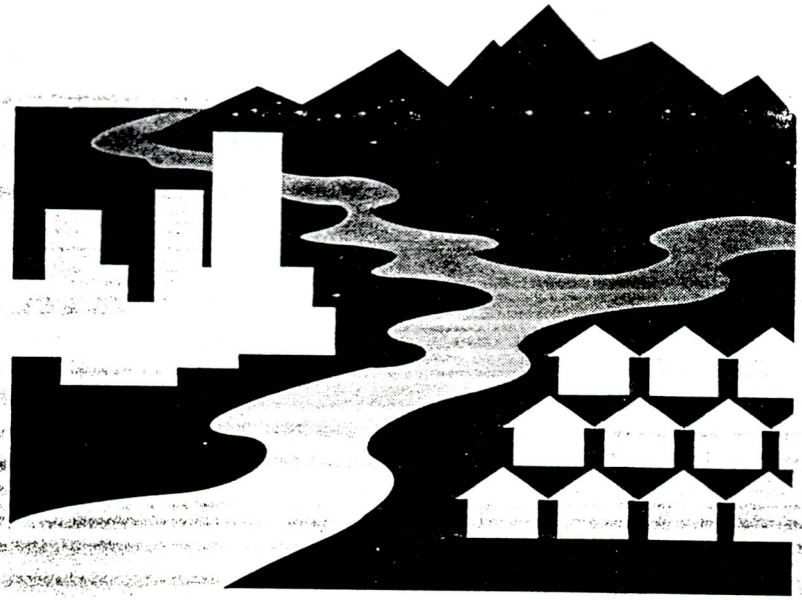
DICK PERREAULT
JUNE '90

Reconnaissance Report

Gila River & Tributaries

Salt-Gila
Arizona

OFFICE COPY
INTERIM REPORT



OFFICE COPY
INTERIM REPORT

U.S. Army Corps
of Engineers
Los Angeles District
South Pacific Division

December 1989

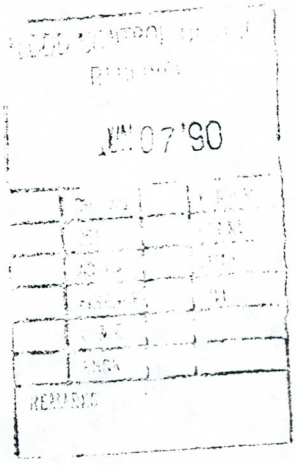
GILA RIVER AND TRIBUTARIES

SALT-GILA, ARIZONA

RECONNAISSANCE REPORT

OFFICE COPY
INTERIM REPORT

DECEMBER 1989



Gila River and Tributaries

Salt-Gila
Arizona

Syllabus

This reconnaissance study was conducted under the Gila River and Tributaries Authority contained in the Flood Control Act of 1938. Funding was provided under the Energy and Water Development Act of 1989. Local support for the study was from the Flood Control District of Maricopa County, Arizona. Reconnaissance phase funding was received in December 1988.

Increasing urbanization and channelization of the Salt and Gila Rivers, in conjunction with Central Arizona Project plans of the U.S. Bureau of Reclamation, resulted in a restudy of the flooding problem in the area.

A number of flood protection measures and alternatives were considered. Economic analysis of the most likely measure resulted in annual average costs of $2.3 million and average annual benefits of $48 thousand for a benefit cost ratio of 0.02.

This study focused on the flooding problem, and associated solutions, downstream from the confluence of the Verde and Salt Rivers to Gillespie Dam. It was determined that no analyzed solution was economically justified, therefore the study should not proceed to the feasibility phase, but be terminated at the reconnaissance phase.

GILA RIVER AND TRIBUTARIES
SALT-GILA
ARIZONA

TABLE OF CONTENTS

APPENDIX

FIGURES

TABLES

CHAPTER I

INTRODUCTION

A. STUDY AUTHORITY

This study of the Salt and Gila Rivers through the Phoenix metropolitan area is an interim study conducted under authorization of Public Law 761, Seventy-fifth Congress, known as the Flood Control Act of 1938. That Act reads in part as follows:

SEC. 6. The Secretary of War is hereby authorized and directed to cause preliminary examinations and surveys for flood control including floods aggravated by or due to tidal effect at the following-named localities, and the Secretary of Agriculture is authorized and directed to cause preliminary examinations and surveys for run-off and waterflow retardation and soil-erosion prevention on the watersheds of such localities; ...

* * * * * * * * * *

Gila River and Tributaries, Arizona and New Mexico

* * * * * * * * * *

The Salt-Gila study was funded by the Energy and Water Development Appropriation Act of 1989, Public Law 100-371.

B. STUDY PURPOSE

The purpose of the study was to conduct a reconnaissance level investigation of flood control problems and opportunities along the Salt and Gila Rivers from Granite Reef Dam to Gillespie Dam (Figure 1). The purpose of a reconnaissance study is to determine whether a project appears feasible from a Federal perspective and whether or not a feasibility level study should be conducted. The finding of a reconnaissance study is either a recommendation to proceed with a feasibility study or to terminate investigations at this time. This report discusses and presents the results of the plan formulation process and identifies specific analytical results.

C. STUDY SCOPE AND GOAL

During early scoping sessions, the Flood Control District of Maricopa County expressed concern that urbanization of the floodway fringe district, channelization of the Salt River for development, and sediment deficient water downstream of flood control structures, would cause depletion of overbank storage, incisement of the channel, and translation of the peak flows downstream. It was felt that these developments had increased the potential for serious flooding in the study area. A study area map is provided in

Figure 1.

The goal of the study was to identify and select a flood control plan that would assist in solving the water resource problems in the area. A variety of criteria, including support from local interests, social and environmental acceptability, and engineering and economic feasibility was considered during the course of the study. Alternative solutions were screened against these criteria.

