US Army Corps of Engineers ®
Los Angeles District

U.S.ARMY

Rio Salado Oeste, Phoenix, Arizona Ecosystem Restoration Feasibility Study

COL Alex C. Dornstauder
Commander and District Engineer, Los Angeles District

Civil Works Review Board

October 18, 2006

Study Authority

Flood Control Act of 1938, June 1938

Gila River and Tributaries, Arizona.

House Resolution (Docket 2425) May 1994

" . . . review reports . . . In the interest of flood damage reduction, environmental protection and restoration, and related purposes. "

Study Area

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona

Salt River Watershed

15,000 square miles

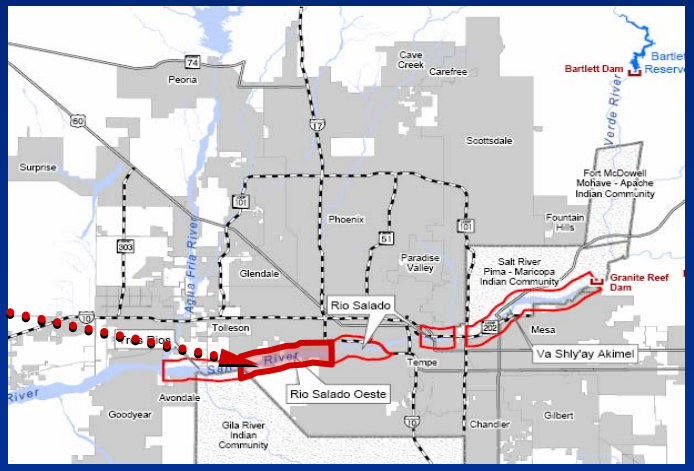
Joins Gila River west of Phoenix

Downtown Phoenix

(19th AVE to 83rd AVE - **8** miles)

Other USACE Projects

Tres Rios / Rio Salado / Va Shly'ay Akimel



Greater Phoenix, AZ Metropolitan Area
and
Salt River Project System

Study Area

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona

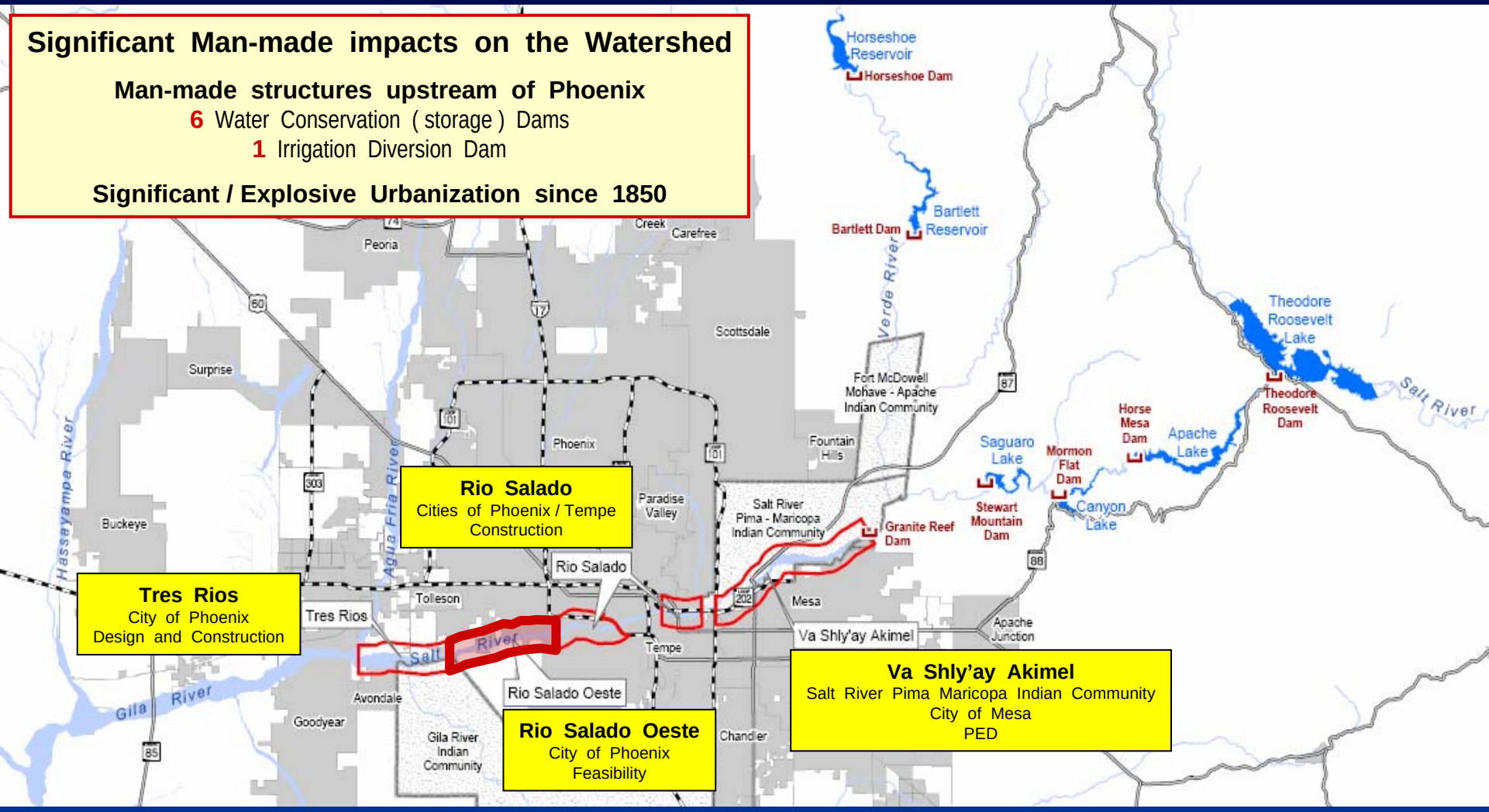
Significant Man-made impacts on the Watershed

