DICK PERTREAULT
3/20/90

tempe

rio salado

ENVIRONMENTAL ASSESSMENT

City of Tempe
Community Development Department

City of Tempe
P.O. Box 5002
115 East Fifth Street
Tempe, AZ 85280

Tempe

Community Development
Department

Mr. Richard G. Perreault
Project Manager
Maricopa County Flood Control District
3335 West Durango Street
Phoenix, Arizona 85009

March 14, 1990

Re: Environmental Assessment for Rio Salado

Dear Dick:

I am enclosing a copy of the recently completed Environmental Assessment for Tempe Rio Salado. We have presented this to Mary Butterwick of EPA.

While a time consuming document to produce, the EA appears to be just what EPA is looking for in the processing of 404 permit applications. I hope that our document will be of some value to you.

Sincerely,

Steve Nielsen

Steve L. Nielsen
Rio Salado Project Manager

RECEIVED
MAR 19 1990
RGP
REMARKS

RESERVATION FOR THE APWA CONSULTANT
RELAY TEAM AND ANNUAL PICNIC
MARCH 31, 1990

_____
Name

_____
Agency

_____

Count me in on the Government Officials Relay Team - I've been waiting for an opportunity to show the private sector that I am a hard working public employee and a winner.

I am also eager to bring a potluck dish.

You must sign this WAIVER to be entered

In consideration of your acceptance of this entry, I hereby, for myself, my heirs, my executors and administrators, waive any and all rights and claims for damages I may have against the sponsors, coordinating groups, and any individuals associated with the event, their representatives, successors and assigns, and will hold them harmless for any and all injuries suffered in connection with said event.

Also, none of the above are responsible for the loss of personal items nor any other form of aggravation in connection with said event. In filling out this form, I acknowledge that I am an amateur in such events. I also give permission for the free use of my name and picture in any broadcast, telecast or print media account of this event.

Signature: _____ Date: _____

_____
Name

_____
Company

_____
Total number attending

I am not a jock and will therefore, not be in the race. I will, however, be present to cheer lustily and will bring a delicious dish to share at the picnic.

Return to: Grant I. Anderson, P.E.
City Engineer
City of Glendale
5850 W. Glendale Ave.
Glendale, AZ 85301
435-4152

or

Mark Wavering, P.E.
INCA Engineers, Inc.
1702 E. Highland, #207
Phoenix, AZ 85016
277-8161

R.S.V.P. by March 15, 1990. Make copies if necessary.

ENVIRONMENTAL ASSESSMENT

FOR THAT PORTION OF THE

TEMPE RIO SALADO PROJECT

FROM THE SOUTHERN PACIFIC RAILROAD BRIDGE
TO McCLINTOCK DRIVE IN

Tempe, Maricopa County, Arizona

Prepared By:

City of Tempe
Community Development
Department
115 East Fifth Street
Tempe, Arizona 85280
(602) 350 - 8587

Table of Contents

PAGE

Purpose and Need 1
- Introduction & summary of proposed action 1
- Project history 6
- Project schedule 8

Alternative Analysis 9
- Design criteria 11
- Design goals 12
- Design discharge 13
- River form 14
- Channelization alternatives 21
- Channel cross-section alternatives 29
- River stabilization 38
- Project cost 42
- Availability 43
- Capable of being done 44
- Determination of practicable alternatives 45

Physical/Chemical Characteristics & Anticipated Changes 47
- Substrate 47
- Currents, circulation or drainage patterns 50
- Suspended particulates; turbidity 53
- Water quality 56
- Flood control functions 59
- Storm, wave & erosion buffers 62
- Erosion & accretion patterns 62
- Aquifer recharge 65
- Baseflow 66

Biological Characteristics & Anticipated Changes 67
- Special aquatic sites 67
- Habitat for fish & other aquatic organisms 70
- Wildlife habitat 74
- Endangered or threatened species 78
- Biological availability of contamininates 80

PAGE

Human Use Characteristics & Impacts 84
Existing & potential water supplies 84
Water conservation 85
Recreational or commercial fisheries 87
Water-related recreation 88
Aesthetics of the aquatic ecosystem 89
Parks, national & historic monuments, etc. 90
Traffic/transportation patterns 91
Utilities 95
Navigation 97
Saftey 98
Air quality 100
Noise 100
Historic/archeological properties 102
Land use classifications 104
Economics 107
Prime & unique farmland 109
Food & fiber production 109
General water quality 110
Mineral needs 112
Consideration of private property 113
Landfills 114
Visual considerations 116

Summary of Secondary & Cummulative Effects 119

Listing of Figures, Maps, and Tables

MAP		PAGE
1.	Project Area Location Map	5a
2.	Channel Alignment Constraints Map	23a
3.	Preliminary Channel Alignments (SLA)	25a
4.	Refined Channel Alignments (SLA)	27a
5.	Wildlife Habitat Locations Map	78a
6.	Noise Contours Map	101a
7.	Archeological Features Map	103a
8.	Landfill Areas Map	114a

TABLE		PAGE
1.	Frequency and Peak Discharges	11a
2.	Relative Cost of Bank Protection Types	38a

FIGURE		PAGE
1.	Alternative Channel Cross Sections	30a
2.	Inundation Areas 100 Year and SPF	59a
3.	Baseline Water Surface Profile	66a
4.	East Papago Freeway/Hohokam Expressway (ADOT)	92a

Tempe Rio Salado

Project Overview

1. Introduction and summary of proposed action

The Basic Purpose of the Rio Salado Project is to construct a bank-stabilized floodway channel to control flooding and erosion along the Salt River within the City of Tempe. Control of the floodway is crucial to the health, safety and welfare of the City of Tempe and the operation of a State transportation system. The stabilization of the Salt River is necessary for the protection of State and local transportation systems, utilities, recreation features and private property contained within the existing floodway.

This study area represents the second half of a channelization program that encompasses the Salt River floodplain from Tempe's western boundary to it's eastern limits and extends from the Southern Pacific Railroad Bridge east to McClintock Drive.

This environmental assessment is a follow-up to flood protection required by the location of the East Papago Freeway, and relies on previous Army Corp of Engineers and U.S. Environmental Protection Agency approvals. The first phase of channelization between the Sky Harbor Airport and the Southern Pacific Railroad bridge is currently under construction, (permit #88-149-RD).

In January of 1987, an Environmental Assessment was completed for the East Papago Freeway as part of an extensive location study. As a result of this study, the East Papago Freeway was located along the North Bank of the Salt River as it transitions through the City of Tempe. This location appears to have been selected as a result of low land acquisition costs, limited existing development and the least damaging alternative to the expansion of the State's transportation system.

The draft Environmental Assessment stated that it was necessary to channelize the Salt River due to impacts associated with the selected alternative 6 alignment. "The Papago Freeway alignment alternatives will encroach on the Salt River floodplain. As a consequence, flood elevations and hydraulic conditions will be altered throughout the study area....

The encroachment of the Alternative 6 alignment on the Salt River floodplain will result in increased flood elevations, a narrowed floodplain and an increase in channel velocity. The increase in flood elevation may pose a hazard to existing development in the floodplain. There will be a slight increase in flooded area to the south, but overall a reduction in the floodplain width due to the encroachment. The increased velocity will result in an increase in sediment transport and scour in the bed and banks of the channel.

Under the mitigation section of the Adot Draft Environmental Assessment, it stated: "The encroachments on the floodplain by alternatives 6 and 8 are sufficient to result in up to 0.5 feet of increase in flood elevation and will cause an increase in flooding in southern areas of the floodplain. Increase in channel velocity will decrease the channel stability. A stabilized encroachment on the northern boundary of the floodplain will constrain movement of the river and may increase the likelihood of channel erosion to the south." As a result of this concern, 404 permit # 88-149-RD was requested and channelization was approved and begun.

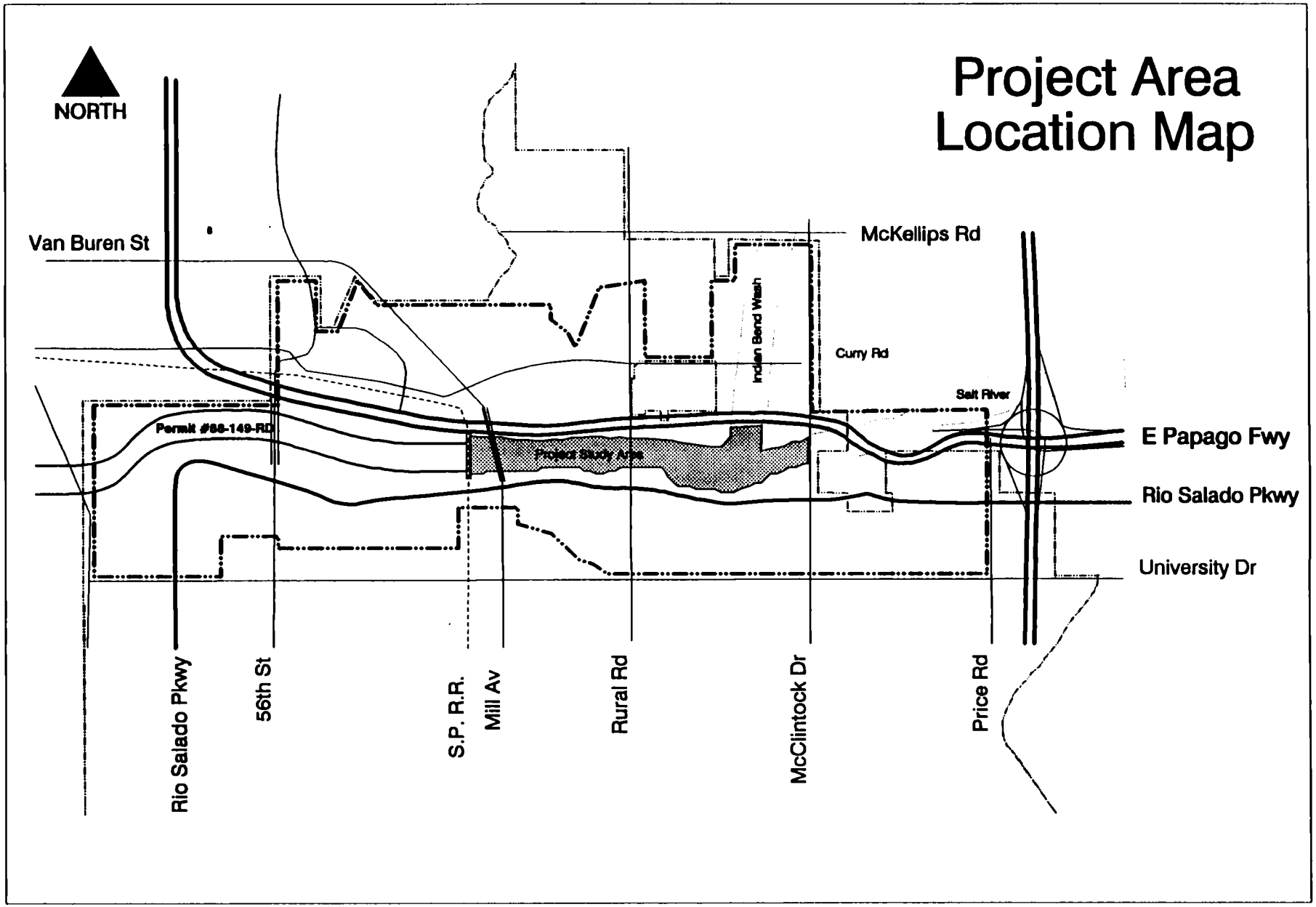
Due to the fact that Tempe is a land-locked community, and a large portion of it's developable land is in the Rio Salado Project Area, the City feels that it is essential that a complete channelization program be implemented as soon as possible to protect this area from damage due to flooding and erosion as well as maintain the safety and integrity of the state's transportation system. This goal is shared by both the Maricopa County Flood Control District and the Arizona Department of Transportation both of whom have elected to help fund the project. By resolution, the County Board of Directors have also committed to the long term structural and maintenance requirements of a floodway channel.