D. STUDY HISTORY

The Central Arizona Project (CAP) was authorized by the Colorado River Basin Act (PL 90-537) to bring Arizona's entitlement of Colorado River water to central Arizona. In 1968, Orme Dam, or a suitable alternative, was authorized as a CAP feature to provide storage as well as flood control along the Salt River. In April 1977, President Carter recommended that Orme Dam be deleted from the CAP. The Bureau initiated flood damage investigations in 1978 with the Central Arizona Water Control Study (CAWCS). Shortly thereafter, the Corps of Engineers (Corps) signed a Memorandum of Understanding with the Bureau to provide Corps' expertise in evaluating flood control benefits of the Bureau's alternative plans to Orme Dam and to allow the Corps to evaluate the residual flood control problems in the Phoenix area with the Bureau's recommendation in place. However, because of the effectiveness of the Bureau's recommendation (Plan 6) in providing flood control, further studies by the Corps were terminated at that time.

The Secretary of the Interior in 1984 selected Plan 6, out of nine possible plans, as the alternative to Orme Dam. The essential elements of Plan 6 were as follows:

* New Waddell Dam on the Agua Fria River to provide regulatory storage for CAP;

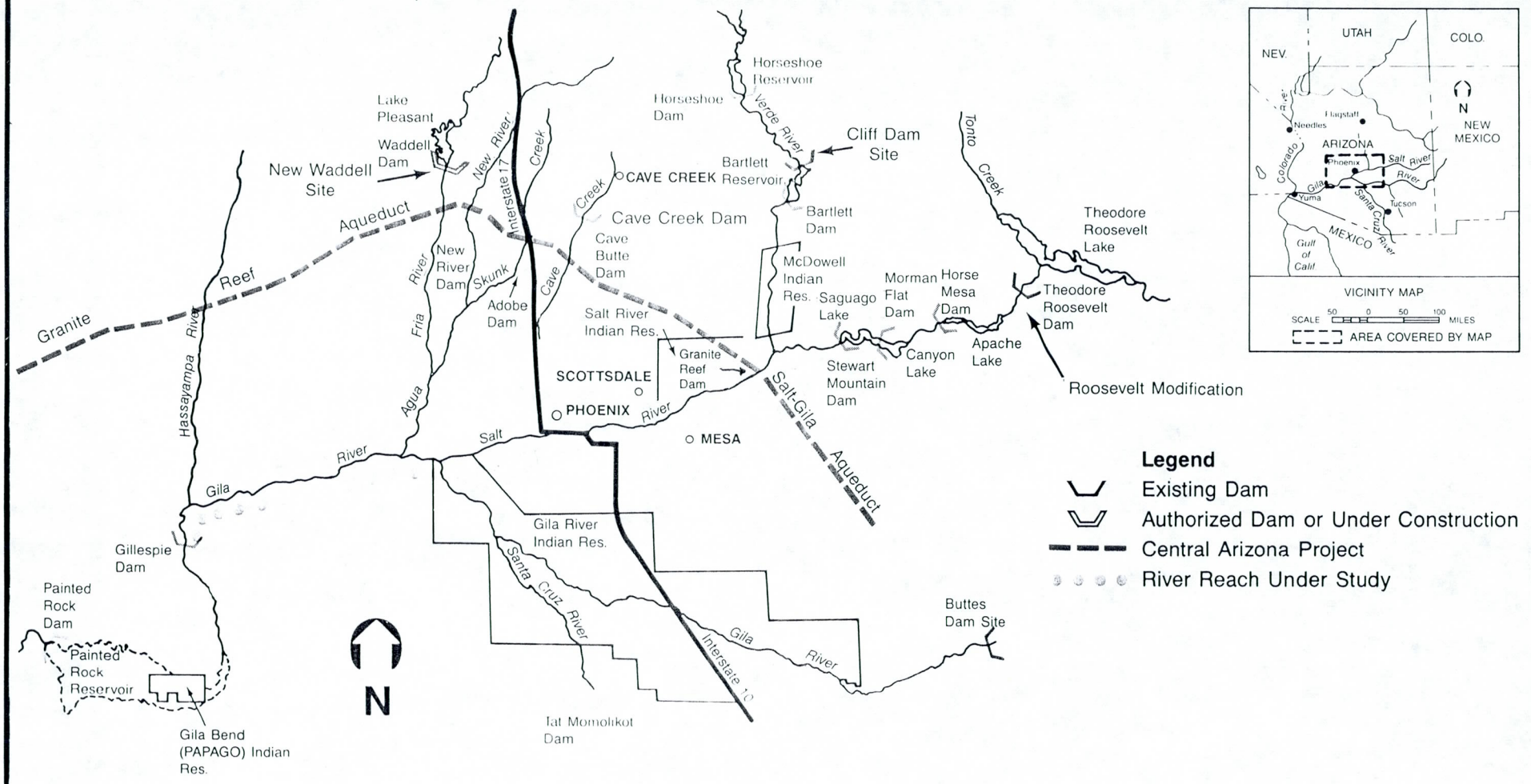
* Cliff Dam on the Verde River for water supply, flood control and to rectify dam safety problems at Horseshoe and Bartlett Dams;

* Roosevelt Dam on the Salt River would be modified for dam safety and flood control, and;

* Stewart Mountain Dam on the Salt River would be modified for dam safety purposes.

Cliff Dam, however, became the object of controversy principally because of its potential adverse environmental impacts. Increasing opposition from a coalition of environmental organizations resulted in an agreement being reached between the Arizona Congressional delegation and the environmental coalition. This agreement is in the form of a Statement of Principles which appeared in the Congressional Record, June 24, 1987.