Man-made structures upstream of Phoenix

6 Water Conservation (storage) Dams

1 Irrigation Diversion Dam

Significant / Explosive Urbanization since 1850



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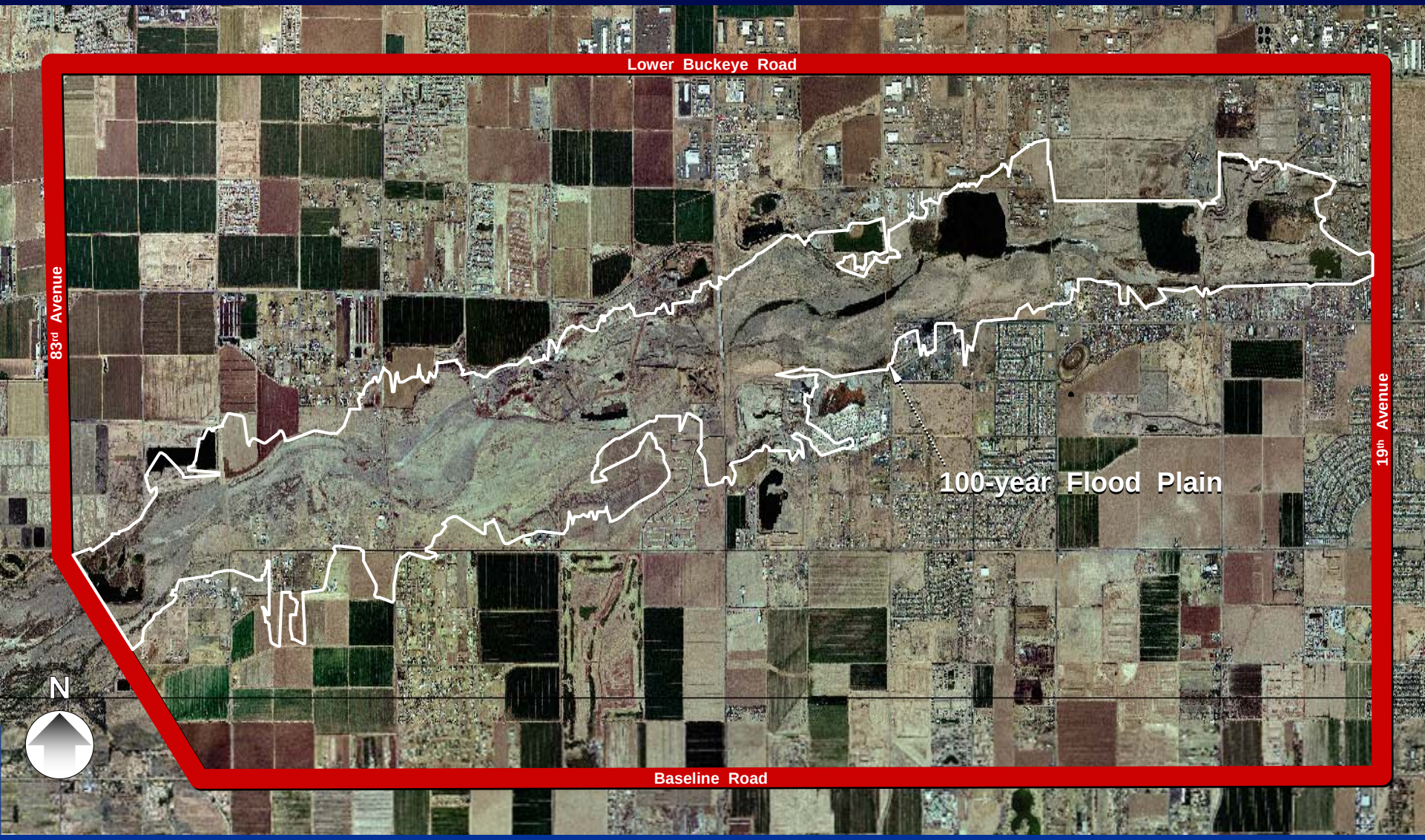
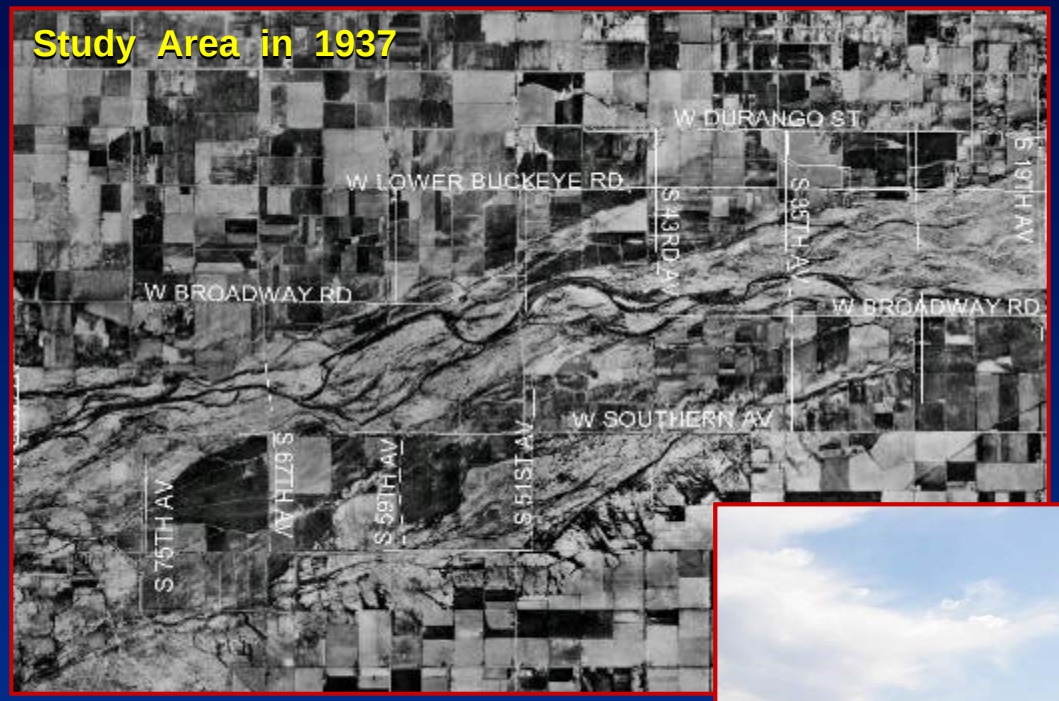
Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona



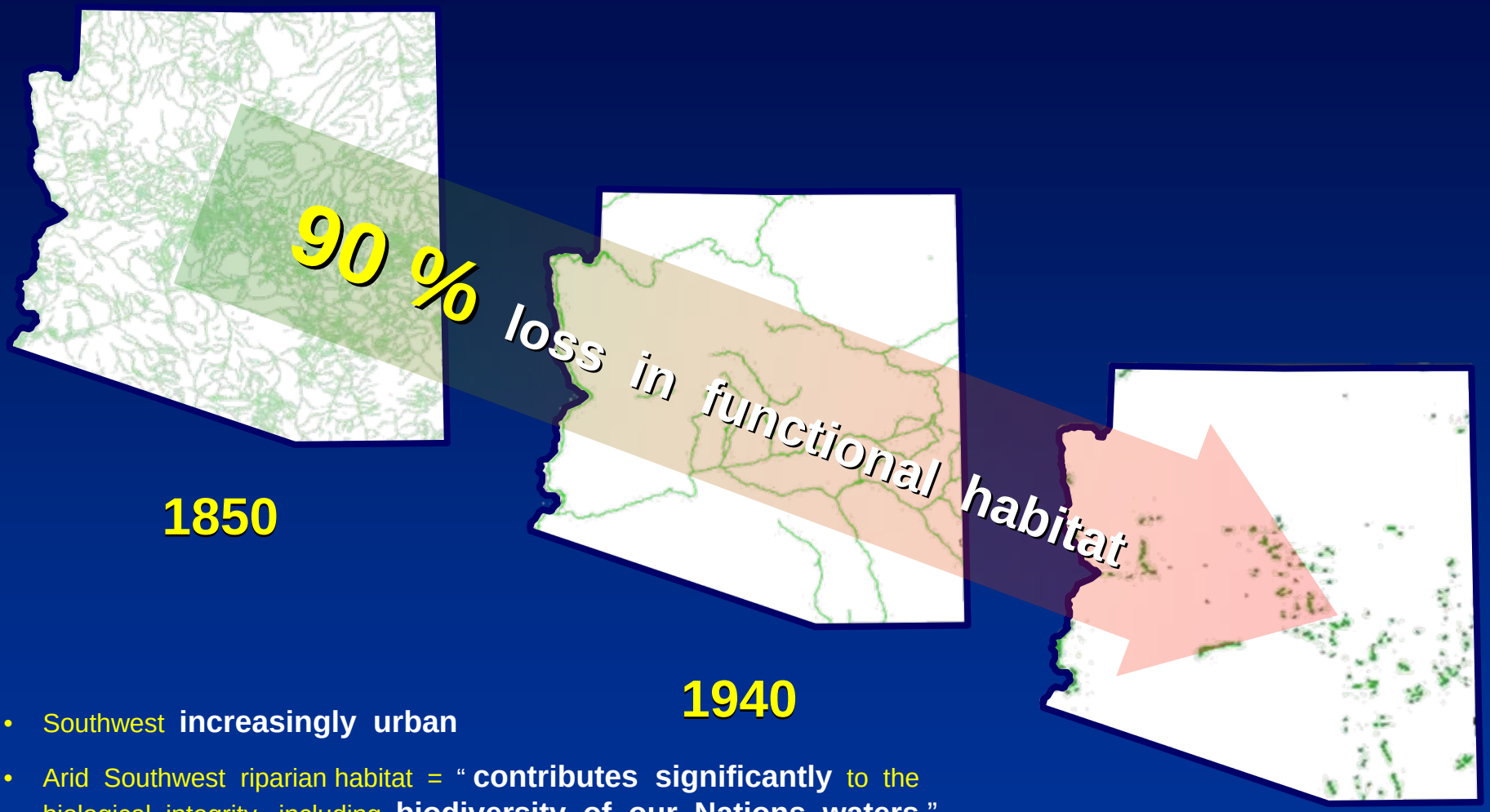
Historic Conditions



- Perennial stream
- Shallow groundwater
- Meandering channel
- Emergent wetlands
- Cottonwood - Willow
- Mesquite

