Angeles District

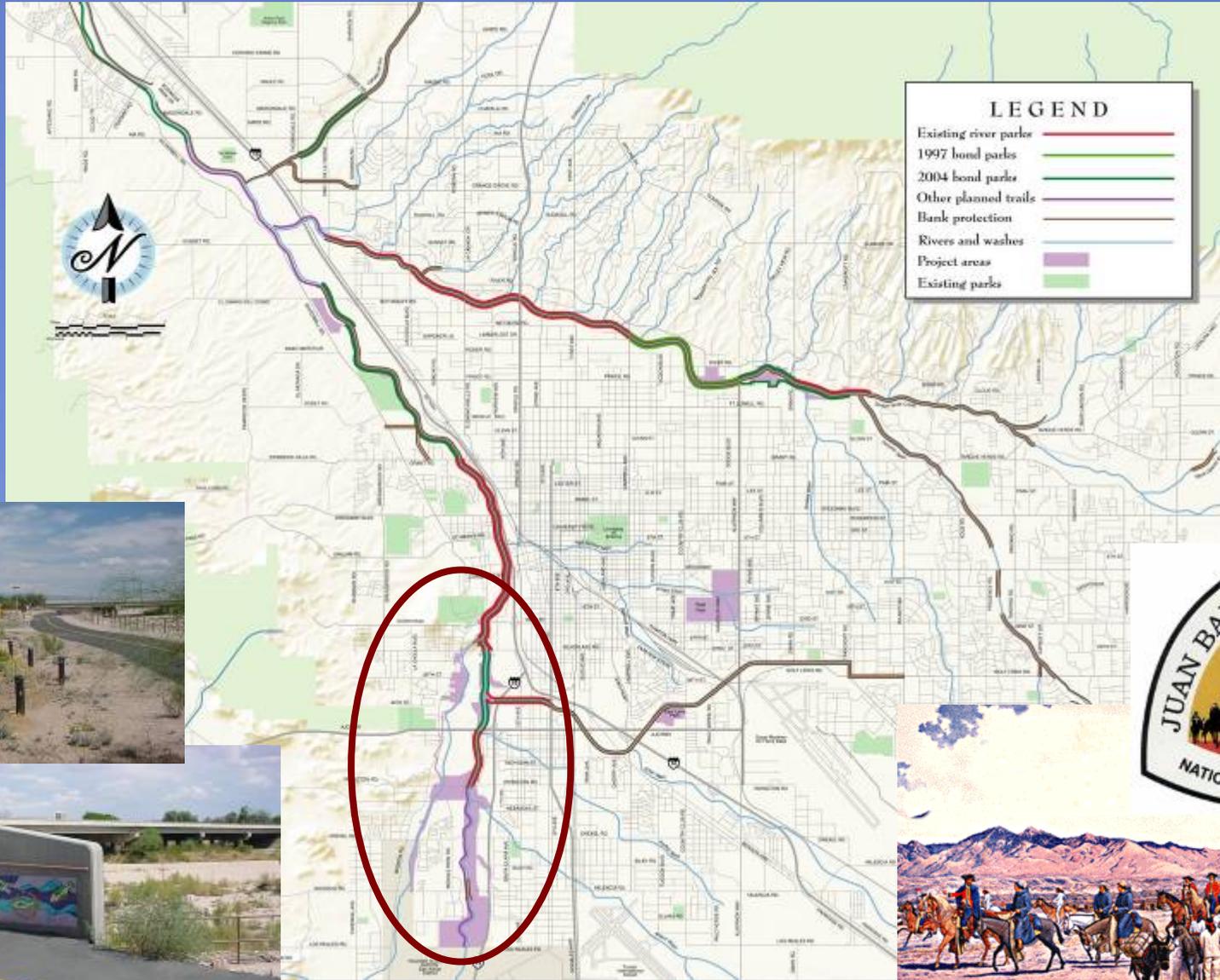


City of Tucson
Arizona