This present request involves a necessary impact on the "Waters of the U.S." in order to provide the maximum available flood and erosion protection within the state's most densely populated urban community.

The City of Tempe will act as lead agency in the design and implementation of this project. The project, however, encompasses lands owned by the State of Arizona, Maricopa County Flood Control District, Bureau of Land Management, Arizona State University, City of Tempe and a single private property owner.

Construction monies for the project will derive from locally generated revenues and be funded by the Maricopa County Flood Control District and the Arizona Department of Transportation. The City of Tempe will assist in the preparation of construction drawings, utility relocations and coordination.

This section of flood and erosion control within the Salt River will be located in the corridor shown on Map #1. The proposed channelization extends east-west between the Southern Pacific Railroad Bridge and McClintock Drive and includes the confluence of the Indian Bend Wash and the Salt River.



City of Tempe Community Development Department

Rio Salado Project

2. Project History

In the 1800's, the flowing Salt River created a natural break in transportation on the man-made trade route connecting Tucson and Prescott. Travelers preparing to cross the Salt provided a ready market for an enterprising entrepreneur, Charles Trumbell Hayden.

In 1871, Mr. Hayden established a store and ferry service at the crossing on the south bank of the river. The ferry service was located at the "narrows" where the river was narrowest and the bottom was firm. This early development eventually grew to become Tempe.

In 1911, Roosevelt Dam was built upstream, greatly reducing the flow of water into the lower reaches of the Salt while intensifying the destruction from periodic releases. By the late 1930's, all the water had been diverted for agricultural, industrial and domestic uses and the river ceased to flow. The Salt River had been transformed from an active, navigable water-way to a barren waste land.

The Salt River did not flow again in the natural channel until 1965, when a major flood occurred. Since then, we have experienced major floods in the late 70's and early 80's, causing bridge failure, extensive property damage, untold traffic congestion and loss of life. Following these catastrophes, new efforts were initiated to counter the risk of flooding. Sadly, these efforts to enhance the Salt River and control flooding were not implemented due to lack of funding.

Several planning studies were initiated throughout 1984 and 1985 by the Maricopa Association of Governments relative to improvements needed in the East Valley. As a result of these preliminary studies, the East Papago Freeway evolved, linking Interstate 10, Phoenix and the East Valley communities together. Freeway location studies and hearings were completed in early 1987 and alignment 6 was chosen through the City of Tempe.

3. Project Schedule

The location study consists of three phases. Phase 1 of the location study ended with the publication of the "Rio Salado Channel Improvement Report" by Simons, Li & Associates, Inc. in August of 1988. Phase 2, or Analysis of Alternatives, was further studied in a "Working Paper of existing conditions & alignment alternatives" prepared by CRS Sirrine, Inc. in September of 1989. Phase 3, Preliminary Design is currently underway.

Construction is scheduled to progress west to east in conjunction with the development of the East Papago Freeway. Current phasing indicates that this section of flood and erosion control will be required to start construction in the summer of 1990. Completion of the East Papago facility, including the interchange with the Outer Loop, is scheduled for the end of 1992. (July 1993)

B. Alternative Analysis

Alternative floodway channel locations and bank-protection measures were evaluated for the Rio Salado Channel between the Southern Pacific Railroad Bridge and McClintock Drive. The Salt River channel has undergone significant change in form over the last thirty years of urbanization. Some of the more important factors causing this change and modification of the hydrologic regime are dam construction, in-stream sand and gravel mining, placement of landfills in the main channel and overbank areas, and construction of river-control structures and levees.

In order to adequately evaluate the various alternatives available, the following objectives were identified for the project:

1. Reduction of flood elevations in the Salt River floodplain through the City of Tempe.

2. Establishment of a stable channel section and profile.

3. Creation of an attractive and usable floodway during non-flow and low-flow periods.

4. Creation of riparian habitat for wildlife species.

1. Design Criteria

The initial data base was established utilizing ADOT control surveys and benchmarks and the state plane coordinate system to establish the grid. At the recommendation of Simons, Li & associates, the City initiated the development of a digital terrain model integrated with the City of Tempe land & utility data base on the Integraph CAD system. This model was completed and utilized for the second phase of the alternative analysis.

Discharges used in the hydraulic analyses were based on values presented in the Central Arizona Water Control Studies CAWCS(1) as indicated in Table Number 1. The channelized conditions utilize only the upstream discharge for each frequency throughout the entire reach, under the assumption that there would be little attenuation of the flood wave. This assumption would then represent the worst-case condition for floodwave propagation in the channel and provide a conservative assessment of downstream impacts. Further study indicated that changes in the river stage are small thus, under the worst case scenario, it was concluded that the downstream effect would be negligible.

FREQUENCY AND PEAK DISCHARGES

FREQUENCY	CAWCS (1)	CAWCS (2)
5 Years	40,000 cfs.	44,000 cfs.
10	93,000	84,000
20	135,000	110,000
50	160,000	135,000
100	215,000	160,000
200	275,000	190,000
500	330,000	235,000 vs 250K (5/88)

Table No.1

It should be noted that modifications, currently under construction at Roosevelt Dam will raise the spillway elevation by 51.7 feet, increasing the volume of the reservoir by 792,420 acre-feet. This improvement will significantly reduce peak discharges within the Salt River. The CAWCS (2) is currently being revised to reflect these changes; the discharges listed in the table above represent preliminary values and are subject to change.

Mis-leading

2. Design Goals

The hydraulic design criteria are based on the design goals for the study and address the following areas:

a. Design discharge.

b. River form

c. River stabilization

d. In-channel features

e. Off-channel features

f. Reclamation of channel and floodplain areas.

3. Design Discharge

The actual discharge used for design is based on the current hydrology of the Salt River as indicated in the CAWCS (1) report of 1982. The 100 year discharge of 215,000 cfs at the confluence of the Indian Bend Wash is considered to be characteristic of the entire project area which covers the Salt River reach from 48th Street to McClintock Drive. As much as a 25% reduction in the 100 year flood discharge for the project could occur upon the completion of the Roosevelt Dam improvements, however, the hydrology of this study is based on existing conditions.

4. River Form

a. River Alignment

The primary objective in designing the river alignment was to select a plan for the main channel form that conforms to the general geomorphic features of the natural Salt River Channel. Additionally, the channel alignment should conform to the location of various structures and facilities that presently exist in the Salt River. Some of these features would be extremely expensive to relocate, and therefore are considered fixed constraints on the channel alignment. The potential for high discharge rates indicates that any curvature of the River must be gradual with a radius of not less than one mile or greater than a one-degree curve.

The Tempe Buttes at Mill Avenue is a geologic control for the profile of the Salt River which transforms the meandering form upstream to a relatively narrow, straight reach downstream. In addition to the natural channel form, five existing bridges also constrain the natural channel form. These bridges are; the Southern Pacific Railroad, Ash Avenue, Mill Avenue, Rural Road and McClintock Drive.

These bridges and the current channelization downstream of this project area are assumed to be fixed constraints that could not be relocated.

The East Papago Freeway location along the North Bank will further constrain the channel along the entire North side of the project area. Planned access ramps from the freeway to McClintock Drive, east of the confluence of the Indian Bend Wash will encroach into the Salt River and restrict the size and width of the channel. This area is directly across from the Arizona State University Golf Course on the South Bank. The Golf Course represents the only significant development occurring in the channel floodway. Several of the golf-links are in the main channel, and will add an additional constraint to the channel alignment.

The location of the Rio Salado Parkway, utilities, Indian Bend Wash confluence and at-grade channel crossings at Mill Avenue represent less rigorous constraints on the alignment. It was recognized that these features could be modified or realigned as necessary.

b. River Profile

The design criteria for the channel profile are intended to meet two main objectives: (1) reduce flood elevations; and (2) provide a stable channel invert that is not subject to substantial aggradation or degradation.

The lowering of the channel invert will permit the narrowing of the floodway, with the result that land can be reclaimed from the adjacent floodplain. The deepening of the channel will result in a flatter channel gradient. In the future, this flatter channel gradient will permit the construction of permanent aquatic features within the channel bed. A previous study for the channelization west of Mill Avenue was conducted by Simon's,Li & Associates Inc., 1988. The study, "Concept hydraulic design, Salt River channelization East Papago Freeway" indicated that the river reach east of Mill Avenue is degrading. Lowering the river gradient in this reach should arrest this process, and provide a more stable river reach.

c. River Section

The river cross-section must provide a section that conveys the design flood discharge through the site with approximately the same hydraulic characteristics as the existing channel. The proximity of the East Papago Freeway as well as the dense urban community mandates that the section should include stable channel banks that will not permit any lateral erosion by major flood flows. Were possible, a low-flow channel capable of conveying the mean Salt River Project (SRP) release up to approximately 5000 cfs, shall be provided. The addition of floodway terraces and off-channel storage can be used to mitigate the loss of floodplain storage. Where?

d. River Stabilization

River stabilization measures are essential to the control of the lateral and longitudinal migration potential of the river channel. In order to flood protect the adjacent property owners as well as insure the safety of the East Papago Freeway, lateral migration of the main channel bankline will not be permitted.

Future design of in-channel features will need to consider both the effects of severe flooding and the potential shifts of the in-channel form.

The vertical profile will be permitted to adjust within a range typified by the movement of channel bedforms and local scour. General degradation will not be permitted, and will be controlled at sufficient intervals to prevent loss of in-channel features and habitat. All grade control structures will be set to an elevation below the effect of local scour at the downstream limits of the structure.

e. <u>In-Channel Features</u>

In-channel features such as the low-flow channel and wildlife habitat will be designed to provide controlled passage of the periodic releases without obstructing the passage of the design flood event. The addition of plant materials into the channel is desired to provide a functional wildlife habitat and to create a visual quality that integrates the river environment within an urban area.

Grade control structures will provide an additional measure of erosion protection for the habitat areas by preventing the undermining of established root systems. In essence, one of the benefits of grade control structures, is the enhancement of habitat survivability. In-channel landscaping will be evaluated for hydraulic roughness and debris creation potentials.

f. Off-channel Features

While channelization will result in a decrease in floodplain storage volume, opportunities will be sought to establish locations of dynamic flood storage that can be used for multiple purposes such as recreation or riparian habitat.

g. Reclamation of Channel and Floodplain Areas

A side benefit to the stabilization of the river will be the opportunity to use land that is currently in the river floodplain. Future recreational features could be added above the 10 year flood level with a reasonable chance of survivability.

Alignment of in-channel features will ensure that hydraulic performance is maintained.

5. CHANNELIZATION ALTERNATIVES

a. No-Build Alternative

The no-build alternative would leave this two mile section of the Salt River in an unstabilized condition with some forms of bank protection occurring both upstream and downstream of this site. The encroachment of the East Papago Freeway into the floodway will create a narrowing of the Salt River. This will result in conditions of higher velocity and higher surface water elevations than currently exist through out the study area.

b. Channel Alignment Alternatives

The ephemeral streams of the southwest pose a significant threat to the urban areas. With ever increasing demand to intensify development, it is essential that adequate flood and erosion protection be sought. Previous studies have indicated that bank stabilization is not practical on existing banks without fear of undermining, thereby causing greater damage and erosion.

The construction of a stabilized bank floodway has become a necessary component of flood control.