The Statement of Principles stated that no further funds would be appropriated for the study or construction of Cliff Dam and that Plan 6 would



Color Legend

Red	Corps of Engineers
Green	USBR
Brown	All Other Agencies

GENERAL INVESTIGATIONS-SURVEYS
FLOOD DAMAGE PREVENTION STUDIES

GILA RIVER AND TRIBUTARIES
SALT AND GILA RIVERS
ARIZONA

LOS ANGELES DISTRICT
SOUTH PACIFIC DIVISION

1 JANUARY 1989

Figure 1

not include Cliff Dam or similar water conservation storage features on the Verde River as an element of the recommended plan. Plan 6, minus Cliff Dam, is known as Plan 9. The Statement of Principles stated that additional flood control measures may be needed on the Verde River to compensate for the loss of flood control features to have been provided by Cliff Dam, thus additional flood control storage at Bartlett and/or Horseshoe Dams may be required to meet the flood control deficit. The Agreement stipulated that the Corps of Engineers would be requested to undertake studies required to determine and identify appropriate flood control measures on the Verde River.

The Bureau and Corps decided in a Memorandum of Understanding dated in October 1987 that the Corps would provide specific economic and hydraulic data to the Bureau to evaluate flood control storage in Bartlett and Horseshoe Reservoirs in conjunction with the Bureau's dam safety modifications. In addition, a preliminary evaluation of downstream (below the confluence of Verde and Salt Rivers) alternatives would be done to ensure that flood control measures more effective than storage in the two reservoirs were not being precluded by the reservoir alternatives themselves. This effort resulted in the Corps' 1988 Study for Flood Control Alternatives to Cliff Dam. After the Bureau had determined the amount of flood control to be provided by the reservoirs, the Corps would then undertake reconnaissance studies of the residual flooding problems. This report, the Salt-Gila Resumption, reports on the results of that study.

Analysis for the Alternatives to Cliff Dam Study was initiated in November of 1987. The original Scope of Services between the Bureau and Corps indicated that the Corps would develop flood control benefits of the upstream alternatives (i.e. flood control storage at Horseshoe and Bartlett Dams) and preliminary benefits and costs of downstream alternatives. As the study progressed, it became apparent that upstream flood control was not justified. Therefore, the Scope of Services was revised to delete flood control analysis of downstream alternatives. Downstream, in this case, encompassed the Salt and Gila Rivers from Granite Reef Dam to Gillespie Dam. This area became the study area for the Salt-Gila Resumption Study. This Corps' study was funded to evaluate the residual flooding problem with Plan 9 in place and determine the feasibility of Federal interest in a flood control plan.

E. STUDY PARTICIPANTS

A Study Management Committee was established. Representatives included the Corps of Engineers, Arizona Department of Transportation, the Flood Control District of Maricopa County, Maricopa County Planning, Maricopa Association of Governments, the cities of Mesa, Tempe, and Phoenix, and the Arizona Rock Products Association. The Study Management Committee provided study direction, and served as a technical review committee.

F. PUBLIC INVOLVEMENT

Public involvement during this study focused on technical input and coordination with numerous public agencies, organizations, and municipalities in the study area. Five formal meetings were held with the Study Management Team during the one year study effort. In addition, Corps Technical specialists, including hydrologists, hydraulics engineers, economists, and environmentalists, coordinated with various public and private agencies and individuals.

G. EXISTING WATER RESOURCE PROJECTS

Major Corps of Engineers and Bureau of Reclamation projects in the general Salt-Gila area are identified in Figure 1. Additional Corps projects in the metropolitan Phoenix area include the Arizona Canal Diversion Channel and Indian Bend Wash (Scottsdale). No Corps project has been constructed on the Salt or Gila Rivers in the study area.

CHAPTER II

DESCRIPTION OF THE STUDY AREA

A. LOCATION AND BOUNDARIES

The Salt-Gila River study area is located in Maricopa County in south-central Arizona and extends 80 miles from Granite Reef Dam on the Salt River to Gillespie Dam on the Gila River. The study area encompasses portions of the Salt and Gila River Indian Communities and portions of the cities of Mesa, Tempe, Phoenix, Avondale, Goodyear, and Buckeye. A map of the greater Phoenix area is included as Figure 2.

B. DEMOGRAPHICS

Phoenix is one of the ten largest U.S. cities and has a population estimated in 1989 at nearly 1 million. Maricopa County, including Phoenix, has a population of about 2 million. The area continues to experience extremely rapid growth. Phoenix is the state capitol, and is the commercial center for much of the southwestern United States. The portion of the study area from 51st Avenue east to the Salt River Indian Reservation, is highly developed and consists of residential and commercial development. The section of the study area west of 51st Avenue, is less urbanized, and consists primarily of large tracts of State and Federal land, and some private land, primarily in agriculture and sparsely developed residential areas.

C. LAND USE

Primary land uses in and along the river is presented in summary form in Table 1.

TABLE 1

SALT-GILA
ARIZONA
LAND USE BY REACH

REACH	LAND USE
Granite Reef Dam to Price Road	(Salt River Indian Community)[1]
Price Road to I-10	Channelized River
I-10 to 35th Ave.	Encroached and Backfilled
35th Ave. to 99th Ave.	Active Sand and Gravel Mining
99th Ave. to SR85	Active Sand and Gravel Mining (FCD low flow channel)[2]
SR85 to Gillespie Dam	Natural Condition (minimum man-made involvement)

[1] Some active sand and gravel mining.
[2] FCD - Flood Control District of Maricopa County

D. TOPOGRAPHY AND GEOLOGY

The Phoenix metropolitan area is in central Arizona. It is generally within the Basin and Range physiographic province and typified by geologic block faulting and tilting. Despite the prevalence of faults throughout the area, the earthquake danger in the study area is not considered severe. Elevations range from approximately 900 feet above sea level where the Agua Fria River joins the Gila River to over 3800 feet in the McDowell Mountains northeast of Phoenix. The dominant mountain ranges within the study area are the South Mountains, the Phoenix Mountains, and the McDowell Mountains. Camelback Mountain, elevation 2704 feet above sea level, is the most prominent Valley landmark. Principal natural drainages in the study area are the Salt and Agua Fria Rivers which are tributary to the Gila River.