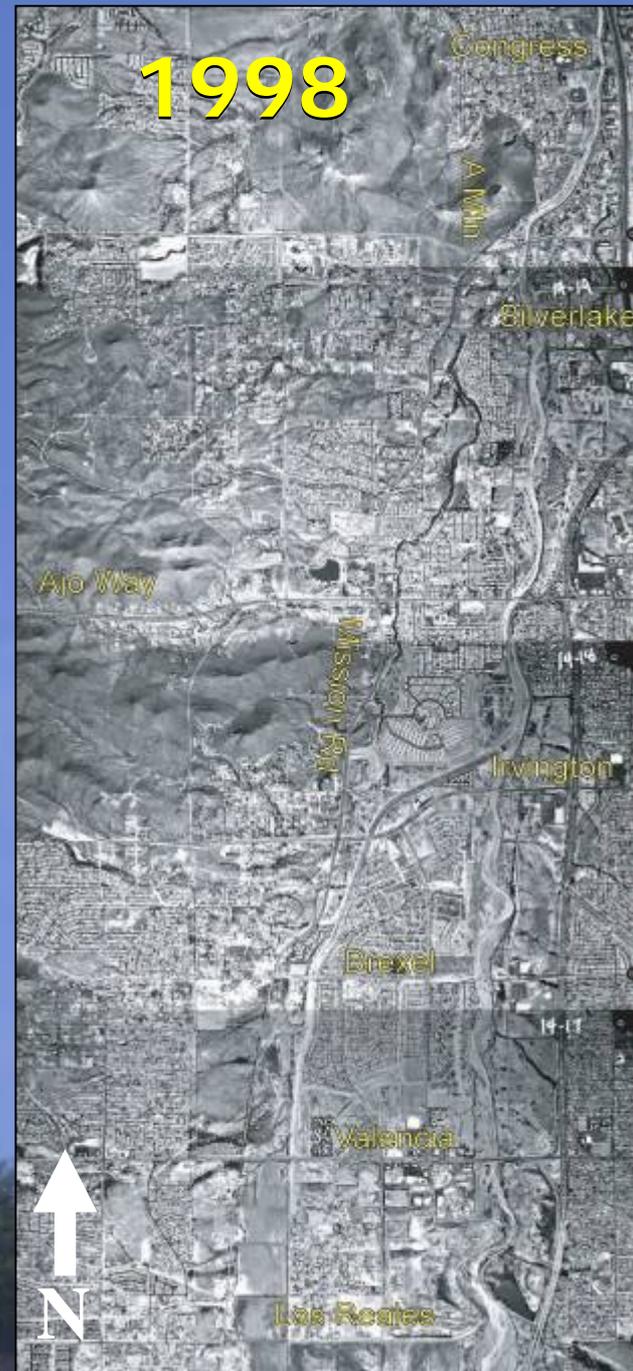
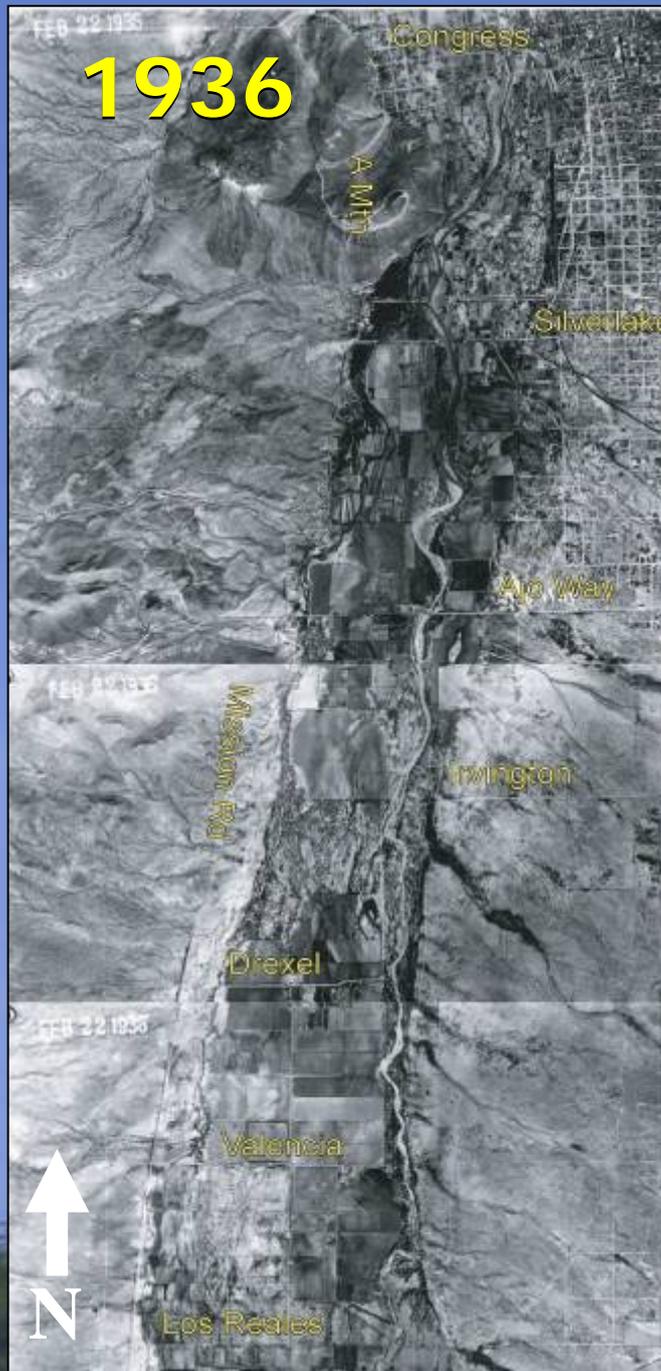
August 2001