The alignment of the 950 foot-wide channel is defined to a large extent by a number of factors, both historical and project purpose derived. The notion of creating a controlled floodway channel began in the early 1970's with the development, by the Army Corp of Engineers of the Indian Bend Wash into a flood control area with water-based recreation. This notion has proliferated with a widespread channelization program throughout the State of Arizona by the local County Flood Control Districts. From a historical approach approximately 15 miles of channelization currently exists immediately downstream of this application. NOT BY OUR DEFINITION OF DESIGNED - STABILIZED CHANNEL

The first two mile segment of this project has been permitted (#88-149-RD) with the specific approval of the EPA and is currently under construction. Additionally, permit #88-031-RD, encompassed within this application area, has also been issued in 1989 with specific conditions of approval that it relate to the Tempe Rio Salado Project.

IBW OUTLET Golf Course ? NOT

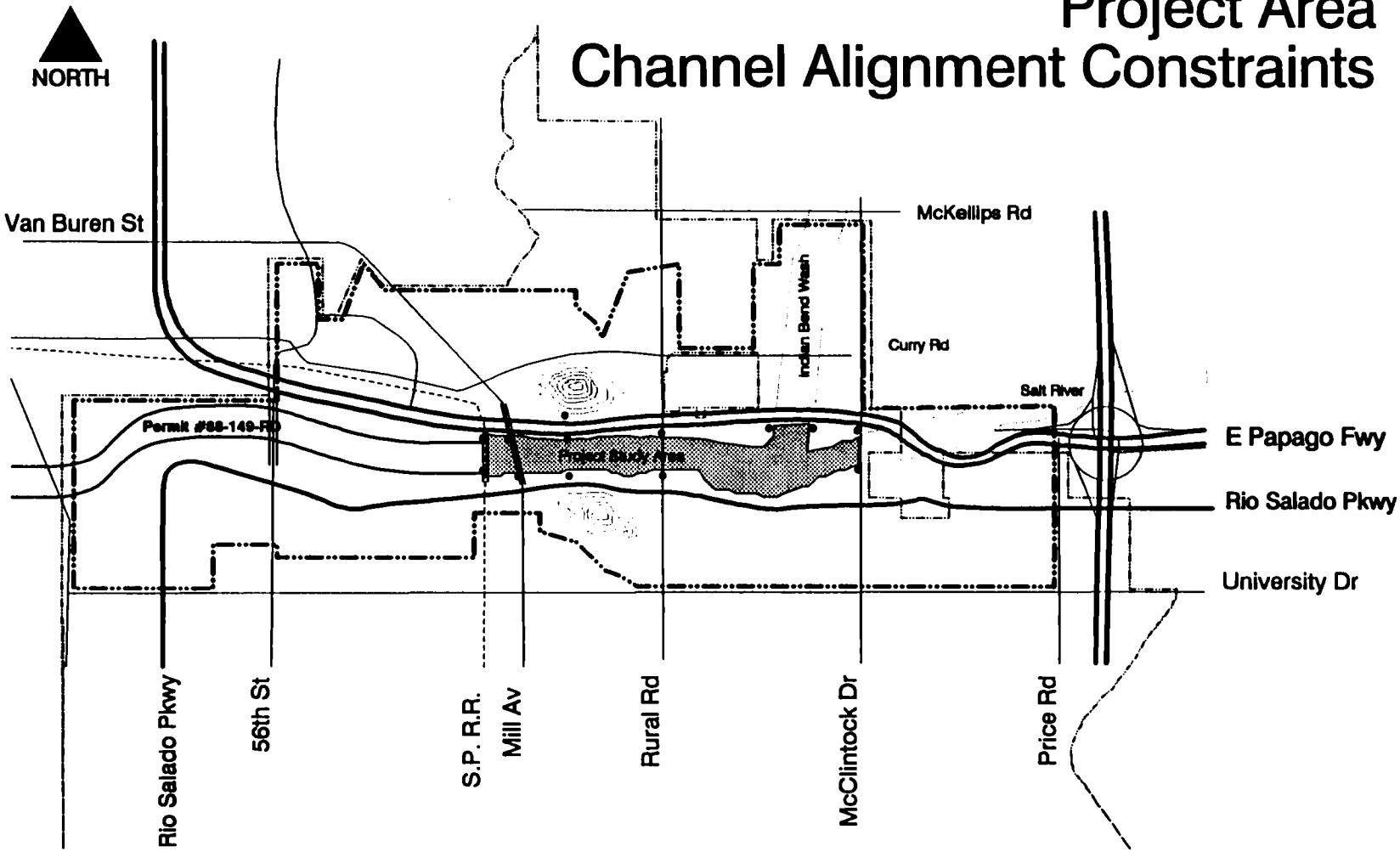
88-031 RD?

The issuance of permit ~~#88-149-RD~~ for the construction of a golf course within the Indian Bend Wash will complete the development of the Indian Bend Wash up to the confluence of the Salt River.

The firm of Simons, Li & Associates were retained in 1988 to begin study of a Salt River enhancement program. Early in the study, the many constraints of the proposed channel area were identified (as illustrated in Map number 2). After careful review of established control points and given hydrologic/geomorphic implications, the channel width was established at approximately 950 feet. Specific control points for this reach of the Salt River have been identified as follows:

> The downstream limit is the connection into the previously permitted channelization project (#88-149-RD) with a channel width of 950'.
>
> One-half mile upstream, the channel width is fixed due to existing topography (Papago Buttes and Tempe Butte) and three existing bridges in the area; Mill Avenue, Ash Avenue and the Southern Pacific Railroad Bridges

Project Area
Channel Alignment Constraints



• Channel Alignment Constraints

City of Tempe Community Development Department

Rio Salado Project

One and one-half mile upstream the channel width is restricted by the Bridge at Rural Road.

Planned construction of the East Papago Freeway along the north bank encroaches and restricts the channel width and alignment. Protection of freeway embankments is an essential component of this permit.

Existing bridges at Rural Road and McClintock Drive were designed to accommodate a peak flow of 210,000 cfs. The Rio Salado project will expand the maximum flood control beyond that currently existing and prevent overtopping of roadway approach embankments at these bridges.

INCOMPLETE SENTENCE

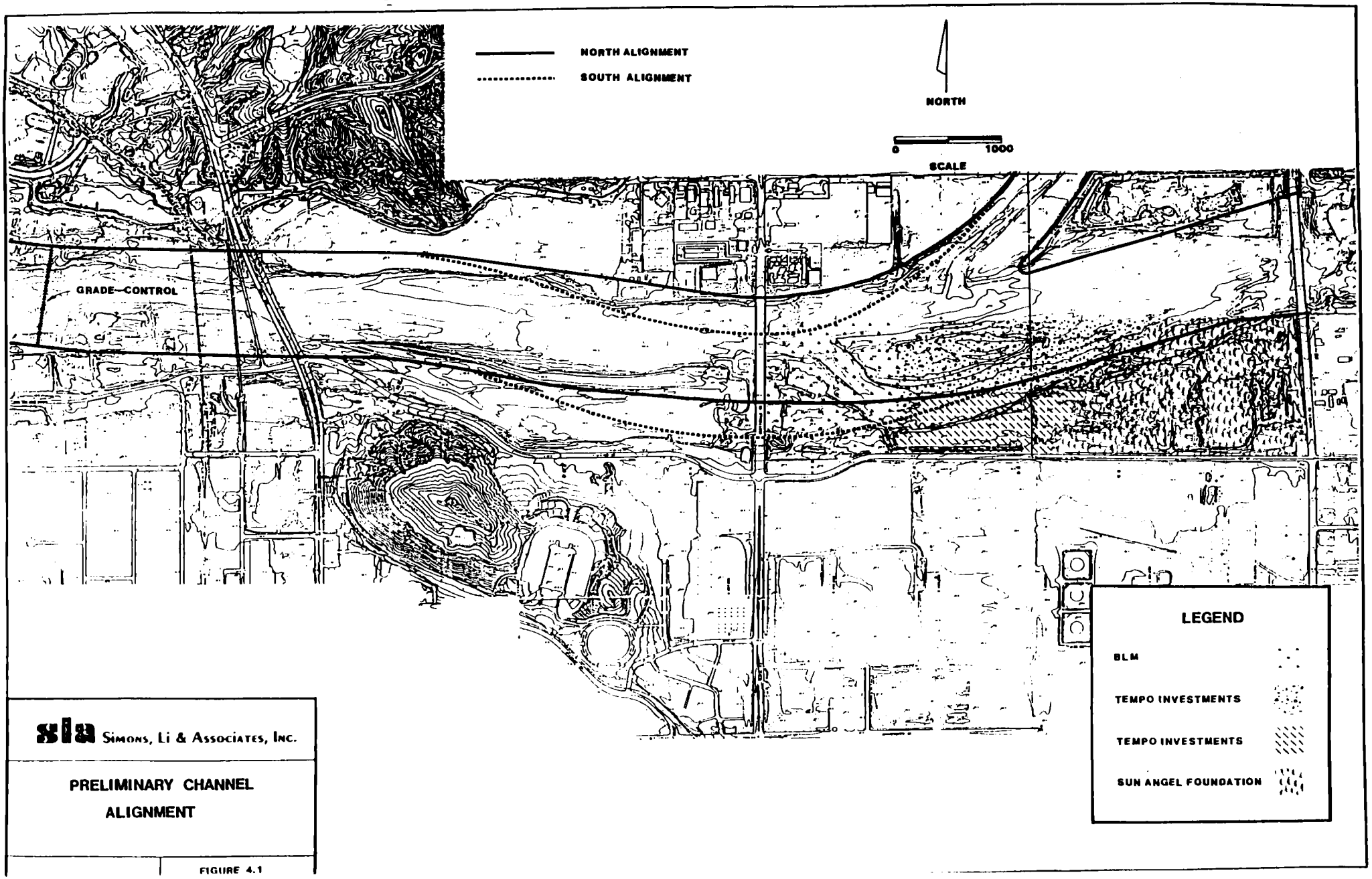
Two miles upstream the encroachment of the Arizona State University Golf Course into the floodway on the South side and the encroachment of the East Papago Freeway off-ramp on the north.

At two and on-quarter miles upstream the abutments of the McClintock Drive Bridge restrict the channel width.

Upon establishment of the control points, two preliminary channel alignment alternatives were developed.

The first alternative aligned the channel with the north abutment of the Rural Road bridge, thereby maximizing the amount of land reclaimed from the south bank (Map number 3). As criteria for channel form were developed in more detail, this alignment was found to have several disadvantages. Most important, from a hydraulic standpoint, this alignment requires the straightening of the natural meander form in this reach of the channel. This created a potential problem due to the presence of the Indian Bend Wash confluence, between Rural Road and Hayden Road. Historically, the confluence has tended to create a natural curvature of the Salt River. Flows from the Indian Bend Wash will tend to erode the Salt River downstream and opposite of the confluence. The eroded sediment is deposited downstream of the confluence resulting in the formation of a channel bend.

The second alternative studied, maintained the natural curvature by aligning the channel with the southern abutment of Rural Road. This alignment more closely follows the natural conditions.



sla Simons, Li & Associates, Inc.

PRELIMINARY CHANNEL ALIGNMENT

FIGURE 4.1

Upon review of the preliminary alternative alignments, the Rio Salado Task Force recommended adoption of the Southern Alignment. It was felt that in order to meet the primary purpose of flood and erosion control, the selected alignment should incorporate a similar meander as that which currently exists within the Salt River. The two preliminary alignments were reviewed by the public and comments were solicited on the potential impact of the alignments on adjacent properties.