E. WATER RESOURCES

The climate of the study area is arid with an annual precipitation of about 8 inches. Most precipitation occurs in two distinct seasons, summer (June through September) and winter (December through March), and is about equally divided between them. Monthly, seasonal, and annual precipitation amounts vary coincidentally from year to year. During any season there may be many successive rainless days.

F. SURFACE WATER

The Salt River has a dry riverbed for most of its course from Granite Reef Dam to the confluence with the Gila River. The Salt and Gila River downstream, from 23rd Avenue to Gillespie Dam, has a small (under 200 cfs) flow due to effluent from sewage treatment facilities.

G. GROUNDWATER

The groundwater level in the metropolitan Phoenix area has generally declined over the past 50 years. The reaches of the study area west of 23rd Avenue are experiencing an increase in the level of groundwater. In some localized areas, such as downstream of 71st Avenue, groundwater is near the surface.

H. CHANGES IN THE OVERFLOW AREA

When compared to previous studies, the 1984 Flood Insurance Study indicated that overflows through the metropolitan Phoenix area have narrowed over the past few decades. Channel scouring from major floods in 1979 and 1980 have provided a deeper, cleaner, and more efficient channel. Construction and infill around larger bridges, and construction of local channels and levees has further contributed to the reduction of the overflow areas. In addition, vegetation resulting from effluent flow has caused floodplain widths to increase in some areas west of 23rd Avenue.

I. BIOLOGICAL RESOURCES

Vegetation found in the study area falls into two different types of communities: riparian ecosystems and the ecosystems of the Sonoran Desert area through which the Salt and Gila Rivers flow. The Environmental Appendix includes a description of both ecosystems.

J. CULTURAL RESOURCES

A preliminary literature review of the study area for archaeological and cultural resources was completed in 1988. The survey noted there is a long, virtually uninterrupted continuum of cultural activity as far back as 300 B.C. This temporal marker is assigned to the earliest phase of the Hohokam Indian period of cultural development. The Salt-Gila River basins served as the core of the Hohokam cultural area until about 1400 A.D.

Three prominent historic resources have been noted, the Granite Reef Diversion Dam constructed in 1906-1908, the Swilling Ditch Head built in 1867-1868, and the Ash Avenue Bridge across the Salt River constructed with convict labor in 1911. The Environmental Appendix includes a more detailed discussion of archaeological and cultural resources.

CHAPTER III

PROBLEM IDENTIFICATION

A. FLOODING

1. CURRENT LAND USE CONDITIONS

A hydrologic evaluation with current (1988) land use conditions indicated that, with Plan 9 in place, the 100-year overflow of the Salt River through the Phoenix metropolitan area is mostly confined to existing channels. The 100-year flood leaves the channel in a number of places west of 51st Avenue where there is some commercial and agriculture development and scattered residential areas. Discharges are displayed in Table 2.

Table 2

SALT-GILA
ARIZONA
CURRENT LAND USE CONDITION DISCHARGES[1]

Concentration Point (CP)	Location	100-Year Discharges (CFS)[2]
CP 40	Granite Reef	175,000
CP 109	Gilbert Road	170,000
CP 110	Tempe Bridge	166,000
CP 111	Central Avenue	164,000
CP 112	67th Avenue	163,000
CP 113	Above Gila River Confluence	161,000
CP 1310	Below Gila River Confluence	214,000
CP 1216	Below Confluence with Waterman Wash	211,000
CP 1217	Below Confluence with Hassayampa River	207,000
CP 1218	Gillespie Dam	203,000

[1] Conditions as of 1988, as developed by Study Management Committee.
[2] Information obtained by using HEC-1 channel routing 1-hour time increments, and Plan 9 outflow from Bureau of Reclamation reservoirs.

2. FUTURE LAND USE CONDITIONS

The future without project condition established the baseline from which the feasibility of Federal flood control solutions were measured. Under Plan 9, flood control storage of 565,000 acre feet will be provided on the Salt River at modified Roosevelt Dam. The future without project condition for

this analysis assumes Plan 9 will be constructed by the Bureau of Reclamation. Table 3 display future 100-year discharge.

Table 3

SALT-GILA
ARIZONA
FUTURE LAND USE CONDITIONS'

Concentration Point (CP)	Location	100-Year Discharges (CFS)
CP 40	Granite Reef	175,000
CP 109	Gilbert Road	170,000
CP 110	Tempe Bridge	166,000
CP 111	Central Avenue	165,000
CP 112	67th Avenue	164,000
CP 113	Above Gila River Confluence	163,000
CP 1310	Below Gila River Confluence	215,000
CP 1216	Below Confluence with Waterman Wash	214,000
CP 1217	Below Confluence with Hassayampa River	211,000
CP 1218	Gillespie Dam	206,000

' Assumptions made for the future development scenario:
- Granite Reef Dam to Price Road: Bottom width of 1000 feet, gravel mining.
- Price Road to the I-10 bridge: Channel bottom width of 886 feet.
- I-10 bridge to 35th Avenue: Channel bottom width of 800 feet.
- 35th Avenue to 99th Avenue: Channel bottom width of 1800 feet.
- 99th Avenue to State Road 85: Channel bottom width of 700 feet, 40 foot depth, gravel mining.
- State Road 85 to Gillespie Dam: Channel remains in the present conditions.