River Parks and Trails

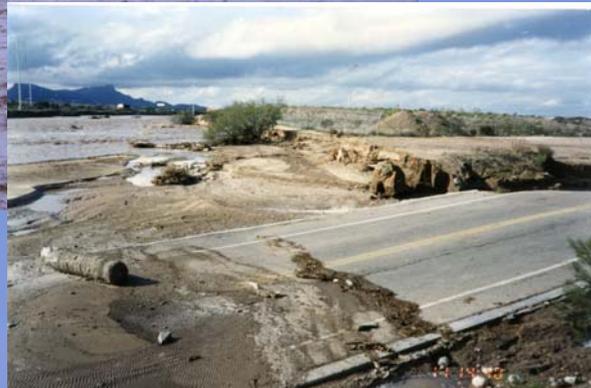


Why Paseo?



Floods and Riverine Restoration

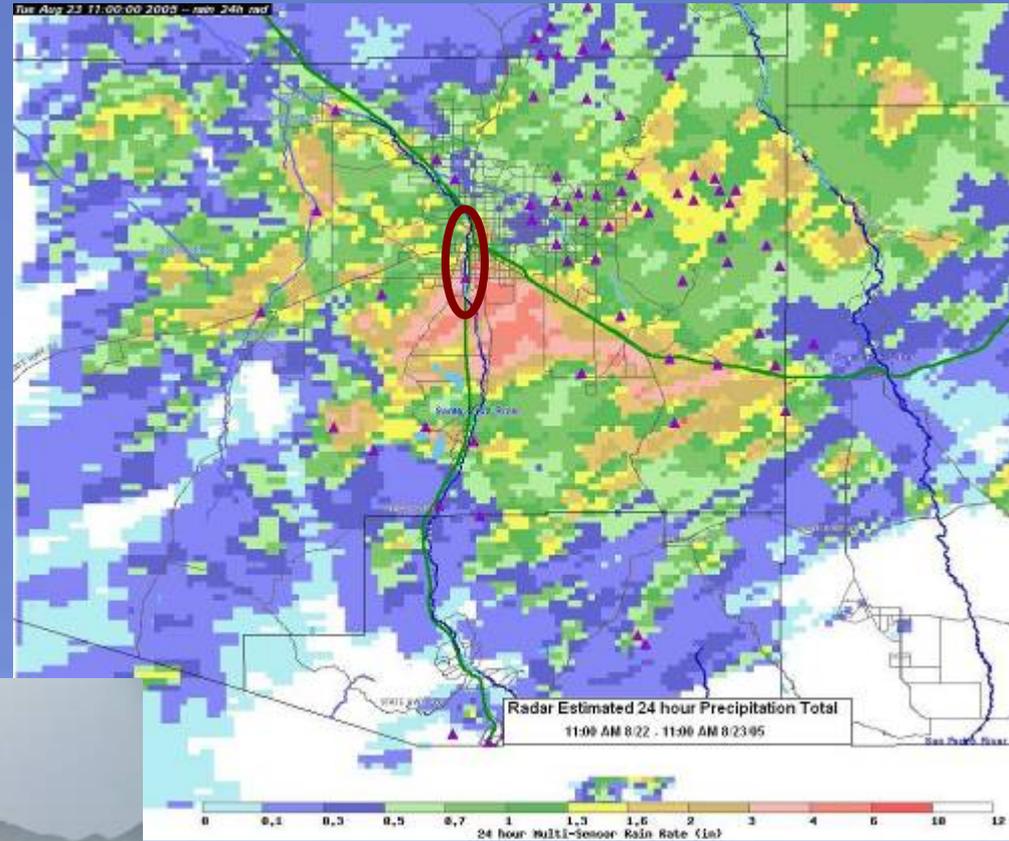
Ecosystem restoration preserves and enhances natural floodplain functions, and protects public safety and infrastructure