Southwestern Riparian Trend

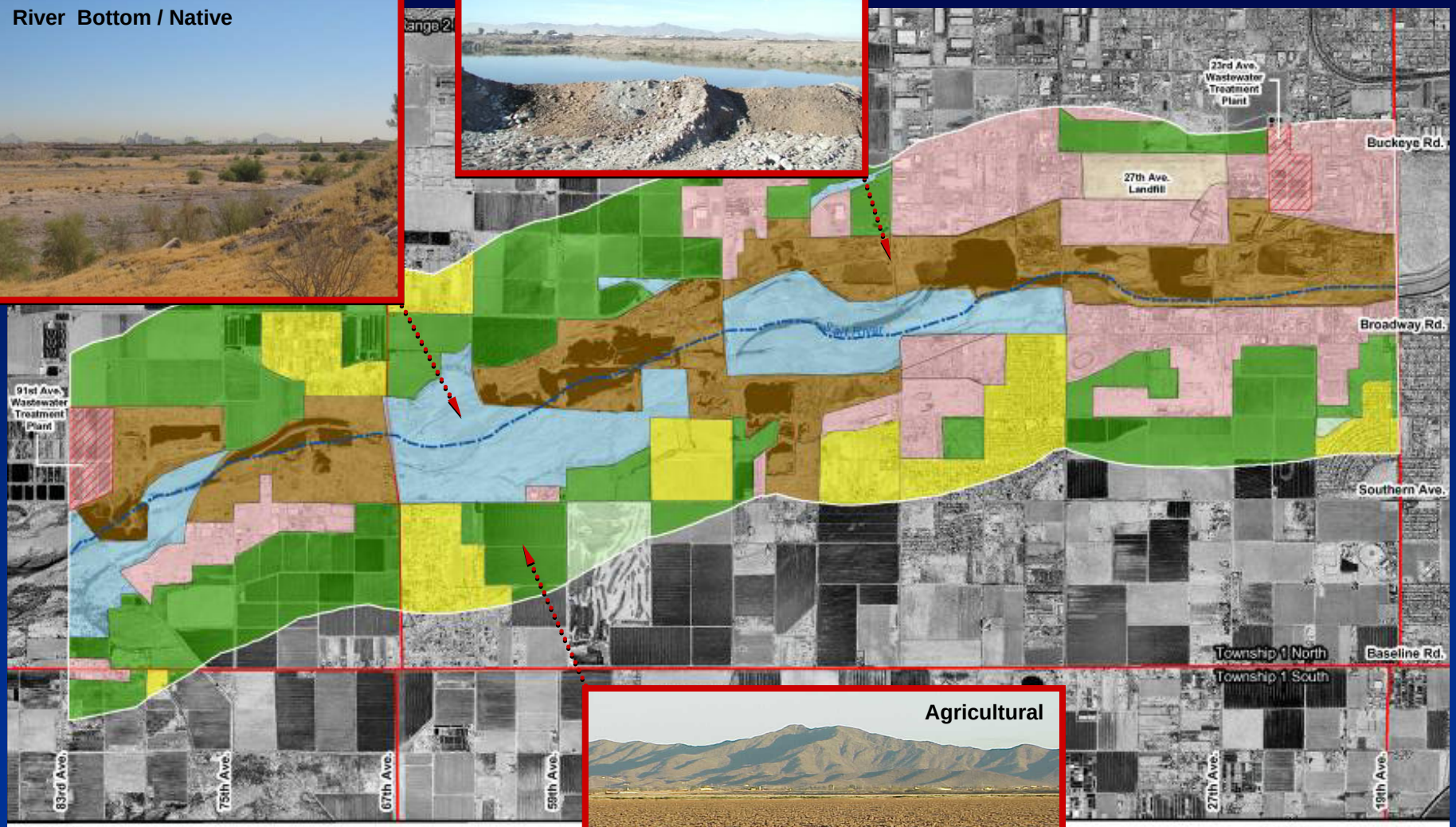
Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona



- Southwest **increasingly urban**
- Arid Southwest riparian habitat = " **contributes significantly** to the biological integrity, including **biodiversity of our Nations waters** " (USFWS, 1993)
- Restoration of **riparian ecosystems** in the Sonoran Desert is **Critical** (Nature Conservancy)

Existing Conditions

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona



Legend

- Residential
- Commercial/Industrial
- Landfill
- Sand/Gravel Operation
- Agricultural
- Recreational
- River Bottom/Native

Existing Land Use

Groundwater Quality and Hydrogeology Report
Rio Salado Oeste Project

N

Figure 1

Future Without Project Assumptions

Land Use

Aggregate operations will **move West**

All adjacent Agricultural land will be **residential within 5 years**

Recreation needs increase

Habitat

Surface water **reduced**

2/3 less cottonwood - willow (**< 100 acres**)

Slight reduction in wetlands (**< 30 acres**)

Study Objectives

- **Restore** native riparian, wetland, and floodplain **habitats** and manage undesirable plant, fish, and wildlife species.
- **Improve** passive **recreation** and environmental **education** opportunities within the study area.
- **Reduce** flood **damages** to infrastructure and structures.

Planning Constraints

Avoid **contaminants / landfills**

Maintain existing level of **flood protection**

Maintain compatibility with **bridges** / highways

Don't create a **vector** problem

Prevent damage to project from **flood flows**

Maintain compatibility with **sand and gravel mining**

Meet **water conservation** requirements

Maintain **public support**

Don't violate **airport** restrictions

Ecosystem Restoration Formulation

Dedicated Water Supply

23rd Avenue Effluent = **9,000** acre-feet / year

Storm water harvesting = **2,800** acre-feet / year

Restored channel = improved conveyance

Recovery well = reuse effluent

Cost - Effective Sustainability

Restoring river functions = minimal O&M

Consider "ideal" floodplain habitat

Avoid large unnecessary expenditures in frequently inundated locations = **10-year** event

Restore Priority Habitats

Cottonwood - Willow / Mesquite

Emergent wetlands / Open water

"Restore degraded ecosystem *structure*, *function*, and *dynamic processes* to a less degraded, more natural condition"

Restoration Measures

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona

1. Revegetation
2. Water Supply / Distribution
3. River Channel Restoration
4. Invasive Species Control
5. Gravel Pit (Lake) Restoration

Scrub – Shrub	Mesquite	Mesquite Bosque	Cottonwood – Willow	Wetland	Water	Wetland	Cottonwood – Willow
35 feet	35 feet	50 feet	50 feet		100 feet		35 feet

Plan Formulation - Initial Screening

- Overall **20** initial alternatives
- Screening of alternatives was based on:
  - **Completeness**
  - **Effectiveness of restoring significant habitats**
  - **Connection of river corridor**
  - **Flood conveyance**
- This left **6** alternatives, including the "no action" alternative

Arizona Riverine Hydrogeomorphic Model

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona

- 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 **three (3) AZ studies** waiting WRDA authorization

Plan Formulation - Cost Effectiveness

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona

Average Annual Functional Capacity Units (AAFCU)
(for Remaining Alternatives and " Refines ")

Plan Formulation - Incremental Analysis

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona

Final Alternative Comparison

Riparian Habitat Restored (acres)

	Cottonwood-Willow	Mesquite	Emergent Wetland	Riparian Scrub	Channel	Functional Capacity Units
No Action	-	-	-	-	-	580
5A	375	417	190	296	170	847
Refine 1	210	56	140	125	170	764

Recommended Plan - Alt 5A

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona

Before

River channel restored

Water supply

(Storm water / effluent)

Revegetation

Invasive species removed

Gravel pits restored

(in floodplain)

Acres Restored

Cottonwood - Willow (**375**)

Mesquite (**417**)