As can be seen from Tables 1 and 2 there is little difference in discharges between the current and future land use scenarios.

B. WATER QUALITY

No water quality issues were analyzed in detail in this reconnaissance phase study. Water quality concerns would be addressed in any subsequent feasibility phase investigation.

C. RECREATION AND AESTHETICS

The Salt-Gila study area is used by offroad vehicles, horseback riders, hikers, and for other informal recreational uses. No recreation or aesthetics issues were analyzed in this reconnaissance study. There is potential for recreation and aesthetic development in the area.

D. ENVIRONMENTAL

The natural environment along the Salt and Gila Rivers in the study area has been altered in recent years due to several factors, but primarily related to human encroachment on and into the flood plain. Vegetative alteration of the area, west of 91st Avenue, has occurred with clearing of the phreatophytes (primarily Salt Cedar) and construction of a pilot flood control channel. The area east of 91st Avenue has been altered by encroachment of the increasingly urbanized Phoenix metropolitan area. Developments have been constructed along the upstream reaches, flood control features have been installed, bridges constructed, and sand and gravel mining is occurring in the channel. All of these factors have altered the natural ecosystem of the Salt-Gila River system. This development continues to be a dynamic and ongoing process.

CHAPTER IV

PLAN FORMULATION

A. INTRODUCTION

The dynamic land use changes, and associated institutional and political setting of the area, required plan formulation in close cooperation with a number of local entities which had specific responsibilities and interests which impacted plan formulation. These responsibilities and interests had to be addressed in addition to economic, engineering and environmental criteria.

B. STUDY PROCESS

The planning process consisted of six steps to identify or respond to problems and opportunities associated with the Federal objective and specific local concerns. The process involved an orderly and systematic approach to making determinations and decisions at each step. The following identifies those steps:

Step 1: Specification of the Problems and Opportunities Associated with the Federal Objective and Specific State and Local Concerns.

Step 2: Inventory and Forecast Water and Related Land Resource Conditions.

Step 3: Formulation of Alternative Plans.

Step 4: Evaluation of Effects.

Step 5: Comparison of Alternative Plans

Step 6: Plan Selection

C. PLANNING CONSTRAINTS

Plans were formulated within existing laws, policies, regulations, and the authorizing resolution. Other constraints include limits presented by area topography, protection of environmental and cultural resources, and need to minimize relocation in the developed residential area.

D. PLANNING OBJECTIVES

1. The Federal Objective

The Federal objective of water and related land resources planning is to contribute to the national economic development consistent with protecting the nation's environment, pursuant to national environmental statues, applicable Executive Orders, and other Federal planning requirements. Corps of Engineers planning objectives are:

a. National Economic Development (NED)

Contributions of national economic development (NED) are increases in the net value of the national output of goods and services. A plan must be economically justifiable, that is, benefits must exceed costs. The plan that reasonably maximizes net benefits (the NED plan) is then selected unless there is overwhelming justification for another plan. The NED plan is also the most economically efficient plan. For this study, therefore, the NED objective was to develop plans that would:

i. provide the maximum reduction in potential flood losses in the Salt-Gila Study area

ii. maximize associated NED benefits realized at the national scale.

b. Compliance with environmental statutes

In addition to meeting the criterion of economic efficiency, any Federal project must comply with the National Environmental Policies Act of 1969 (NEPA).

c. Compliance with Applicable Executive orders

In addition to executive orders which relate directly to environmental quality, Executive Order 11593 instructs Federal agencies to institute procedures to assure that Federal plans contribute to the preservation and enhancement of non-Federally owned sites, structures and objects of historic, architectural, and archaeological significance. The National Historic Preservation Act of 1966, as amended, embodies many of the provisions of the Executive Order. Thus, consideration of historic preservation was a planning objective.

d. Compliance with other Federal Planning Requirements

In addition to the NED objective, alternative plans must be evaluated for effectiveness, completeness, and acceptability. A project must effectively perform its design task. A recommended plan must also contain all elements which are necessary for it to function effectively. A recommended plan must also be acceptable to the community, the local sponsor, and other Federal and State agencies.

E. PLAN EVALUATION CRITERIA

Criteria used in the plan formulation process adhered to current Corps guidelines as follows:

1. Technical Criteria

Discharge-Frequency relationships for urbanized areas were adopted from earlier Corps hydrological studies in the Salt-Gila area. Hydraulic designs

When

were based on approved design practice and on theoretical analyses using applicable criteria set forth in Corps of Engineers' Engineering Manuals.

2. Economic Criteria

An amortization period of 100 years was used. An interest rate of 8-7/8 percent was used. Costs incurred during construction were increased by adding compound interest computed at the project discount rate. Methodology was in accordance with the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies as developed by the U.S. Water Resources Council and published in March 1983.

3. Environmental Criteria

Potential impacts on fish and wildlife resources and/or habitat were to be quantified to the extent possible. Impacts which could not be quantified were to be identified. Mitigation plans were to be developed if necessary.

4. Social Criteria

Adverse impacts identified in Section 122 of Public Law 91-611 were to be assessed and considered in development of measures and alternative plans.

F. DEVELOPMENT OF ALTERNATIVES

The flood control investigation centered on those reaches along the Salt and Gila Rivers where the 100-year flood event could break out of the channel and cause damage. Overflow analysis and site visits determined that anticipated damages east of 51st Avenue were not sufficient to warrant further analysis at this time. The study therefore focused on that area west of 51st Avenue to 123rd Avenue, a distance of 9 miles.