Flood Control in Desert Environment



Santa Cruz River Flood Event
August 23, 2005



Paseo Objectives and Vision



Local Water Availability

- Stormwater Harvesting
- SAWRSA Settlement Water from Secretary of Interior
- Reclaimed Municipal Wastewater
- Remediated Groundwater
- Groundwater
- Leased 'Central Arizona Project' water



Kino Environmental Restoration



Kino Changes

August 21, 2001

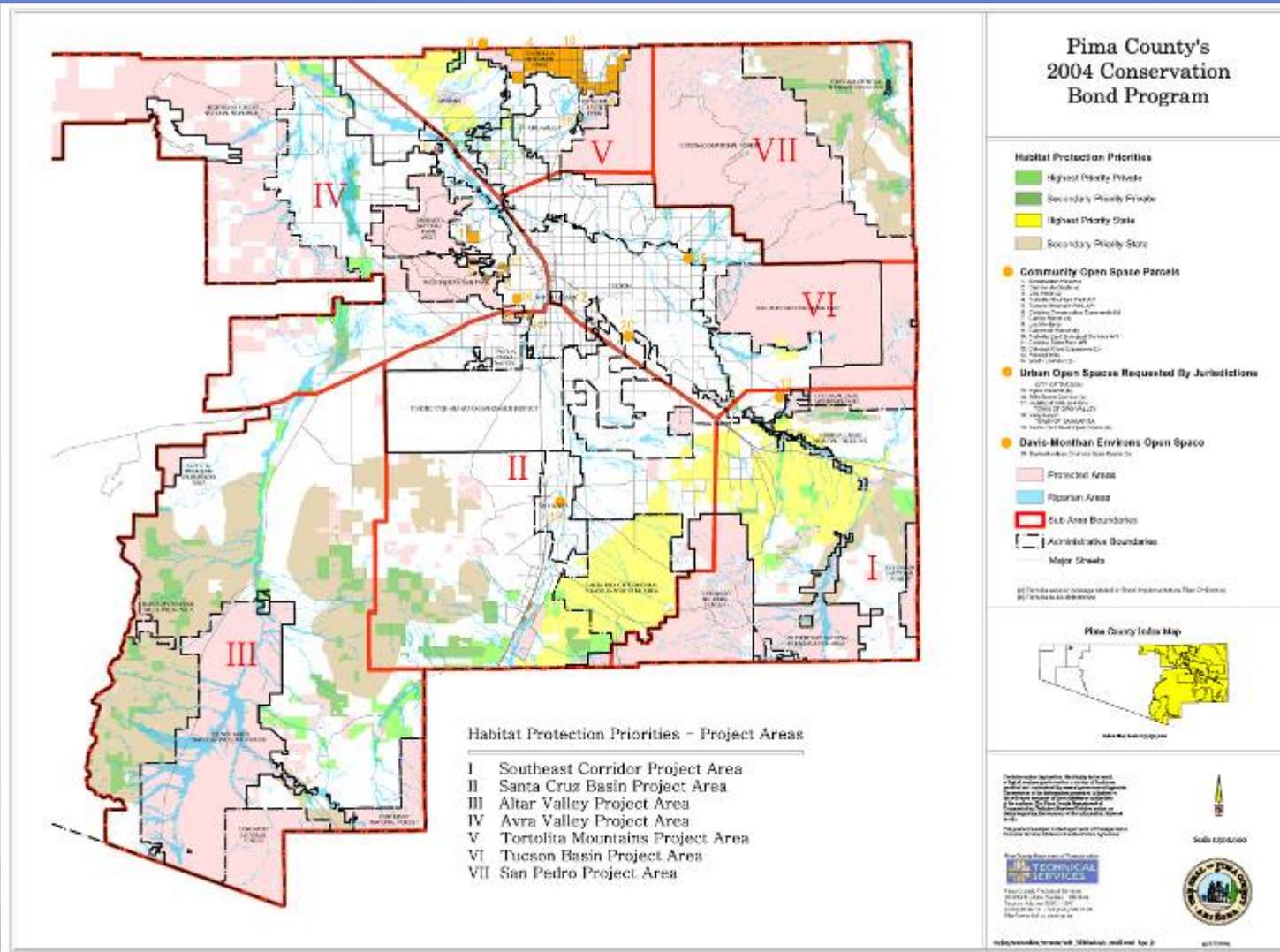


Stormwater
Harvesting Success

October 4, 2005



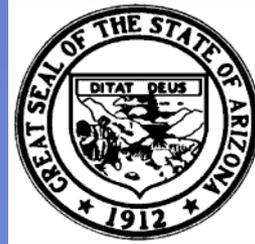
Local Project Readiness



Successful 2004 Bond Election: **\$174 million** for open space

Strong Local Support

- Local Government Support
- Federal Agency Support
- Local Indian Nations Support
- Community and Neighborhood Support
- Environmental and Advocacy Group Support