Wetlands (**190**)

Riparian Scrub (**296**)

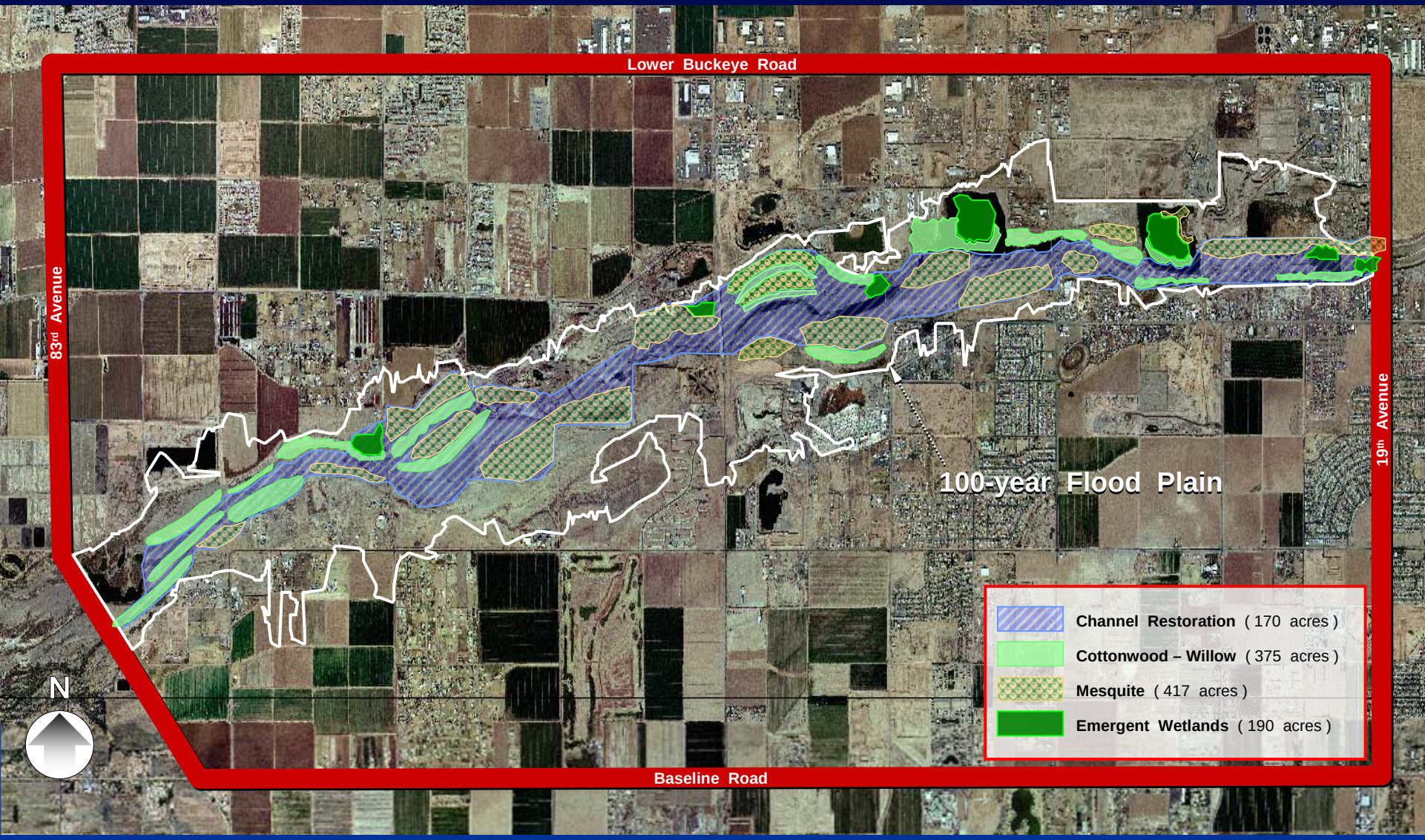
Scrub shrub (**56**)

channel (**170**)

After

Recommended Plan - Alt 5A

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona



Recreation Plan

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona

Site Preparation

Parking Lots (500 Spaces)

Entry Roads

Sidewalks & Ramps

Multi-Use Trails

Bridges & Culverts

Access Control

Security Lighting

Signage

Picnic / Trail Shelters

Restroom Facilities

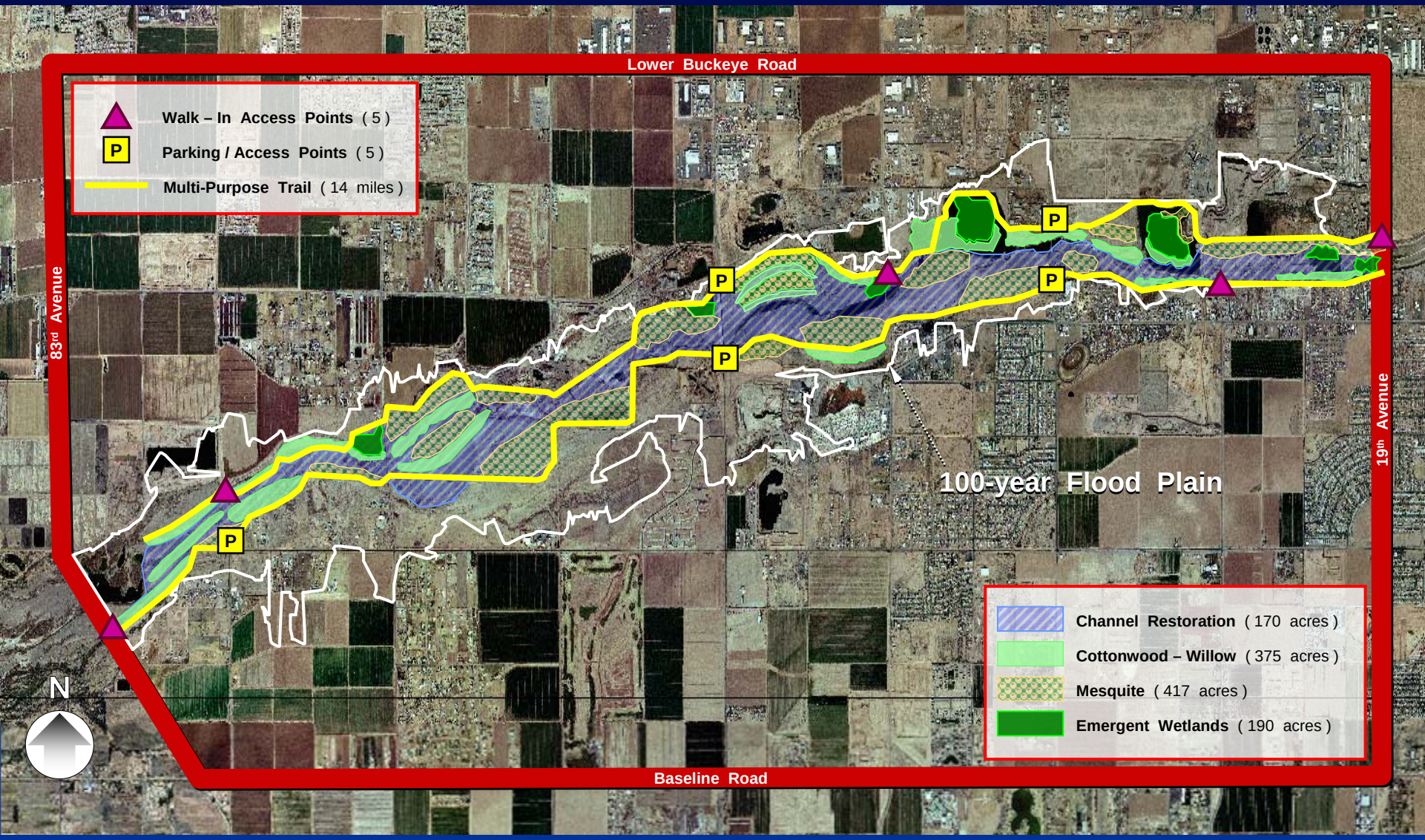
Utilities

Park Furniture

Interpretive Guidance Media

Recreation Plan

Salt River Watershed, **Rio Salado Oeste**, Phoenix, Arizona



0 1 2 3
Miles

Recommended Plan - Estimated Costs

Construction	$74,220,000
Contingency @ 20%	14,844,000
Preliminary Engineering and Design / EDC @ 11%	9,797,000
Construction Management @ 6.5%	6,426,000
Total Construction Cost	105,287,000
Real Estate	55,900,000
Subtotal	161,187,000
Monitoring and Adaptive Management (5 years)	3,765,000
Total First Cost	**$ 164,952,000**