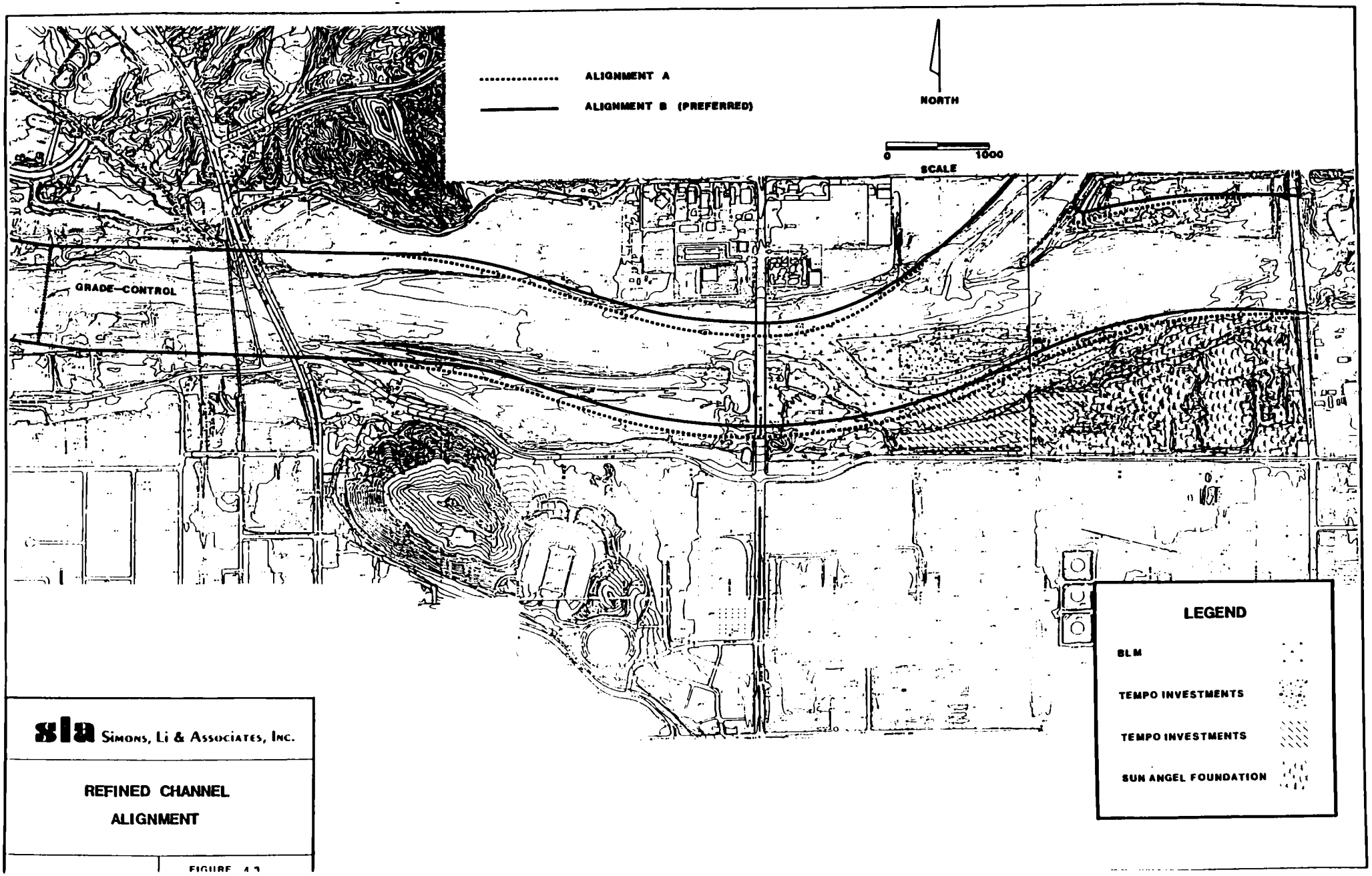
It should be noted that the current location of the Arizona State University Golf Course at the upstream limits of the project conflicted with both channel alignments. As constructed, a portion of the Golf Course falls within the floodway and the entire course north of the Rio Salado Parkway is in the floodplain.

Opposite the golf course, on the North side of the floodway, will be the East Papago Freeway, constraining the channel to it's current alignment. While there may not be a solution to completely flood protecting the golf course, it was felt that the primary objective would be to find an alignment that would protect the in-stream portions of the course from scour damage.

Two alignments were formulated based on the preferred southern channel alignment (Map number 4).

The first alignment, B1 used the south abutment at Rural Road as a control and directed the channel alignment due west through the Hayden Road Bridge. This alignment still failed to adequately protect the existing golf course and would subject the course to scour damage during high flows. At the request of the University officials, this option was discarded.

The second alignment, B2, was established by offsetting the south channel bank 100 feet to the north at Rural Road, while keeping the channel bend radius at a minimum. This provided sufficient area on the south bank to provide limited bank protection to existing development and would protect the golf course from scour damage.



sla Simons, Li & Associates, Inc.

REFINED CHANNEL ALIGNMENT

FIGURE 4.3

Preferred Channel Alignment

As a result of the high degree of flood and erosion protection for the East Papago Freeway and existing development along the South Bank, alignment B2 was selected as the preferred alternative. This alignment created a stabilized floodway channel that conformed with the general geomorphic features of the natural Salt River and worked within the established control points of the five bridges that cross the Salt River. Channel width is determined by the downstream channel already under construction, bridge control points, existing geomorphic features and utilities, the East Papago Freeway alignment and overall hydraulic performance.

6. Channel Cross-Section Alternatives

In 1989 a second channelization study was completed by CRS Sirrine, Inc.. The purpose of this study was to further analyze the channel configuration with emphasis on the reach encompassing the Southern Pacific Railroad, Ash Avenue and Mill Avenue Bridges. The study recognized that the hydraulics of the Mill Avenue bridge were more complex than previous analysis had defined. The 30 degree skew of the bridge and the close proximity of the two downstream bridges were a concern. Additional impacts occurred from a tri-city sewer line along the North bank and the Rio Salado Parkway on the South bank.

The design program for channel cross-section was established based on a channel designed to the standard project flood. The channel bed slopes toward the center of the channel with an overall channel depth from the top-of-bank to channel invert of approximately 30 feet. For the purpose of initial study, it was felt that the final channel slope should not exceed 3:1 however, the basic channel section lends itself to a variety of modifications and can provide diverse features both on the channel banks and within the channel section.

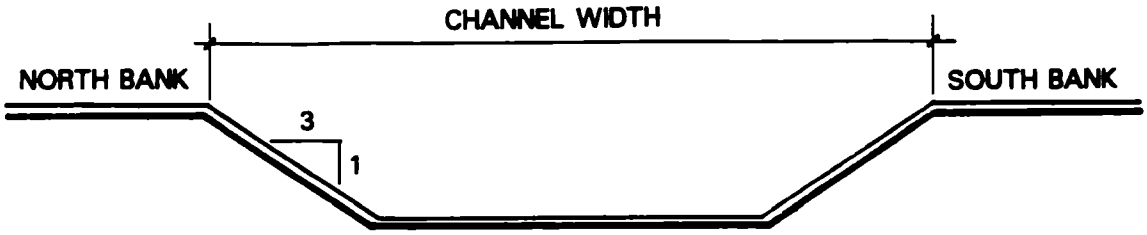
Four types of channel sections (see Figure number 1) were considered:

S1	-	Single trapezoidal channel
S2	-	Compound channel with south bank terrace only
S3	-	Compound channel with north bank terrace only
S4	-	Compound channel with both north and south bank terraces

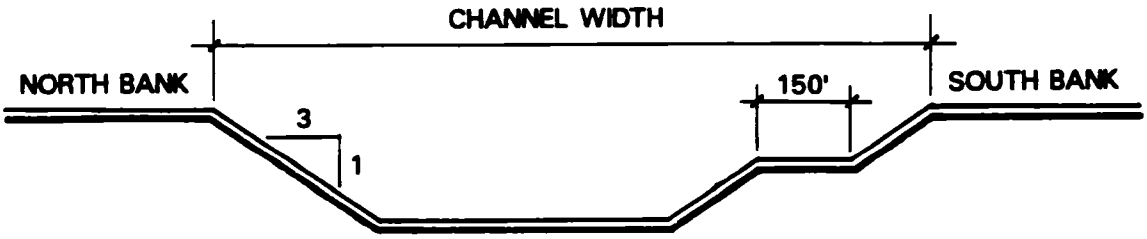
An extensive two-dimensional computer modeling study was conducted to evaluate these section alternatives, together with alignment improvements specific to the bridge waterways.

S1 Cross-section Alternative

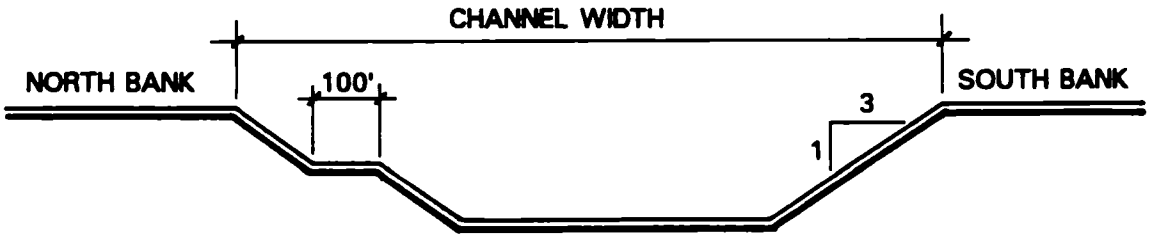
The Single trapezoidal channel section provides the best method of maximizing conveyance within the floodway. The single bank construction would be the most economical of the alternatives. The drawbacks to this type of design are higher velocities, limited recreational use and landscape opportunities on the channel banks.



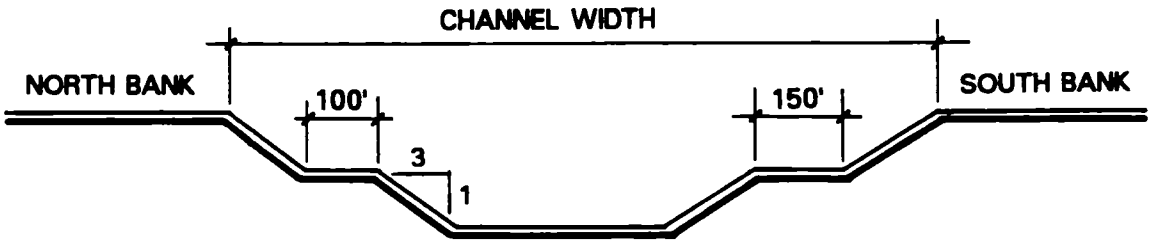
ALTERNATIVE S1:
TRAPEZOIDAL CHANNEL



ALTERNATIVE S2:
COMPOUND CHANNEL W/ SOUTH TERRACE



ALTERNATIVE S3:
COMPOUND CHANNEL W/ NORTH TERRACE



ALTERNATIVE S4:
COMPOUND CHANNEL W/ NORTH & SOUTH TERRACES

ALTERNATIVE CHANNEL CROSS SECTIONS
RIO SALADO CHANNELIZATION

S2 Cross-section Alternative

The compound channel with a south bank terrace only provides the opportunity to create future recreation opportunities along a 150' wide south terrace. Development of the terrace at the 10 flood year event level provides general flood protection for proposed vegetation as well as a much more aesthetically pleasing channel section.

The high velocities experienced within the main channel are reduced by about 50% on the upper terraces. This reduction of velocity will permit the development of a healthy landscape environment. Landscaping on the terrace will be subjected to much lower velocities and should increase the survivability during flood events.

This channel section would decrease the general channel dynamics and increase the costs of channel construction. But terracing on the south bank allows for opportunities to relocate the existing Rio Salado Parkway from the bottom of the channel to a more protected 10 year flood event level.

S3 Cross-section Alternative

Analysis of the utilities located within the area identified a large diameter sewer trunk line which runs parallel to the north bank of the channel. In some locations this 54 inch diameter line extends as much as 100 feet into the proposed channel. Because of the significant cost associated with relocation, a determination was made that the utility must be accommodated within a terrace in the channel section. As illustrated in fig. 1, S3 incorporates a compound channel design with a north bank terrace.