The End





Santa Cruz River Paseo de las Iglesias, Arizona Ecosystem Restoration Feasibility Study

BG Joseph Schroedel
Commander, South Pacific Region

Civil Works Review Board
18 October 2005



- Milestone meetings during report development and coordination with RIT
- Review certifications: ITR; MCACES; Legal; Policy compliance
- Public participation process
- Key partners and stakeholder input considered

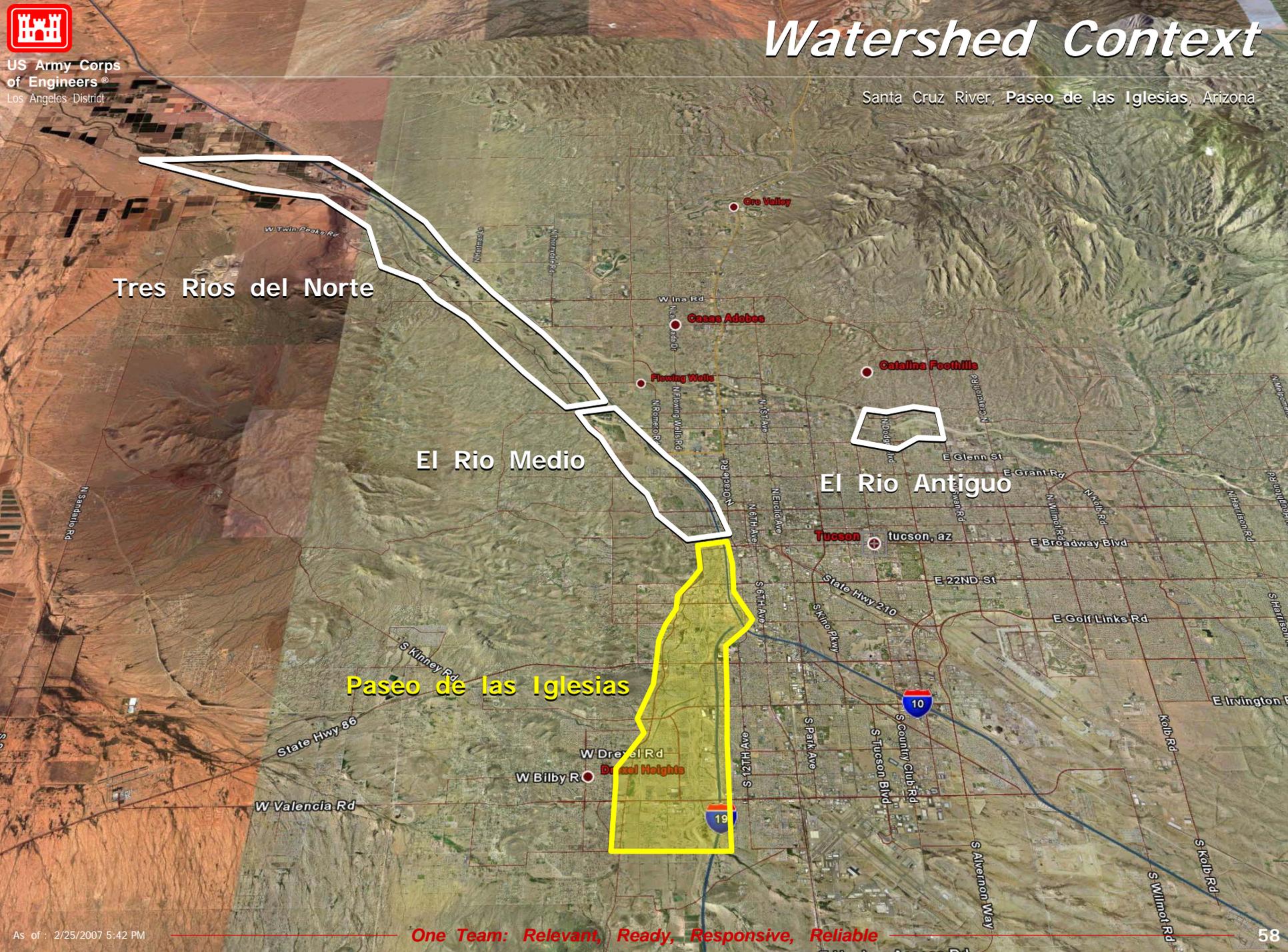


- Concur with Los Angeles District Commander's findings and recommendations
- Confirm that report complies with applicable laws and policies
- Meets CW Strategic Plan goals
- Approve for initiation of State and Agency review