Annualized Investment Cost	10,123,000
Associated Annual Costs (Water Supply)	817,000
Annual Operations and Maintenance (O & M)	2,883,000
Total Annual Cost	**$ 13,823,000**

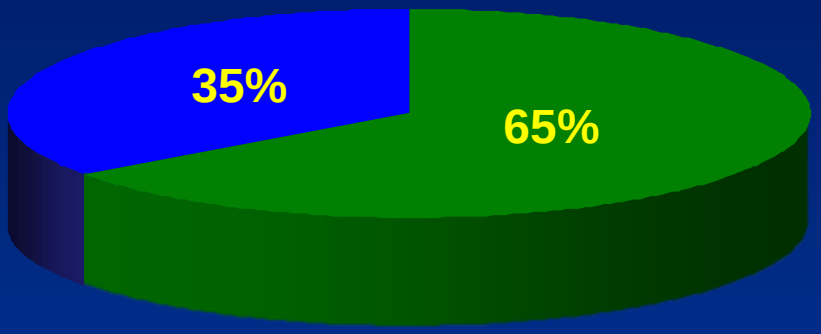
Cost Sharing - Ecosystem Restoration

Total Ecosystem Restoration Cost

$ 153,777,000

Non-Federal

$53,822,000



Federal

$ 99,955,000

Total Average Annual Functional Capacity Units = **847**

Total Annual Costs = **$ 12,367,000**

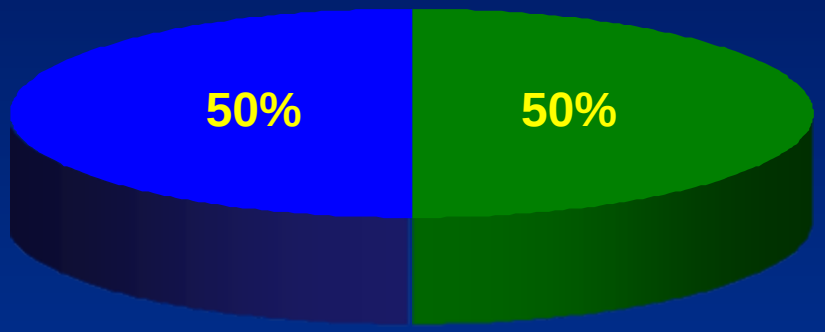
Cost Sharing - Recreation Plan

Total Recreation Cost

$ 11,173,000

Non-Federal

$ 5,586,500



Federal

$ 5,586,500

Benefit - Cost Ratio = **1.98**

Annual expected recreation benefits = **$ 2,889,000**

Total Annual Costs = **$ 1,456,000**

Flood Damage Reduction

Estimated flood damages through study area

$ 247,000 expected annual damages **decrease** in **" Future w/o Project "**

65% industrial area at 35th Avenue

Most residential properties **outside 100-year floodplain**

Considered structural and non-structural solutions

Levee, channel, floodwall, relocation

Results

Costs significantly exceed benefits

Dropped from further consideration

Incidental flood damage reduction benefits

Other Benefits

- **Three (3)** Federal Threatened / Endangered Species habitat
  Bald Eagle / Yuma Clapper Rail / Southwest Willow Flycatcher
- Local and migratory wildlife species **(Pacific Flyway connection)**
- Synergy with local planning for **revitalization** and **redevelopment**
- Promotes **community cohesion** as destination facility / location
- **Vital linkage** with upstream and downstream communities through contiguous recreation trail system

Summary

Before

Riparian ecosystem restored

50% Increase in *ecosystem functionality*

Significant Increase in nationally - critical riparian habitat

Significant benefits to local and migratory species

Holistic Watershed Approach

Linkage to *USACE Projects* and *Salt River System*

Holistic Urban Master Planning

Increased *Recreation Opportunities*
Improved *Aesthetics* and *Quality of Life "Essentials"*
Significantly Increased *Investment Opportunities*

Flood Damage Reduction

After

Issue / Concern:	**Institutional** and **legal recognition** of **significance** are important and need to be stated
Reason / Basis:	ER 1105-2-100 defines significance including institutional and legal recognition
Significance:	Need to justify significance of the ecosystem being restored
Resolution:	Included additional descriptions of recognition from: State of Arizona, Arizona Game and Fish Department, The Audubon Society, The Nature Conservancy, US Fish and Wildlife Service
Resolution Impact:	**Expanded description of the significance of ecosystem of concern in the report**

PGM has been finalized and all issues are resolved

Public and Agency Comments

Department of the Interior

Done

Determine if there are Land and Water Conservation Fund Projects in the study area

Environmental Protection Agency

Done

Discuss adaptive management and complete Section 7 Consultation

Stakeholder support received from:

U. S. Fish and Wildlife Service
U. S. Environmental Protection Agency
Arizona Game and Fish Department
Arizona Department of Water Resources
Flood Control District of Maricopa County
Audubon Arizona

Arizona Riparian Council
Valley Forward
Phoenix Community Alliance
Phoenix Planning Commission
Phoenix Parks and Recreation Board
Members of the Public

Environmental Operating Principles

Achieve Environmental Sustainability

Storm water harvesting and adaptive management

Consider Environmental Consequence

More natural system that will support riparian life including endangered species

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

12 Points

Employ integrated, comprehensive systems - based approach

Planned and designed project features as a system including up and downstream projects

Employ risk - based concepts

Planning / Design / Construction / O&M

Planned for risk of flood flows, uncertainty in storm water discharges

Continuously reassess / update policy

Program Development / Planning Guidance / Design and Construction Standards

Applied lessons learned from construction into feasibility study

Dynamic independent review

Interdistrict, Policy, sponsor, agency review through study

Employ adaptive planning and engineering systems

Applied lessons learned into alternative designs

Focus on sustainability

Applied ecological and engineering principles in design of alternatives to restore river functions

Review and inspect completed works

Assess / modify organizational behavior

Collaborated with Con Ops in design / cost estimating

Effectively communicate risk

Acknowledged and planned for risk of flood flows

Establish public involvement risk reduction strategies

Manage and enhance technical expertise and professionalism

Interdisciplinary team including Corps, agency, sponsor, University and contractor personnel. Shared and learned from multiple disciplines

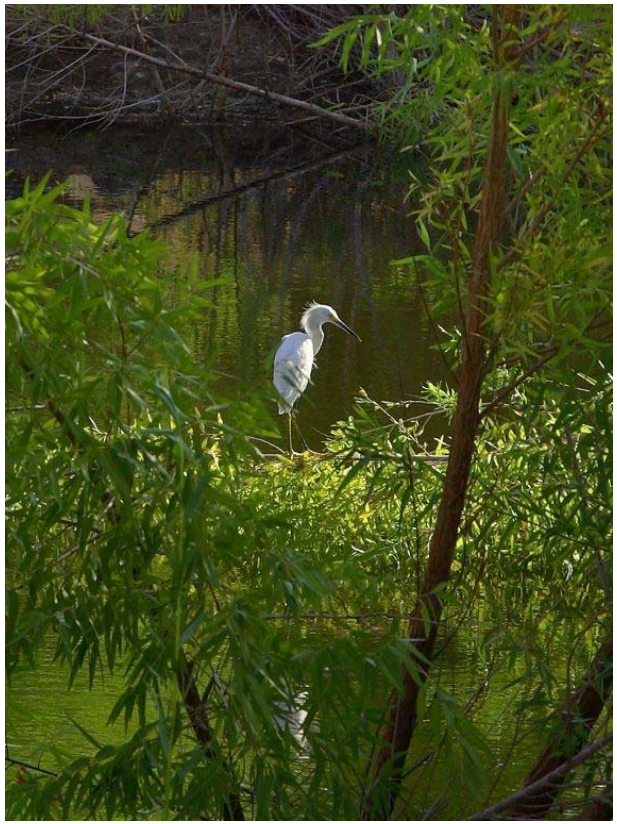
Invest in research

Questions ?