Terracing the north bank would also allow for the future recreational use and landscaping in the Mill Avenue to Rural Road reach. At the confluence of the Indian Bend Wash, use of terracing would be limited due to flow conditions. East of the confluence, the east bound off-ramp for the Papago Freeway encroaches slightly into the floodway, also limiting the use of a north bank terrace. Additional study will be conducted as part of the final design in this area.

As indicated previously, the use of terracing provides many opportunities for additional recreation features and landscaping within the floodway with minimal flood risk. Construction cost, technique, drainage and loss of channel performance would be potential impacts associated with this section.

S4 Cross-section Alternative

From an aesthetic and functional use perspective a compound channel with both north and south terraces as depicted in section S4 is ideal. The north terrace would have a width of approximately 100 feet and the south terrace an additional 150 feet, such a section would provide extensive areas for future recreational use and landscaping. Once again, substantial channel construction costs would be incurred with some loss of channel performance.

Preferred Cross-section Alternative

In selecting a preferred cross-section, each alternative was based on the following needs:

1. Improved hydraulic performance at Mill Avenue bridge.
2. Provide flood protection for existing utilities too costly to relocate.
3. Evaluation of hydraulic performance of each alternative.
4. Maximum flood protection for existing Rio Salado Parkway.
5. Landscape survivability.
6. Construction Cost.
7. Potential for public recreational use.

Scoping sessions were held with Tempe staff, hydraulic design consultants, Maricopa County Flood Control District, landscape architects and environmental specialists in evaluating the ability of each of these alternatives to meet the project needs. The outcome of this study was a recommendation to use a combination of various cross-sections throughout the project.

It is recommended that a compound channel with both north and south terraces from the downstream project limits at grade control structure #4 through the three bridges at Mill Ave. This would provide protection for the sewer trunk line on the north terrace and protection for the Rio Salado Parkway on the South Terrace. A further recommendation was made to provide a small earth berm on the south bank to expand flood protection for the Rio Salado Parkway to the 50 year event.

- The use of both terraces will provide an attractive element to the flood and erosion control project by allowing for the addition of future landscaping and potential for in-channel recreational use. While the additional cost for this cross-section is somewhat higher, it was felt that the survivability of the landscaping in this area merited the increased cost.

Due to the necessity to maintain a high level of hydraulic performance throughout the channel area, the use of an alternate cross-section was developed upstream of the bridges. The south side terrace begins to taper east of the Mill Avenue bridge to an 80 foot terrace and continues to a point east of Rural Road.

A trapezoidal channel cross-section is utilized for the remainder of the reach to McClintock Drive.

The north bank cross-section narrows the terrace just east of the sewer trunk to a 24' terrace. This cross-section continues to the end of the project at McClintock Drive. The small terrace is sufficient to provide for pathways and some landscaping.

This combination of channel cross-sections provides a cost effective approach to design, maintains the specified hydraulic performance established by the Maricopa County Flood Control District of 250,000 cfs and provides for a channel that insures a higher degree of survivability for landscape vegetation and public use.

7. Low Flow Section Alternative

As evidenced by aerial photography, an incised low-flow condition exists within the current floodway in a meandering form. The geometry of meandering rivers is quantitatively measured in terms of: (1) low-flow channel width W; (2) meander amplitude A: and (3) meander wavelength. Existing conditions reflected a channel of 300 to 400 feet in width with a meander amplitude of 1300 feet and a meander wavelength of approximately 4000 feet. When calculated utilizing a 5000 cfs discharge capacity, the channel requirements call for a bottom width of 300 to 500 feet with a depth of 5 feet. The idea of a low-flow channel within the main conveyance is a desirable opportunity to naturally contain periodic water releases without damage to existing plant life or future recreational use.

8. River Stabilization

River stabilization measures are structures designed to control the lateral position and vertical profile of the channel. Study indicated three alternatives for bank stabilization that are adequate for the range of hydraulic conditions found in the Tempe reach of the Salt River. The following criteria was used in the analysis of river stabilization alternatives:

1. Cost of construction
2. Durability
3. Appearance
4. Habitat Value

While each of the alternatives could be used in a flexible landscape design, bank protection in general needs to conform to the main-channel alignment without abrupt discontinuities in form.

Table number 2, illustrates the relative cost associated with the various bank stabilization methods. Cement-stabilized alluvium is the least costly of the three alternatives, and conventional rock riprap is twice the cost.

RELATIVE COST OF BANK PROTECTION TYPES

TYPE	UNIT COST	VOLUME	TOTAL COST
Rock Riprap	1.0	1.0	1.0
Wire-tied Rock	2.0	0.33	0.66
Cement-stabilized Alluvium	0.5	0.84	0.42

Table No. 2

Rock Riprap

Conventional rock riprap has proven to be very durable at numerous locations throughout Arizona. While the cost is double that of cement-stabilized alluvium, rock riprap has the most natural appearance when used in small areas. The use of riprap in large quantities in a uniform manner tends to appear artificial. Because vegetation can be established within the voids in the rock areas, habitat value is considered to be good. Excessive vegetation can become a maintenance problem. The use of riprap within this channel area would exceed the natural supply of rock materials and add further to the overall costs of construction.

Wire-tied Rock

Wire-tied rock also has a high habitat value by permitting vegetation growth in the voids in the rock blanket. When used in conjunction with large bed loads, wire-tied rock can suffer abrasion problems and tend to accumulate trash and debris in the wires.

Cement-stabilized alluvium

Cement-stabilized alluvium is the most stable when placed at the angle of repose of the alluvial material from which it is derived. Negatively, this results in steep, monolithic structures that have an unnatural appearance. Proven to be very durable, cement-stabilized alluvium is the least expensive of the alternatives. Because the surface area is usually smooth and lacks voids, habitat value is considered to be extremely poor.

Preferred bank-stabilization alternative

Review of the conventional methods of bank stabilization produced little in the way of an acceptable aesthetic bank treatment. High velocities in the lower portions of the channel section supported the need for the most stable of the alternatives. To fully achieve the goals of the project it was felt that a composite section of bank protection needed to be developed which combined the best features of both cement-stabilized alluvium and native rock. A system of earth covering or plating would be necessary to visually soften the channel banks and allow for the establishment of vegetative cover.

With anticipated velocities of 14-15 fps the study determined that bank stabilization utilizing soil cement is a prerequisite up to the 10 year flood level. Above the 10 year event level, velocities at the bank line reduce to 6-8 fps, a wire-tied rock mattress or riprap is the preferred material due the high habitat value.

Grade control structures were located at the upstream and downstream channel limits as well as the confluence of the Indian Bend Wash to prevent channel profile erosion.

As proposed, this system of structures will prevent both lateral and longitudinal scour within the Salt River floodway for flood events up to the magnitude of the Standard Project Flood. The bank protection in straight reaches and on the interior of bends permits the upper portions of the bank to be plated with native alluvial material. This alluvial material will provide a substrate for various types of riparian vegetation. Damage to vegetation will be minimal since the upper portion of the bank protection is set above the elevation of the ten-year flood.

The natural banks of the Salt River in this reach are entirely unstabilized and provide a continuous supply of sediment during flood flow. The addition of channel bank stabilization, the nature of the native alluvial material and eventual revegetation of portions of the channel bank, will assure that water quality in the Salt River will not be compromised, in fact, turbidity during flooding should decrease significantly.

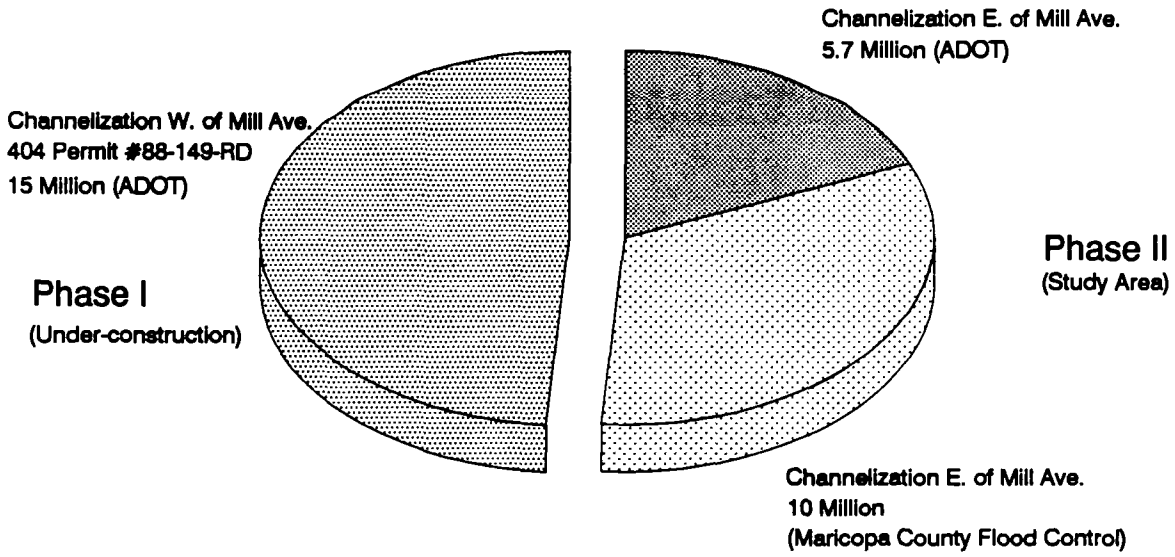
9. Project Cost

The flood and erosion control project is expected to cost 31 million dollars. Overall channel construction costs have been allocated in the following manner, along with the agency responsible for construction:

Channelization W. of Mill Ave. 404 permit #88-149-RD	15 million (ADOT)
Channelization E. of Mill Ave. (Current Request)	10 million (Maricopa County Flood Control
	5.7 million (ADOT)

SALT RIVER CHANNELIZATION PROJECT COST

Phase I and II



10. **Availability**

Within the City of Tempe, the Salt River Bed is owned by five government agencies and one private property owner. It has been widely accepted that the overall enhancement of the Salt River within our community is in keeping with the commitment by the City Council to promote the highest quality of living. In a land-locked community, such as Tempe, it is necessary to use our land and cultural resources wisely. To that extent, the development of the Rio Salado Project Area, representing 10% of the land in Tempe, meets the basic purpose stated.

11. **Capable of Being Done**

The desire to control the Salt River began almost twenty years ago. While it has gone through many stages of study, current constraints on the floodway mandate the construction of an adequate system of flood and erosion control. The first half of the channel is currently under construction. A new bridge at Mill Avenue is undergoing location hearings and a new bridge at Priest Drive is under construction. The final section of channelization is under design with funding committed by the State of Arizona and Maricopa County.

12. **Determination of Practicable Alternatives**

As indicated in the Environmental Assessment for the East Papago Freeway, it is necessary to provide additional bank stabilization and erosion control due to the construction of the Freeway. With the current construction of the first half of the floodway channel and the establishment of channel control points both upstream and downstream, it appears prudent that the necessary flood and erosion control measures be taken to ensure that a potentially devastating floodway overtopping does not occur in the valley's most densely populated community.

The location of the East Papago Freeway along the North Bank of the Salt River determines the North bank of the floodway. The current channelization project downstream and the existing bridges at Rural Road and McClintock Drive upstream, have determined channel width and general location. The encroachment of the Freeway and resulting increases in both velocity and water elevation negate a no-build alternative.

In order to provide for the safety and well being of the community, without adverse economic impact, it has been determined that this flood and erosion control project is the least damaging practical alternative to the "waters of the U.S.". On the whole, the stabilized Salt River banks will supply substantially less sediment to the flow during floods. The addition of channel bank stabilization, the nature of the native alluvial material and eventual revegetation of portions of the channel bank, will assure that water quality in the Salt River will not be compromised. In fact, turbidity during flooding should be significantly decreased. The use of earthen materials, from the river bottom in the creation of a bank-stabilized floodway channel has minimal environmental impact and meets the project purpose of providing adequate flood and erosion control within an urban area. The Rio Salado Channelization Project achieves the basic project purpose and is economically practicable.