Watershed Context

Santa Cruz River, Paseo de las Iglesias, Arizona



Tres Rios del Norte

El Rio Medio

El Rio Antiguo

Paseo de las Iglesias

Tucson, Tucson, AZ

Civil Works Review Board

Santa Cruz River - **Paseo de las Iglesias**, Arizona
Ecosystem Restoration

Significant Policy Review Concerns

John C. Furry, Ecologist

Office of Water Project Review
Policy and Policy Compliance Division

18 October 2005



Policy Review Team Recommendation

Santa Cruz River - **Paseo de las Iglesias**, Arizona
Ecosystem Restoration

**Release the Report and FEIS for
State and Agency Review and
Filing with USEPA,**

**subject to modifications to comply
with §404 CWA requirements**



No Remaining Significant Policy Issues

Santa Cruz River - **Paseo de las Iglesias**, Arizona Ecosystem Restoration

Vertical team work and partnering with the public, the non-federal sponsor, and other agencies overcame the following concerns:

- **Sustainability** of the project
- **Late discovery** of a critical project constraint
- **Clean Water Act compliance**
- **Formulation** - real estate concern for **water costs**
- **Real Estate Plan submission**



Sustainability

Santa Cruz River - **Paseo de las Iglesias**, Arizona Ecosystem Restoration

Issue / Concern: **Uncertain the non-federal sponsor could guarantee enough water to sustain the implemented project**

Reason / Basis: **Water available for the project today might decline below minimum required if others assert their rights to water**

Significance: **Loss of effectiveness or whole project**

Resolution: **Determine how much water the non-Federal sponsor can guarantee and design alternatives up to that volume**

Resolution Impact: **The issue is resolved.**



Critical Project Constraint

Santa Cruz River - **Paseo de las Iglesias**, Arizona Ecosystem Restoration

Issue / Concern: No technically-feasible, cost-effective alternatives passed economic evaluations as “best buys” at AFB

Reason / Basis: No time to reformulate. New alternatives were compared to high water demand alternatives. Workable low water alternatives dropped out based on economic analysis.

Significance: No sustainable alternatives in final array

Resolution: Reformulated to screen out infeasible alternatives, then completed incremental cost-benefit analysis

Resolution Impact: A practicable alternative is recommended. **The issue is resolved.**



Clean Water Act Compliance

Santa Cruz River - **Paseo de las Iglesias**, Arizona Ecosystem Restoration

Issue / Concern: Report is not in full compliance with §404 requirements

Reason / Basis: ER 1105-2-100 requires preparing authorization reports for §404(r) Exemption, and for §401 State WQ Certification

Significance: §404(r) eliminates the need for §401 State WQ Certification, and saves non-Federal sponsor permit fee

Resolution: District acquiring missing information and adding appropriate statements to report and FEIS to qualify for §404(r) Exemption

Resolution Impact: **Resolution will delay release for State & Agency Review less than 1 week.**



Water Costs

Santa Cruz River - **Paseo de las Iglesias**, Arizona Ecosystem Restoration

- Issue / Concern: Need binding agreements for water supply and costs, and for lands needed for delivery systems
- Reason / Basis: Water availability and cost, and real estate interests effect formulation, feasibility, and sustainability of alternatives
- Significance: Regional water issues vary widely among alternatives effecting selection and total project cost
- Resolution: Non-Federal sponsor provided sufficient information and assurances of water delivery and costs to prepare draft report
- Resolution Impact: **The issue is resolved.**



Real Estate Plan Submission

Santa Cruz River - **Paseo de las Iglesias**, Arizona
Ecosystem Restoration

Issue / Concern: Real Estate Plan (REP) was not in AFB package

Reason / Basis: Conflicting regulations: one says REP due in draft report; another says submit nearly complete version for AFB

Significance: After AFB approval, Draft Report does not come to HQ for approval before release for public review

Resolution: District complied with Conditional Approval by getting advanced approval of REP

Resolution Impact: Public review occurred as scheduled. **The issue is resolved.**



Questions ?