RioSalado

Presentation to U.S. Army Corps of Engineers Civil Works Review Board October 2006

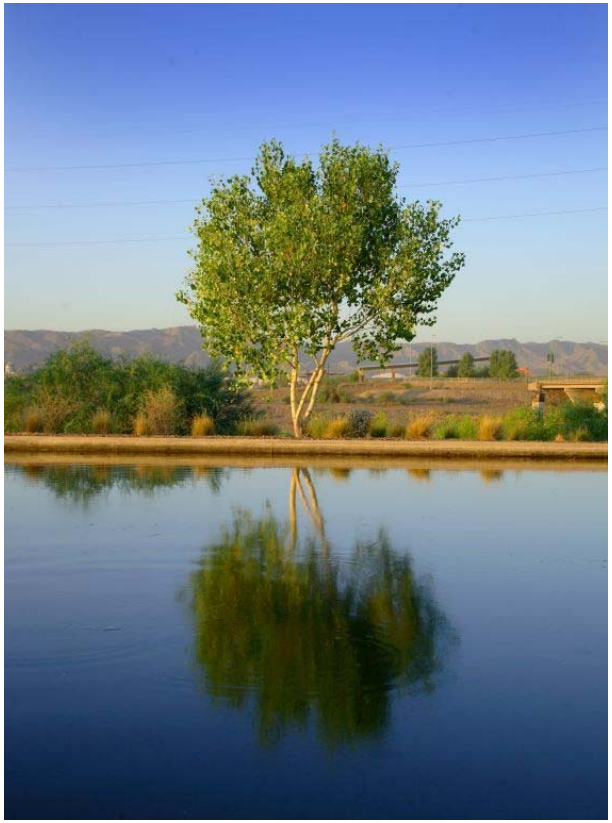
City of Phoenix



RioSalado

HABITAT RESTORATION PROJECT

Bringing the Salt River back to life in Phoenix

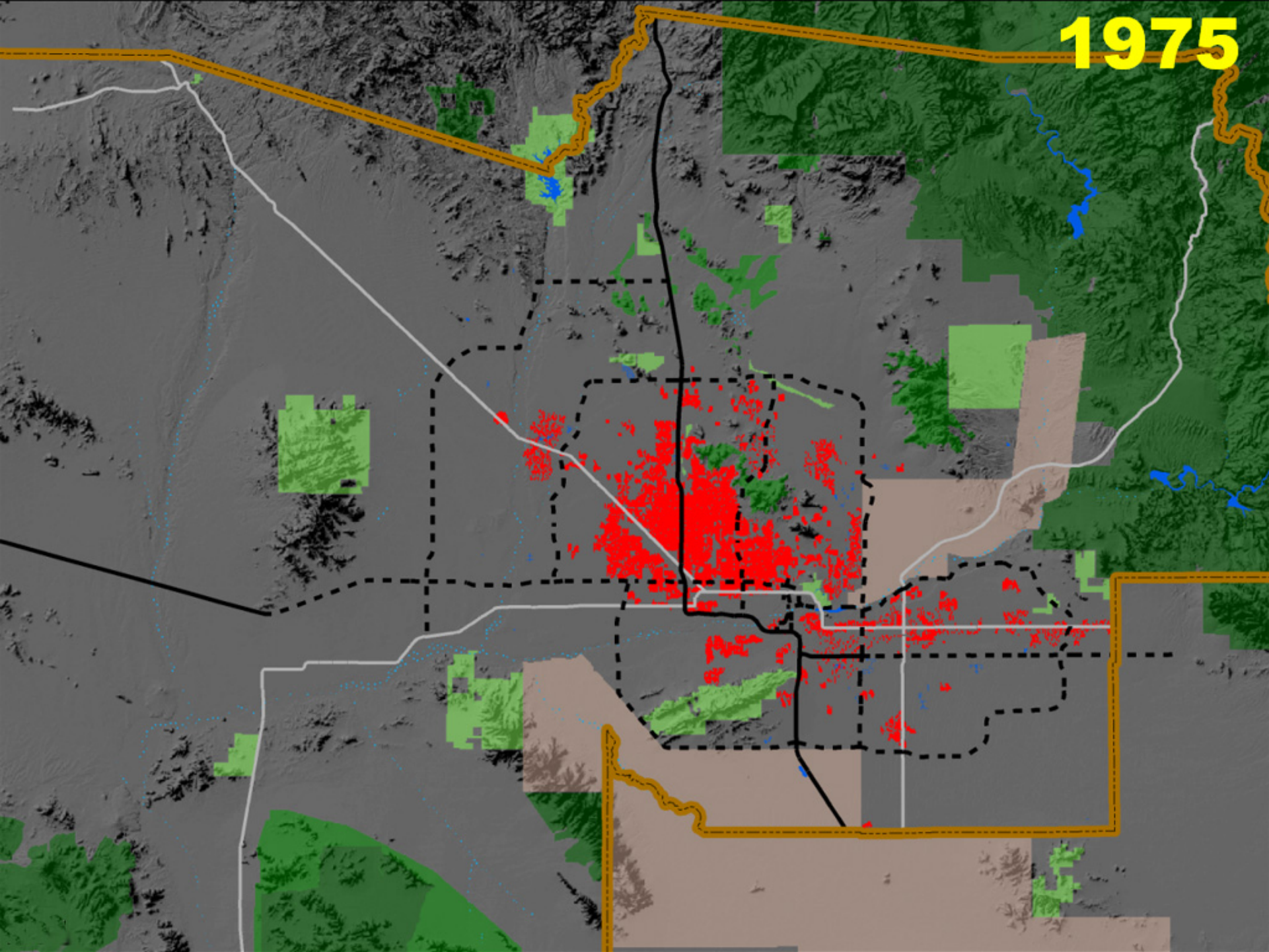


Reasons to restore the Salt River

- Federal dams constructed in the early 1900's ceased all natural flow.
- Blighted corridor of trash and debris.