C. Physical/Chemical characteristics and anticipated changes

1. Substrate

The geologic makeup of the project area is predominantly alluvial deposits consisting of floodplain and channel sediments of the Salt River. The exception to this occurs at the Papago Buttes and Tempe Butte which are comprised of Precambrian, Tertiary rocks and Quaternary alluvial deposits.

Isolated Precambrian and Tertiary rock outcrops may be encountered within 20' of the surface in and around the buttes.

Soil structure is Quaternary sediments consisting of channel alluvium, uncemented sand, gravel and cobbles; sediments overlying terraces of the Salt River, weakly to moderately cemented silty sand and clayey sand with gravel; Indian Bend Wash sediments, cemented sands and silts mixed basin and alluvial sediments; basin sediments and sediments overlying older Salt River terraces; and pediment colluvium and alluvium sediments overlying the shallow bedrock in the Butte area.

Alluvial material in the Salt River is generally coarse and contains almost no fine sediments that would contribute to an increase in turbidity. The largest sediment sizes in the bed of the river exceed one foot in diameter.

The natural banks of the Salt River in this reach are entirely unstabilized and provide a continuous supply of sediment during flood flow.

East

<u>Impact.</u> The Papago Freeway Alignment will encroach on the Salt River floodplain. As a consequence, flood elevations and hydraulic conditions will be altered throughout the study area.

This encroachment of the freeway, coupled with the existing development of portions of the ASU golf course in the floodway ,as well as existing bridges designed to a lesser flood event level(Rural Road and McClintock Drive are designed to convey 210,000 cfs.) has narrowed the floodway.

A corresponding increase in flood elevation may pose a hazard to existing development in the flood plain, however, a reduction of floodplain width will be realized. The increased velocity will result in an increase in sediment transport and scour in the bed and banks of the channel.

The development of the proposed channel with displace approximately 3.5 million cubic yards of alluvial material from within the Salt River. Two million yards will be used for borrow and aggregate materials associated with the construction of the East Papago freeway system. The remaining 1.5 million yards of alluvial material will be used in the construction of the bank protection.

Mitigation Measures. Because of the large sediment sizes present, an armor layer can form composed of large cobbles that will limit channel bed erosion, however lateral erosion may continue after the channel bed has been armored. The development of a stabilized channel section will be necessary to prevent continued lateral erosion.

Vertical grade control will also be necessary at the upstream limit of the study area as well as at the confluence of the Indian Bend Wash. Channel design should tie into ADOT grade control structure #4 at the downstream limit of the study area to ensure channel stability.

2. Currents, circulation or drainage patterns

Flow in the Salt River is a rare occurrence. In 1945 the last of a series of water-conservation reservoirs were completed on the tributaries of the Salt River. From 1942 to 1964, all runoff from the Salt was stored in reservoirs. This water is then released from the reservoirs into the Salt River and flows downstream to Granite Reef Dam where it is diverted into canals for irrigation and municipal use.

The first significant release of water into the Salt River below Granite Reef Dam occurred in 1965. Subsequent releases occurred in 1966,1968, and 1973. The total volume of water released between 1965 and 1973 was less than 2 million acre-ft. Unusually high runoff occurred in the watershed in 1978 and again in 1980 releasing approximately 5.45 million acre-ft into the normally dry Salt River.

Between the years of 1978 and 1980 the ground water level under the Salt River rose an average of 35.5 feet. This rise was a direct result of the infiltration of floodwaters within the alluvial substrate of the Salt River channel and the recharging of the ground-water system. As a result of an abundance of surface water, the average annual amount of ground-water pumpage during this period was reduced by 35%, at a savings of 1.9 million acre-ft of water. The filtration rate within the study area was 1.3 ft./day, the highest within the Salt River.

Impact. The narrowing of the floodplain will alter the hydraulic conditions within the study area. The skew angle of piers at the Mill Avenue bridges will require additional study as will the overall hydraulic performance of the channel.

Channelization of the Salt River allows an opportunity to capture storm water runoff within the urban area. A stabilized channel and landscaping will reduce sediment transport and erosion to improve water quality while providing an area that can support ground water recharge.

Mitigation Measures. The proposed discharge of materials into the area will have no effect on current water circulation, fluctuation or salinity. The study area shows no apparent requirement for mitigation.

3. **Suspended particulates; turbidity**

The City of Tempe has been working closely with the Arizona Department of Environmental Quality in the analysis of suspended particulates and turbidity. Approximately 1.5 million cubic yards of native alluvial material will be utilized in the construction of and plating of the stabilized channel banks.

Bank protection would consist of cement stabilized alluvium bank protection, native rock and grade control structures. This system of structures will prevent both lateral and longitudinal scour within the Salt River floodway for flood events up to the magnitude of the Standard Project Flood. The bank protection will be designed with native soil plating to accommodate vegetation and to enhance the general aesthetic appearance. This alluvial material will provide a substrate for various types of riparian vegetation. The upper portion of the bank protection is set above the elevation of the ten-year flood and, therefore, has a probability of less than ten percent of being flooded in any given year.

The native material plating is the only area on the channel banks that will be unstabilized. This will be a significant improvement as the natural banks of the Salt River in this reach are entirely unstabilizied and provide a continuous supply of sediment during flood flow.

The bank slope is at a 3:1 (horizontal:vertical), which is a more stable condition than the existing steep bankline. At the same time plating is underlain by cement stabilized alluvium and rock bank protection would limit any bank scour to the depth of the plating. The use of cement stabilized alluvium in the lower portion of the channel bank provides for a completely stabilized bank which would prevent any type of sliding or slumping failure of the slope due to under cutting. Shear forces on the upper portion of the bank are substantially less than the average shear force for the channel. This would result in a lower potential erosion rate for the upper portion of the bank compared to the overall channel.

Impact. The supply of sediment from plated areas of the new channel will be potentially much less than for the existing system. Since native alluvial material is being used to plate the upper bank, the fraction of fine sediments will be consistent with that of the Salt River flood plain. It should be noted that the alluvial material in the Salt River channel is generally coarse and contains almost no fine sediments that would contribute to an increase in downstream turbidity.

Revegetation opportunities are available with the type of bank protection selected and will further mitigate concerns about erosion. Depending on the type of vegetation established, it is likely that some degree of filtering and sediment deposition will occur in the vegetated zone.

Mitigation Measures. The addition of channel bank stabilization, the nature of the native alluvial material and eventual revegetation of portions of the channel bank, will assure that water quality in the Salt River will not be altered by the proposed placement of materials within the study area.

While it is not expected that turbidity will increase in this reach of the Salt River, Tempe is working with the Arizona Department of Environmental Quality in the analysis of cumulative water quality impacts within the reach to ensure that the Reach Load Criterion (RLC) is not exceeded. The RLC for this area, has been temporarily established by ADEQ at a value of 6,850 cubic yards passing the No. 60 mesh screen.

4. Water Quality

Within the project area, the alluvial deposits are generally much thicker, and the depth to water averages approximately 60 feet. Two areas of relatively low VOC content (less than 20ppb of trichloroethylene (TCE)) in the groundwater are present. Both locations are within the Indian Bend Wash Superfund Project site which overlaps the eastern portion of the study area with the northwestern portion of the superfund study area.

TCE contents of less than 20ppb have been found in water from two wells in the McClintock Drive and Curry Road area (NIBW). The direction of groundwater flow is to the north in this vicinity, away from the Salt River channel.

The other area of known contamination occurs south of the Salt River, between Rural Road and Price Road. Water from two APS, One Tempe and one SRP well in this vicinity contain TCE contents of less than 20ppb. The source of this contamination has not been determined. The direction of groundwater flow in this area is believed to be to the south and southeast.

Impact. No potential for impacts is expected on the Rio Salado Channel due to the depth of existing ground water. Because of the identified superfund area, close coordination with the Environmental Protection Agency is necessary.

Encountering contaminated soil would constitute a significant impact on construction. Disposal of contaminated soil could involve a high cost and extensive project delay.

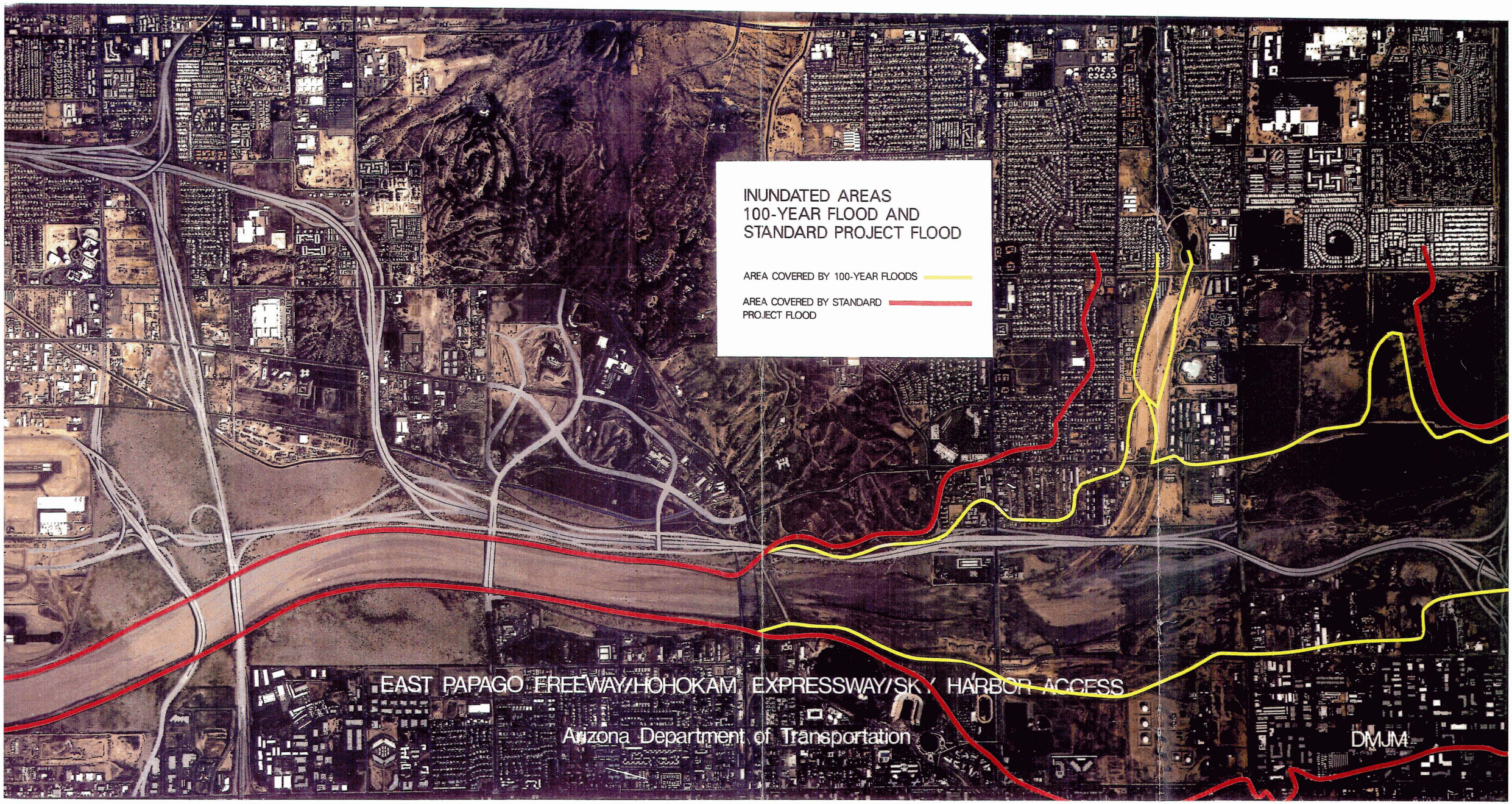
It will be necessary to identify sources of ground water contamination prior to any introduction of water into the area. Current studies are contemplated to fully document ground water flow directions and potential impacts due to water quality. Future plans for the introduction of water into the project area will require specific approval by both Federal and State Agencies.