G. ALTERNATIVE EVALUATION

The study focused primarily on commercial and residential structures on both sides of the Salt River located within the 100-year overflow area from 51st Avenue to 123rd Avenue were surveyed, with the exception of structures on the Gila River Indian Reservation. A qualitative evaluation of potential agriculture damages was conducted. It was determined that there would not be sufficient agricultural benefits to warrant further analysis at the reconnaissance level.

Many of the structures surveyed were elevated 4 or more feet. Structures north of the river from 115th to 123rd Avenues are protected to 115,000 cfs (with 3 ft. of freeboard) by the Holly Acres levee.

In order to determine potential flood damages it was assumed, all structures (including those elevated and those protected by the Holly Acres levee) and their contents within the 100-year overflow area were considered to be completely destroyed in the event of a 100-year flood. Sand and gravel

operations in the river channel, however, were not considered since these operations are assumed to be equally affected with or without a project. In order to provide an estimate of the project feasibility at a 100-year level of protection, all damages were assumed to be prevented.

The alternative selected for reconnaissance analysis included levees providing 100-year flood protection at both sides of the river for a distance of about 9 miles for a total of 18 miles of levees. Grade control structures at 4 bridges were also included. First cost plus interest during construction totaled $25.6 million. Equivalent annual construction cost was $2.3 million, annual benefits were $47.6 thousand, for a benefit to cost ratio of 0.02.

CHAPTER V

CONCLUSIONS

As District Engineer, Los Angeles District, U.S. Army Corps of Engineers, I have reviewed and evaluated, in light of overall public interest, the data, information, and alternatives for water resource development pertaining to the Salt-Gila, Arizona. Principal elements considered in my review included engineering feasibility, environmental impacts and effects, economic factors of regional and national economic development, and social well-being. Data and information reviewed include investigations and studies prepared by my staff, documents and information furnished by local interests, and the stated views of these interests and agencies relative to the various possible alternatives for achieving the stated objectives of providing flood control features. The Salt-Gila Reconnaissance Report constitutes compliance with the overall Gila River and Tributaries authority.

Alternatives for solving flood problems within the study area were evaluated at the reconnaissance level. The study effort in this report was coordinated with interested agencies at the Federal, state and local levels.

I find that the results of the Salt-Gila Study, as developed in this report, are based upon a thorough analysis and evaluation of various practical alternatives for achieving the stated objectives. I find that there currently appears to be no potential to proceed with a feasibility study for the following reasons:

1. The cost of flood control facilities appears to be substantially greater than the flood control benefits which would result from such facilities.

2. Flooding depths expected in the study area do not produce sufficient damages to economically justify construction.

While there are local flood control problems in the Salt-Gila area, no solution was found to justify further Federal study at this time. The Los Angeles District will continue to cooperate with local authorities to identify sites which may qualify under the Continuing Authority Program.

CHAPTER VI

RECOMMENDATION

I recommend that the Salt-Gila, Arizona, study be terminated at the reconnaissance phase.

Charles S. Thomas
Colonel, Corps of Engineers
District Engineer

GILA RIVER AND TRIBUTARIES

SALT-GILA

ARIZONA

APPENDICIES

APPENDIX A

ENVIRONMENTAL

SUMMARY ENVIRONMENTAL EVALUATION
SALT-GILA, ARIZONA

A. EXISTING ENVIRONMENT

The Salt River has a dry riverbed for most of its course below Granite Reef Dam to its confluence with the Gila River. Since Granite Reef Dam is a diversion structure for water supply, there is a limited amount of water occasionally available immediately below the structure. As a result, a riparian community has emerged just below the dam and runs for approximately one to one and a half miles below the structure. The remainder of the Salt River has only a highly disturbed scattered vegetative cover all the way down to 23rd Avenue, where the effluent from a sewage treatment plant enters the river. The natural ecosystem has been further altered by numerous ongoing sand and gravel operations in the riverbed.

The riverine system becomes riparian again from 23rd Avenue downstream to Gillespie Dam due to inflows from sewage treatment facilities. The 23rd and 91st Avenue Wastewater Treatment Plants provide secondary sewage treatment for a large portion of Phoenix. The cities of Buckeye, Tolleson and Avondale, and the community of Estrella also have sewage treatment plants on line, proposed or under construction. These additional plants will increase the amount of available flow in the Salt-Gila river system.

Below the confluence of the Salt & Gila River, the riparian habitat increases dramatically; therefore, a great contrast may be observed between the upper and lower river systems with regard to habitat values. The area immediately upstream from Gillespie Dam is especially heavy with riparian growth.

In 1967, the Bureau of Land Management created the Gila River Greenbelt, now known as the Fred J. Weiler Greenbelt. These public lands currently total 62,735 acres, from 91st Avenue to Gillespie Dam. These lands are presently managed by the Arizona Game and Fish Department (AGFD). Established wildlife refuges in the area include the Arlington State Wildlife Area, the Powers Butte State Wildlife Area, the Robbins Butte State Wildlife Area and the Base and Meridian State Wildlife Area. Additional lands have been acquired by AGFD and have augmented existing preserves. Mitigation lands for various projects have also been purchased in this area for by the U.S. Bureau of Reclamation and the Flood Control District of Maricopa County.

Listed below is a brief inventory of biological and cultural resources in the project study area. These are significant existing resources. Other items, such as hydrology, land use, air quality, etc., are not described in detail due to the nature and scope of this report.