Recent Rio Salado Beyond the Banks Developments

University Center $30 million
Riverview Center $10 million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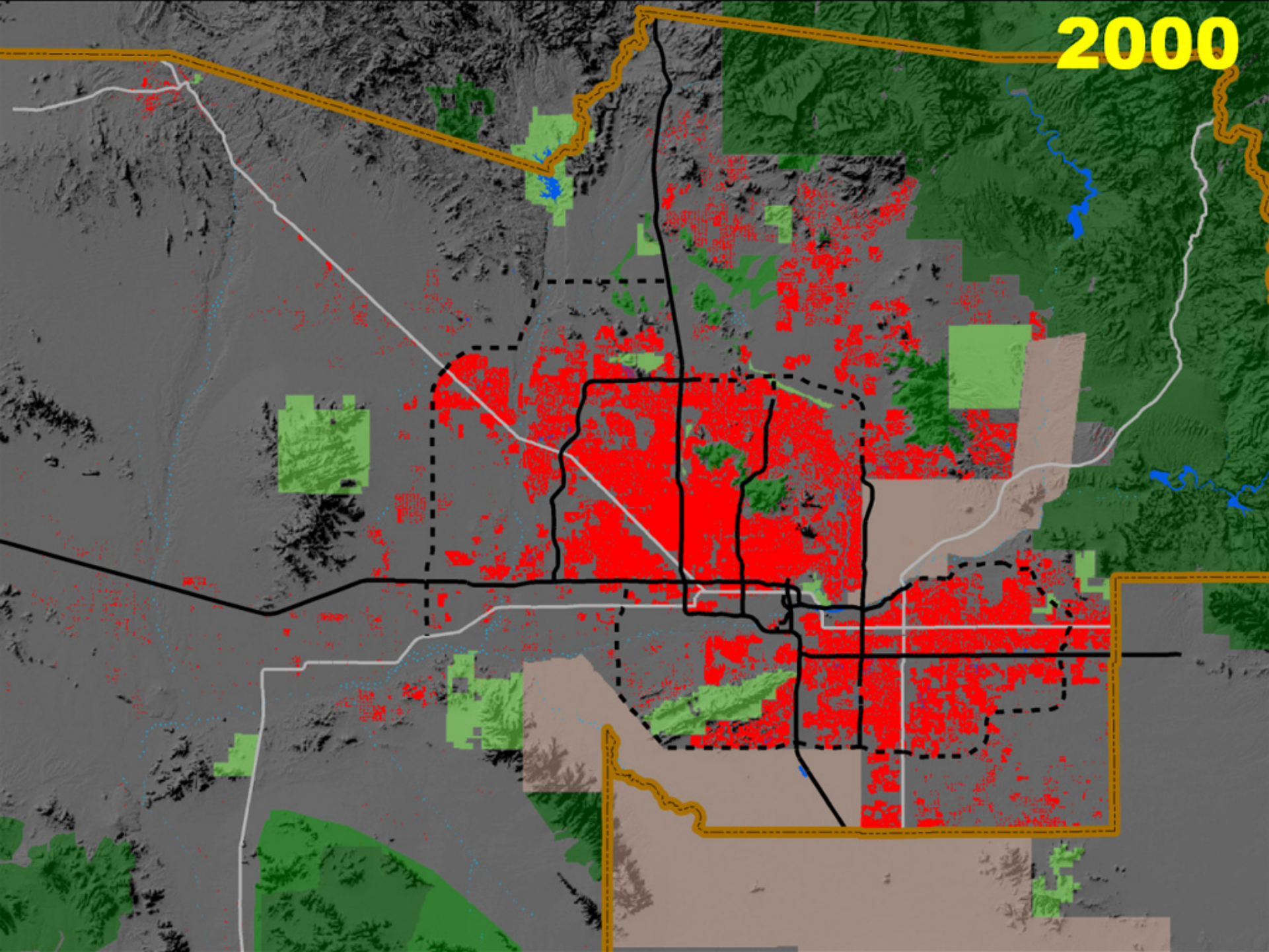
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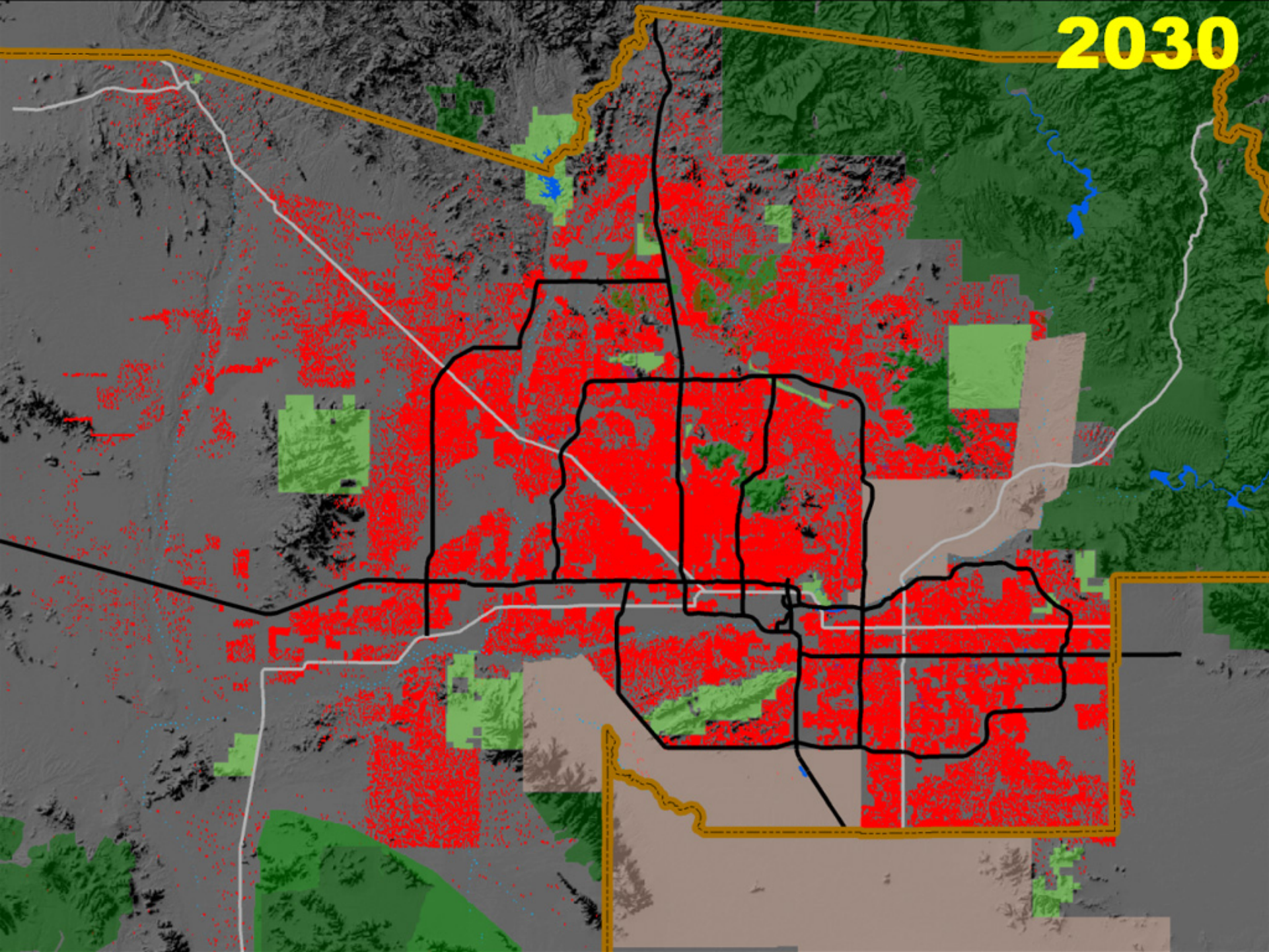
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Project Objectives & Goals

- Create a sustainable balance of flora and fauna.
- Restore the native wetland and riparian habitats.
- Provide passive recreational and educational elements.

Strong Local Support

- Flood Control District of Maricopa County
- Arizona Department of Water Resources
- Valley Forward Association
- Audubon Arizona
- Neighborhoods