Mitigation Measures. To ensure ground water contaminants will not be encountered during construction, a soil sampling plan, approved by EPA will be necessary. The objective of the plan will be to determine whether there is contamination in any of the soils to be moved or used in the project. The plan would include a scan for EPA priority pollutants, and would address surface and subsurface soils to the depth to be excavated for the project.

Compliance with the Clean Water Act in obtaining a Water Quality Certificate from ADEQ is required prior to issuance of a 404 permit.

5. Flood control functions

As identified in the Basic Project Purpose, the study area contemplates the construction of a flood and erosion protection channel for the reach between the Southern Pacific Railroad and McCllintock Drive. As indicated in figure 2, the Standard Project Flood under current conditions would cause extensive flooding within the urban community. The location of the East Papago Freeway along the north bank of the Salt River has further impacted the hydraulic conditions and stability of the Salt River. The significance of this impact was recognized in the Environmental Assessment done for the East Papago Freeway. Elevating the freeway along the north bank will raise the flood elevation an additional .50 feet, further extending the level of flooding associated with a Standard Project Flood. In addition, it was realized that the hardening of the north bank without channelization would tend to destabilize the channel and increase flooding potential to the South.


INUNDATED AREAS
100-YEAR FLOOD AND
STANDARD PROJECT FLOOD
AREA COVERED BY 100-YEAR FLOODS
AREA COVERED BY STANDARD PROJECT FLOOD
EAST PAPAGO FREEWAY/HOHOKAM EXPRESSWAY/SKY HARBOR ACCESS
Arizona Department of Transportation
DMJM

Failure to stabilize the channel could cause flooding, shifting of the channel and extensive erosion. In order to protect the health, safety and well-fare of the community, as well as a major State transportation component, it was felt essential that a bank protection program occur. This same conclusion was realized in the first phase of the project occurring between the Phoenix Airport and the Southern Pacific Railroad Bridge and subsequent bank protection is currently underway.

Impact. The negatives associated with channelization occur with the loss of floodplain storage and roughage resulting in changes to existing hydraulic conditions. Channelization requires the lowering/raising of channel banks and can have an impact on existing wildlife and vegetation.

Mitigation Measures. As indicated in the alternative analysis, much attention is necessary in selecting an alignment, profile, cross-section and method of stabilization that insures that minimal impacts are realized. Continued hydraulic modeling and channel design will assist in maintaining optimum channel standards.

The impacts associated with loss or damage to existing vegetation and wildlife necessitate a comprehensive wildlife mitigation plan. Tempe will work closely with both Federal and State Environmental agencies to ensure that a satisfactory mitigation plan is established. This plan will require the assessment of existing conditions and a methodology that not only restores but enhances the environment. The complexity of this plan will require assistance of both landscape architects and environmental specialists.

6. Storm, wave and erosion buffers

The Salt River is an ephemeral waterway. Utilized as a floodway channel for the last fifty years, requirements for storm, wave and erosion buffers are not applicable.

7. Erosion and accretion patterns

The current unstabilized condition of the Salt River allows both lateral and vertical changes in the river bed, as illustrated during flood flows in the 70's and 80's. During these flows, the valley experienced extensive property damage, untold traffic congestion and loss of life as a direct result of flooding and erosion. Channelization of the Salt River downstream of the study area has been completed for a distance exceeding 15 miles. With current transportation alignments and contemplated upstream channelization, it is essential that a planned methodology of flood and erosion control be implemented within the Tempe reach.

The Papago and Tempe Buttes create a geomorphic restriction on the Salt River creating cause for concern as channelization upstream of this site without protection of the study area could have severe flooding and erosion impacts.

Impact. Increased water elevations and velocity may be experienced as a result of narrowing the floodway while the current unstable river conditions have created erosion and accretion problems within the Salt River.

Constriction of the channel will require additional methods of lateral and vertical stabilization of the river. Channel design will need to focus on the protection or relocation of in-channel utilities, invert levels of the Indian Bend Wash confluence, reduction of velocity and lowering of surface water elevations.

Mitigation Measures. As previously approved by the Army Corp of Engineers and the U.S. Environmental Protection Agency for the first phase of construction, it is essential that a program of bank stabilization be initiated in the upstream reach of the project area.

Methods of bank protection should be designed and installed that will meet the goals and objectives described within the alternative analysis.

A comprehensive program for wildlife mitigation shall be presented to the U.S. Fish and Wildlife Service to insure the restoration and enhancement of the existing habitat areas.

8. **Aquifer recharge**

Studies conducted by the U.S. Bureau of Reclamation and Salt River Project in 1983 analyzed the ground water infiltration rate through the alluvial substrate of the Salt River during major flood events. At that time the infiltration rate in the McClintock Drive area was 1.3 ft/day, the highest within the Salt River. Aquifer recharge within the study area is expected to be be very high.

Impact. The construction of bank stabilization and grade control will have a positive effect on preventing erosion within the study area. It is expected that turbidity levels will be further reduced with the revegetation of the area.

EPA has identified portions of the study area as falling within a Superfund site. The construction of bank stabilization could disturb or come in contact with potential contaminants.

Mitigation Measures. Soil sampling should be conducted prior to construction to insure that the material removed, disturbed or relocated from the project area is free of contaminants. In the event that contaminants are found, all construction should cease until the appropriate agencies have been contacted.

9. **Baseflow:**

The baseline condition was analyzed using a two-dimensional modeling system developed by the U.S. Geological Survey for the Federal Highway Administration, known as "Finite Element Surface Water Model System," or simply "FESWMS".

Model input data consist of digitized terrain data, the design discharge, and hydraulic parameters. This modeling approach was chosen because of the complexity of the river conditions, which involve multiple and skewed bridges across the Salt River floodplain, figure 3.

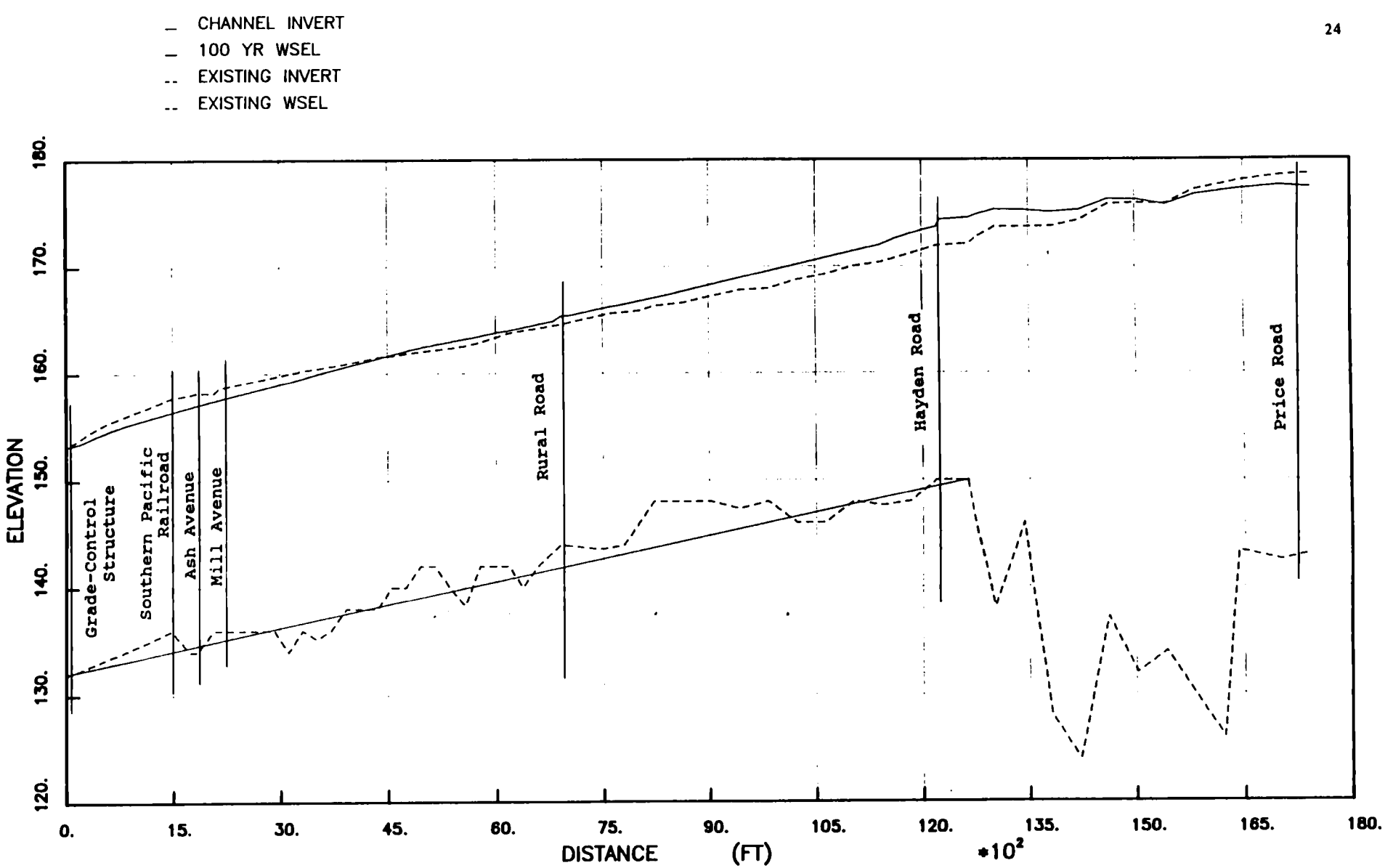


Figure 4.4 Baseline Water-Surface Profile

D. Biological characteristics and anticipated changes:

1. **Special aquatic sites (wetlands, mudflats, coral reefs, pool and rifle areas, vegetated shallows, sanctuaries and refuges)** (230.40-45)

Today the Salt River is characterized as an ephemeral river with flows regulated by upstream releases from dams operated by the Salt River Project and with unregulated flows due to flooding. The Salt River is generally dry and does not support special aquatic sites as defined in the 40 CFR 230.40-45 Guidelines.

The U.S. Fish and Wildlife Service has been consulted and no special aquatic sites are located within the project area.

Near term impacts on the project area from other sources are perceived to increase pressure on already degraded conditions. Specifically, new freeway construction throughout the project reach, new channelization below the project area, ongoing Superfund activities upriver, and the continuing neglect and abuse of this intensely urban area demand immediate, extensive restoration of the already damaged aquatic ecosystem.

Preservation of existing micro-climates and conservation of the remnant ecosystem overall require a coordinated effort.

The Salt River reach within the study area is a riparian ecosystem adjacent to a drainage way most easily characterized by plant species which differ from the immediate uplands. The City of Tempe joins the U.S. Fish and Wildlife Service in recognizing the opportunity to restore conditions of a desert riparian river system with all recreational and aesthetic benefits to both the public as well as to fish and wildlife resources.

The alternative selected for flood and erosion control would create the potential for future habitat areas. These sites could be selected and designed to control current unplanned easy access to remote project sites. Local ordinance would effectively designate specific habitat areas as sanctuaries and refuges. Where these areas are supplied by a permanent source of water, a special aquatic site may be designated to allow additional protection pursuant to 40 CFR 230.10 (a)(3).

IMPACT. EPA correspondence dated 12/29/89 recognized: "the Salt River within the project area has been significantly degraded and believes that the Rio Salado Project provides an important opportunity to enhance the aquatic ecosystem in this area." The development of flood and erosion protection measures proposed by the City of Tempe considers Section 404 (b)(1) Guidelines as minimum requirements for project performance.