1. Biological Resources

The types of vegetation that may be found in the immediate or adjacent areas to the Salt-Gila system fall into two different types of communities:

the riverain riparian ecosystems and the ecosystems of the areas through which the Salt-Gila Rivers flow. Non-riparian vegetation ecosystems are:

1) Sonoran Desertscrub, Arizona Upland Subdivision, Palo Verde-Mixed Cactus Series

2) Sonoran Desertscrub, Lower Colorado Subdivision, Creosotebush-Bursage Series

3) Sonoran Desertscrub, Lower Colorado Subdivision, Creosotebush-Bursage Series, Mesquite Allscale Association

Riparian ecosystems are:

1) Sonoran Riparian and Oasis Forests, Cottonwood-Willow Series
2) Sonoran Riparian and Oasis forests, Mesquite Series
3) Sonoran Deciduous Swamp and Riparian Scrub, Salt Cedar Disclimax Series

Examples of the riparian species are cottonwoods (Populus fremontii), black willows (Salix gooddingii), and mesquite (Prosopis juliflora) - now largely replaced by salt cedar (Tamarix pentandra). Examples of vegetation that may be found in the surrounding communities are palo verde (Cercidium microphyllum), triangleleaf bursage (Ambrosia deltoidea), white bursage (Ambrosia dumosa), brittlebush (Encelia farinosa), creosotebush (Larrea divaricata), range ratany (Krameria parviflora), allscale (Atriplex polycarpa) and wolfberry (Lycium spp.).

Types of wildlife that would be most affected by any development related to the river would, of course, be the riparian-based waterfowl. The report "Final Environmental Literature Review for Flood Control Alternatives to Cliff Dam, Maricopa County, Arizona" completed for the U.S. Army Corps of Engineers in 1988 noted that more than half of the waterfowl nestings in Maricopa County occur in the Gila River section of the study area. Waterfowl species include, but are not limited to, mallard (Anas platyrhynchos), ruddy duck (Oxyura jamaicensis), sora (Porzana carolina), pied-billed grebe (Podilimbus podiceps), black-bellied whistling duck (Dendrocygna autumnalis), common moorhen (Gallinulla chloropus), cinnamon teal (Anas cyanoptera), least bittern (Ixobrychus exilis), green-backed heron (Butorides striatus), Virginia rail (Rallus limicola), American coot (Fulica americana), American avocet (Recurvirostra americana), and black-necked stilt (Himantopus mexicanus). The report also noted that the study area is the most important nesting area in Arizona for the white-winged dove (Zenaida asiatica). It is also the most important nesting area in the state for the mourning dove (Zenaida macroura) (USFWS).

Threatened and endangered species in the study area include the Yuma clapper rail (Rallus longirostris yumanensis), the southern bald eagle (Haliaeetus leucocephalus leucoccephalus), American peregrine falcon (Falco peregrinus), fulvous whistling duck (Dendrocygna bicolor), long-billed curlew (Numenius americanus), western yellow-billed cockoo (Coccyzus americanus occidentalis), black-crowned night heron (Nycticorax nycticorax hoactle), black-bellied whistling duck (Dendrocygna autumnalis) and razorback sucker (Xyrauchen texanus).

2. Archeological/Cultural Resources

A preliminary literature review of the study area for archeology/cultural resources was completed in 1988. An earlier survey of the historic resources in the Phoenix metropolitan area was submitted by the State Historic Preservation Office, Natural & Cultural Resource Section of the Arizona State Parks Board in Phoenix, Arizona early in 1977. The 1988 survey noted there is a long, virtually uninterrupted continuum of cultural activity possibly as far back as B.C. 300. This temporal marker is assigned to the earliest phase of the Hohokam Indians Pioneer period of cultural development. The authors explained that the cultural occupation probably extends further back into the Archaic period except very little is known of this period in the Phoenix basin. They contend that there should be Archaic sites next to a permanent water source. There has also been an earlier lack of concern with small Hohokam sites, interest favoring the larger, grander sites-therefore surface surveys may have been incomplete.

The Salt-Gila basins served as the core of the Hohokam cultural area until about A.D. 1400. The literature review put site distribution at about one site per linear mile in the immediate vicinity of the Salt River. Many sections of the area, especially in the Gila River portion, have not been surveyed at all. These figures were compiled from a series of reports culled from Maricopa County records and a survey done in 1963-64 of the Salt River from Granite Reef Dam west to the confluence of the Salt and Gila Rivers.

Three prominent historic resources have been noted. The Granite Reef Diversion Dam constructed in 1906-08; the Swilling Ditch Head built in 1867-68; and the Ash Avenue Bridge across the Salt River constructed in 1911 with convict labor.

In addition to the Prehistoric and Historic resources along the river system there are contemporary Native American enclaves as well. The southern boundary of the Salt River Indian Reservation runs along approximately 15 miles of the Salt River with the boundary located well within the river bed. The Gila River Indian Reservation has its northern boundary on the Salt River for about four miles upstream of the confluence of the Salt and Gila Rivers.

At the time of the 1988 literature review none of the prehistoric or historic resources had been nominated to the National Register although numerous ones were considered potentially eligible. The 1988 survey cautioned that the intense amount of development in the Phoenix Basin has resulted in an regular appending of cultural resource information.

B. ENVIRONMENTAL EFFECTS

1. Archeological/Cultural Resources

Since there are sections of the study area that have not been surveyed at all, or poorly at best, archeological impacts cannot be fully assessed.

2. Biological Resources

The project study area has habitat that has been affected by numerous developments in the recent past. The Flood Control District of Maricopa County has cleared a one thousand foot wide swath of riparian

vegetation (phreatophytes, consisting mainly of salt cedars) from 91st Avenue all the way down to Gillespie Dam. In addition, it has begun construction on a pilot channel, a form of low flow channel that cuts through the center of the clearing and cuts through all of the Salt-Gila's natural meanders of flow. Both actions are designed to improve the flood flow. These activities have had an impact on the various species, especially fowl, that utilize the riparian forest for nesting and habitat.