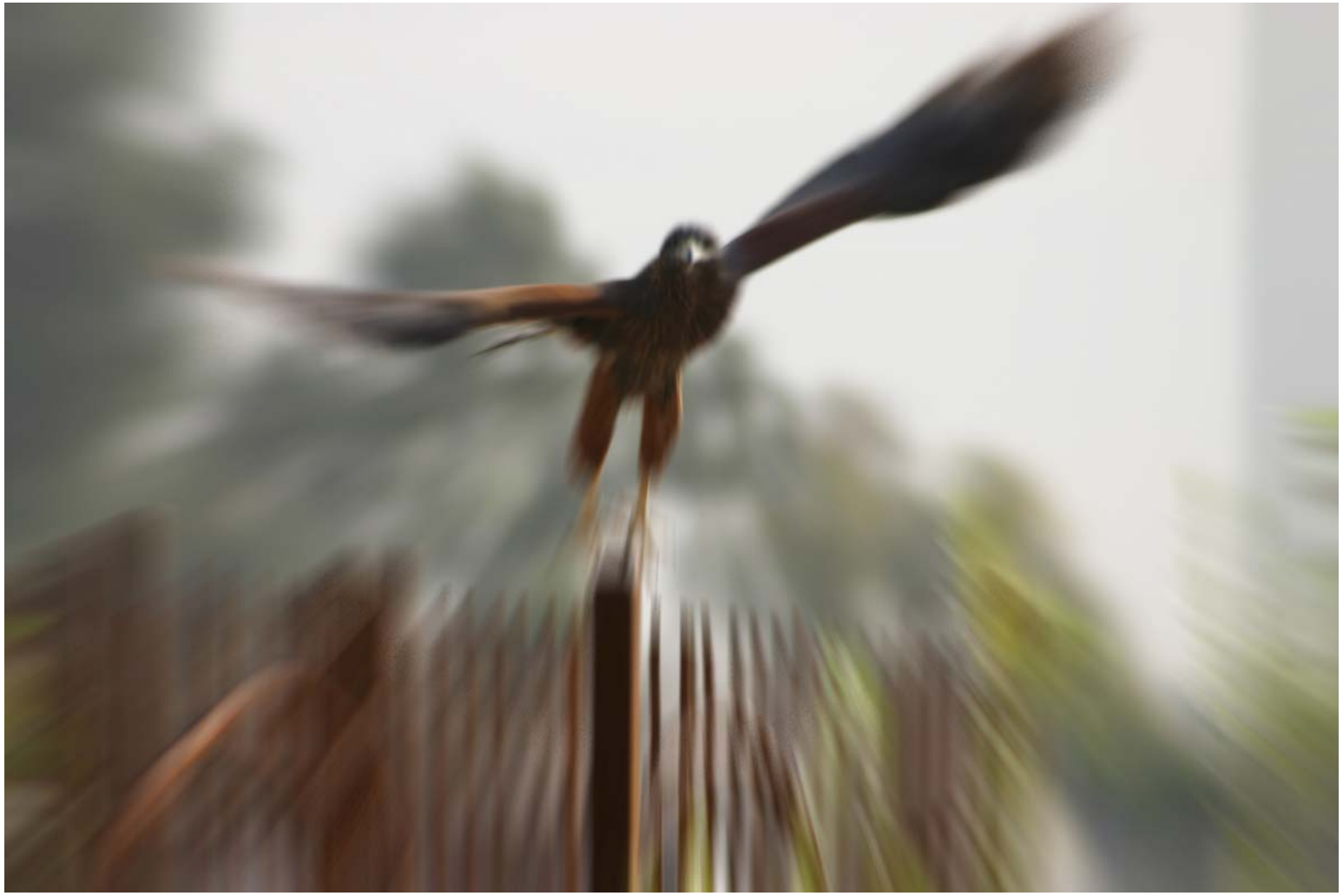
Successful 2006 Bond Election: $5 million for Rio Salado Oeste

National Significance of Restoring Desert Ecosystems

Before

After

Questions



Shipman Image Productions

Rio Salado Oeste, Salt River Maricopa County, Arizona Ecosystem Restoration Feasibility Study

Col. John R. McMahon
Commander, South Pacific Region

Civil Works Review Board

18 October 2006

Briefing Objectives

- Rationale for project support
- Quality Assurance Activities
- Other Observations
- Expected response to the draft Chief's Report
- SPD Recommendations
- Lessons Learned

Rationale for SPD Support

- Report complies with policy and law
- Recommended plan is technically sound, economically justified, and is NER plan
- Plan supported by sponsor, congressional delegation, and public
- Division Commander's transmittal 27 September 2006

Quality Assurance

- Facilitate major milestone meetings during report development and coordinate with RIT
- Review certifications: ITR; cost estimate [M-CACES]; Legal; Policy compliance
- Ensure key partners and stakeholder input considered during report development

Other Observations

- Observations of the review process
  - ITR - Policy Review - Quality Assurance
- Aquatic ecosystem restoration in arid region is a challenge
- Timely completion for WRDA authorization
- Congressional support

Expected Response to Draft Chief's Report

- Expect a favorable response to Draft Chief's Report
  - EPA
  - U.S. Fish and Wildlife Service
  - Arizona Game & Fish

Recommendations - South Pacific Division

- Concur with Findings of District Commander
- Recommend that Board approve the Final Feasibility Report and begin State and Agency review
- After favorable State and agency review, also recommend that Chief's Report be completed

Civil Works Review Board

Significant Policy Review Concerns

Rio Salado Oeste Ecosystem Restoration project

Mark Matusiak

Office of Water Project Review

Washington, DC – 18 October 2006

- Release the Report and FEIS for S & A review and filing with USEPA

Significant Policy Issues for Rio Salado Oeste Study

- Non-standard estate for project lands
- Real estate needs, land values
- Plan formulation, CE/ICA
- Screening criteria

Policy Compliance Review – Significant Issue

Issue/Concern: Non-standard estate for project lands (easement).

Reason/Basis: HQUSACE requested additional information concerning the proposed use of easements to acquire interest in project lands. Fee simple interest is generally preferred. Sponsor prefers to maintain the option of easements for lands owned by Maricopa County.

Significance: HQUSACE questioned whether easements were sufficient because it was not clear under Arizona law that easements would survive fee transfer of land.

Resolution: HQ Office of Chief Counsel discussed issue with SPD and SPL Office of Counsel, and agreement reached that proposed easement was sufficient.

Resolution Impact: The issue is resolved.

Policy Compliance Review-Significant Issue

Issue/Concern: Real estate needs, land costs.

Reason/Basis: The draft report did not clearly identify the parcels that would be acquired for the project.

Significance: HQUSACE could not determine if the minimum amount of land needed to support the ecosystem restoration purpose was being acquired. Also, real estate costs equal to 34% of total project cost exceed the 25% target in Corps guidance.

Resolution: The final report included a map of parcels to be acquired overlain with proposed restoration and recreation features. Proposed acquisitions appear to be reasonable. Report includes additional information describing escalating land values in Maricopa County.

Resolution impact: The issue is resolved.

Policy Compliance Review-Significant Issue

Issue/Concern: Plan formulation, CE/ICA.

Reason/Basis: The relationship between different scales of alternatives and associated habitat responses need to be fully evaluated. HQUSACE requested at the AFB stage that additional scales of implementation for selected measures be developed for the plan.

Significance: Not clear from the report that a reasonable range of implementation scales were examined during plan formulation. A range of implementation scales helps validate the results of the CE/ICA process by establishing high and low ranges of possible plan combinations.

Resolution: The draft report included expanded description of scales of measures considered during formulation, and final report analyzed a number of additional increments. Additional increments and existing increments were analyzed using CE/ICA.

Resolution impact: The issue is resolved.

Policy Compliance Review-Significant Issue

Issue/Concern: Screening criteria for selection of final alternatives.

Reason/Basis: The logic supporting the screening criteria used at the AFB and draft stages was not included in the report.

Significance: The report did not fully describe the scientific basis for the criteria, i.e., the importance of the ecological components that the criteria were designed to select for.

Resolution: The final report included detailed description of screening criteria, and explained why the factors selected for by the criteria are ecologically important, or take advantage of a cost-effective opportunity. Those criteria relate to the planning objectives.

Resolution impact: The issue is resolved.

Policy Compliance Review-Significant Issue

Issue/Concern: Screening criteria for selection of final alternatives, cont.

Reason/Basis: Screening criterion 4 used in draft report not a valid criterion for determining the Corps' NER plan.

Significance: Screening criterion 4, "lake restoration to maintain an open water body and provide urban fishery" is not a valid criterion for determining NER plan because it does not involve ecological functions. HQUSACE asked that the screening process be redone without Criterion 4 to confirm the selection of the NER plan.

Resolution: Screening process was repeated without Criterion 4 for the final report, and selection of recommended plan was confirmed.

Resolution impact: The issue is resolved.

Lessons Learned

Applied lessons from Rio Salado construction

Cost estimates, design, projected vegetation response

Ongoing Collaboration with stakeholders beneficial

Included stakeholders in entire study process, no issues during public review

Resolve Policy Issues Early

Plan formulation: measures and screening

South Pacific Division Lessons Learned

- Site visit by RIT and policy reviewers
- Maintain open communication
  - among the vertical team
  - between reviewers and Project Delivery Team - including the sponsor
- Sponsor's prior experience with Corps

- Scheduling the CWRB