In some areas, the natural habitat has been supplemented by human activity. This is especially the case in connection with the vast increase in riparian habitat due to increasing amounts of effluent from the wastewater treatment plants. Additional protection may be afforded these riparian habitat areas through Arizona State Executive Order No. 89-16. "Streams and Riparian Resources".

C. COORDINATION

The following agencies were contacted during the development of this environmental evaluation:

a. U.S. Fish and Wildlife Service

b. Arizona Game and Fish Department

c. Maricopa County Parks and Recreation Department

d. Flood Control District of Maricopa County

D. FUTURE PROJECT ACTION

Any future action, especially a feasibility-level report, would require an updated, thorough cultural literature and record search. If no records exist for a given section of the affected area a complete cultural resources survey will be necessary for all possible project alternative. If any sites fall within the affected area, and are unavoidable by project redesign, an evaluation would be required to determine their eligibility for the National Register of Historic Places. Test excavations are the usual manner with which these determinations are made.

If any sites are deemed eligible for Historic Register status, a mitigation plan would be required to be developed and implemented prior to any construction. The mitigation plan would be developed by the Army Corps of Engineers in conference with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP), possibly requiring a memorandum of agreement.

The existing habitat has been degraded by human action in several ways. The most readily apparent factor is the alteration of the lower Salt-Gila by the clearing of phreatophytic vegetation and the construction of the pilot channel. The area upstream of 51st Avenue has been severely altered over the years by the urbanization process of the Phoenix metropolitan region. Intensive developments have been constructed, flood control features have been installed, extensive sand and gravel mining is occurring in the channel bed and several upstream dams have been built on the Salt River above the Phoenix

urban area. All of these factors have altered the natural ecosystems of the Salt-Gila river systems. This development continues to be a dynamic and ongoing proces - developments in the area are continually being proposed.

Although a large portion of the Salt-Gila system has been severely degraded, the lower portion of the system continues to serve as ecological habitat of regional importance.

The area is also likely to be a very important prehistoric/cultural resource. The area is also a possible candidate for future recreation-related development, especially as the region becomes increasingly urbanized. Continued impacts to the lower river system could have a profound effect upon the existing natural environment.

APPENDIX B

ECONOMICS

SUMMARY ECONOMICS EVALUATION
SALT-GILA, AZ

1. Detailed economic analysis began at approximately 51st Avenue (between Broadway and Dobbins Road in Phoenix, Arizona), and continued west to 123rd Avenue, a distance of approximately 9 miles. This area was selected based upon hydrologic and hydraulic analysis and subsequent field evaluation to determine where the 100-year overflow could cause damages. A qualitative evaluation determined there would be minimal agricultural benefits to warrant further analysis at the reconnaissance level. Structures on both sides of the river located within the 100-year overflow area were included in the structure survey of the area.

2. Many structures surveyed have already been elevated, some to over 4 feet. Structures north of the river from 115th to 123rd Avenues are also protected by the Holly Acres levee, which is not reflected in the current delineation of the 100-year overflow area.

3. In order to determine potential flood damages under existing conditions, all structures (including those elevated and those protected by the Holly Acres levee) and their contents within the 100-year overflow are considered to be completely destroyed in the event of a 100-year flood. In order to provide an estimate of the project feasibility at a 100-year level of protection, all damages are assumed to be prevented.

4. Primary identification of structures was accomplished through a reconnaissance field survey of the floodplain performed on 17 March 1989. This survey identified thirty structures and provided data on structure type, building material, condition and first flood elevation.

Forty nonsurveyed structures were located and recorded by mapping 100-year floodplain limits upon a street map. Registered corresponding property addresses were then identified via a commercial property data base.

Structure and contents values for improvements within the 100-year floodplain were calculated by the following equations:

Depreciated Building Value (DBV) = Square footage *
Square foot construction & type cost multiplier *
Local multiplier * Depreciation factor

Content Value (CV) = DBV * .5
Total Value = DBV + CV

5. The study used a discount rate of 8 and 7/8 percent, an amortization period of 100 years and an October 1988 price level. The property data base provided information on property use, construction materials, construction date and square footage for all structures within the project's scope. Construction costs per square foot for various building classes & types, the local multiplier and depreciation factors were based on the latest updates of Marshall & Swift's Marshall Valuation Service and Residential Cost Handbook.

6. The following assumptions concerning methodology and data were made:

(1) 100% destruction of structures and their contents within the 100-year floodplain

(2) Content value equals 50% of depreciated building value

(3) All structures have a 35 year life expectancy for depreciation purposes

(4) Mobile homes are single width, 12' x 52' and 10 years of age unless specified otherwise

(5) Surveyed structures are classified as to construction quality based upon survey appearance

(6) Nonsurveyed single family residences are generally of Class D/Type Average.

(7) Sand & gravel mining operations are unaffected equally with & without project for a net NED benefit of $0

7. The EAD model calculation of equivalent annual damage is $47,550.

8. Construction Costs:

100 yr Levee:
18 miles @ $1,000,000/mile = $18,000,000

Grade Control:
4 bridges @ $500,000/bridge = $2,000,000

Construction Cost = $20,000,000

Mitigation:
5% of construction cost = $700,000

Engineering & Design:
10% of construction cost = $1,400,000

Supervision & Administration:
10% of construction cost - $1,400,000

TOTAL FIRST COST = $23,500,000

Plus Interest during construction = $2,085,000

GROSS INVESTMENT = $25,585,000

9. BENEFIT/COST RATIO:

Equivalent annual construction cost amortized over 100 years at 8.875% interest: $2,271,000

Equivalent annual damage reduction: $47,550

B/C Ratio: 47,550/2,271,000 = .02