MITIGATION. While the Salt River today is generally dry and does not currently support special aquatic sites as defined in the 40 CFR 230.40-45 Guidelines, the City of Tempe will continue to work with the U.S. Fish and Wildlife Service and Arizona Game and Fish to recognize and develop opportunities to restore conditions of a desert riparian river system with all recreational and aesthetic benefits to both the public as well as to fish and wildlife resources.

2. **Habitat for fish and other aquatic organisms:** (230.31)

Today the Salt River is characterized as an ephemeral river with flows regulated by upstream releases from dams operated by the Salt River Project and with unregulated flows due to flooding. The Salt River is generally dry and does not provide permanent habitat for fish and other aquatic organisms in the food web defined in 40 CFR 230.31.

Proposed flood and erosion control alternatives could provide enhanced habitat for fish and other aquatic organisms. Additional habitat for fish and other aquatic organisms in the food web could be made available in the form of surface waters. The City of Tempe has contracted for a Preliminary Study of Lake Design, Water Quality, and Lake Management Options for the Tempe Rio Salado Project submitted by Aquatic Consulting & Testing, Inc. This study has verified the potential for development of surface waters in conjunction with flood and erosion protection.

The introduction of fish and other aquatic organisms into the ecosystem will require a sound management, monitoring, and maintenance program. Development and implementation of a new fishing program will be subject to coordination with, and approval of, the U.S. Fish and Wildlife Service and Arizona Game and Fish.

Water sources for new habitat for fish and other aquatic organisms include Salt River flows, treated reclaimed water, and storm water runoff. If ground water recharge is allowed, it will impact the alluvial basins above hardrock plateaus. The City of Tempe has contracted for an Evaluation of Hydrogeologic Aspects of Potential Storage and Reuse of Wastewater throughout the city prepared by Kenneth D. Schmidt and Associates. This evaluation has verified the hydrogeological feasibility of water storage and recovery within the project area.

When groundwater recharge is controlled within managed basins it is considered part of an effective groundwater cleanup strategy. Remediation of the Indian Bend Wash South Superfund site will require continued coordination with Superfund personnel to ensure sustained program compatibility with ongoing surface and groundwater cleanup activities.

Water quality within the project area is subject to the standards adopted to protect aquatic and wildlife uses by the State of Arizona. Reclaimed water will be treated to near drinking quality standards and will undergo UV treatment to support fish and other aquatic organisms in the food web.

Revegetation of the project area will use native vegetation in habitat areas and will provide enhanced habitat for fish and other aquatic organisms in the food web as well as wildlife in general. Removal of non-native vegetation from habitat areas will be maintained so as to eliminate competition with native species and improve native survivability. As habitat within the floodway is subject to damage from flood events, the maintenance plan developed by the City of Tempe includes repair of damage and replacement of destroyed materials.

The alternative selected for revegetation provides for the establishment of indigenous emergent vegetation along the lowflow channel and surface waters. The City of Tempe will continue to coordinate with the Center for Environmental Studies at Arizona State University and the Nature Conservancy for riparian restoration.

IMPACT. The channel cross section is configured to include a lowflow channel designed to allow the pass through of mean Salt River Project (SRP) spills up to approximately 5,000 cfs. This controlled bypass will decrease the negative impact of nuisance flows on the aquatic ecosystems within the floodway and allow for reestablishment of plant and animal communities more consistent with historical conditions along a naturally flowing river.

MITIGATION. The channel is designed with the same hydrologic capacity as the previously permitted channel downstream to mitigate effects of downstream flows. The objective for the selected river cross section is to convey the design flood discharge through the reach with approximately the same hydraulic characteristics as the existing channel. The objective for river stabilization is to control lateral and longitudinal migration of the channel. In addition to achieving these basic project requirements, In-channel features have been designed to restore riparian areas and enhance aesthetic and natural values.

3. **Wildlife habitat (breeding, cover, food, travel, general):**

Historically, the construction of dams from the beginning of the century through 1945, reduced the Salt River discharge to small bypass flows from irrigation, except for periods of severe flooding. Beginning in the late 1940's the Salt River has been intensively used to supply aggregate resources for construction. This activity has resulted in the deeply incised channel discussed in Section E. The cumulative long term effects of infrequent, irregular river flows, extensive mining and post-mining operations, combined with increasingly intense urban competition has resulted in a substantially degraded environment.

The Salt River is a riparian area where an ecosystem exists because of the presence of enough water to sustain unique conditions. In Arizona, riparian areas are of great benefit and an integral part of a healthy economy and our outdoor quality of life. The riparian area is where people in Arizona recreate, mine, graze cattle, and harvest timber.

Today the project area is dominated by large expanses of cobble and rubble, 113 acres of desert scrub, and 23 acres of cottonwood/honey mesquite (USF&W, 1989). The cottonwoods and mesquites are primarily located in groves west of Mill Avenue although they are also found adjacent to the A.S.U. golf course south of the confluence with Indian Bend Wash. Typically, they are more dense along the river banks where storm water run off enters the river bed. Heavier vegetation occurs at the locations where City storm drains enter the river.

The desert scrub consists of a combination of plant types including numerous native shrubs, xeric grasses, woody herbaceous growth, intrusions of exotic plants transported from surrounding urban areas, and a continuously changing array of volunteer annuals. Scrub areas occur in irregular random locations within the river bed. They are found at river banks, channel depressions, and near other features which collect storm water. Desert broom, Quail bush, Brome grass, Brittlebush Burrobush, and Thistle are among the most common scrub species found. Salt cedar, an inefficient habitat plant, occurs frequently in the river bottom.

This area is part of a continuous wildlife corridor in the Salt River that provides foraging and/or breeding habitat for Gambel's quail, desert cottontail, verdin, red-tailed hawk, and other migratory birds.

IMPACT. Riparian areas provide some of the last remaining habitat for many resident and migratory birds, mammals, and reptiles in urban environments and are considered important amenities for public use activities such as wildlife observation.

Flood control and erosion protection provided by the Tempe Rio Salado Project will enhance the wildlife environmental quality of areas within and outside of the river channel. This channelization program is a continuation of the downstream project underway by the Arizona Department of Transportation (ADOT) and has been environmentally enhanced with this proposed habitat restoration over and above the ADOT project.

Off-Channel features have been designed to create floodwater storage areas adjacent to the river floodway. The objective is to establish locations of dynamic flood storage and to provide new riparian habitat. These non-conveying water storage areas will expand the natural riparian setting outside of the floodway boundaries and greatly enhance wildlife habitat values.

Thirteen acres of cottonwood/honey mesquite habitat would be lost due to project construction (USF&W, 1989). This area represents 56 percent of the primary wildlife habitat within the project area.

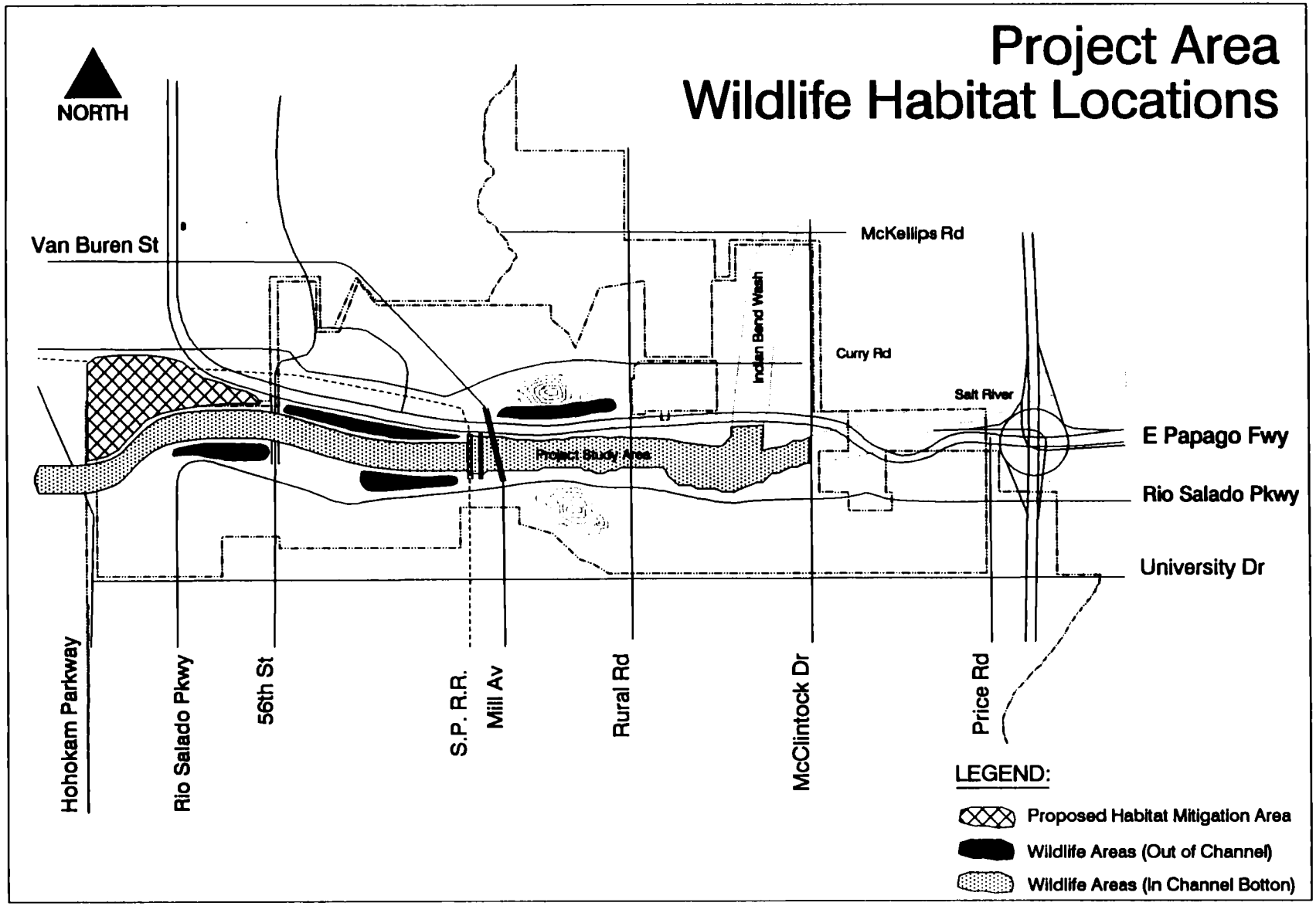
MITIGATION. The construction of both the freeway and flood control and erosion protection will have substantial effect on the Salt River area. To minimize the damage associated with past and future urban pressures on this riparian area, the City of Tempe has contracted for a Tempe Rio Salado Project Wildlife Habitat Master Plan prepared by Howard Needles Tammen & Bergendorf. This plan has been developed in cooperation with the U.S. Fish and Wildlife Service and the Center for Environmental Studies at Arizona State University.

The detailed provisions of this master plan have met regulatory requirements and propose the provision of additional functional habitat to be carried throughout the corridor, see Map 5.

Erosion control utilizes the alternative of rock gabions for armoring specifically to be compatible with a native vegetation habitat and to facilitate additional revegetation. Extensive restoration, conservation, and preservation of wildlife habitat exceeds requirements for mitigation and achieves the secondary project purpose of converting miles of dry river bed into an aesthetic environment.

4. **Endangered or threatened species:** (230.30)

Today the project area has been urbanized, redeveloped, taken out of agriculture and left vacant, or otherwise disturbed. The extent of this disturbance is so widespread as to greatly reduce the probability of the existence of endangered or threatened species as defined in 40 CFR 230.30. Moreover, previous inventories and assessments in the project vicinity (ADOT Environmental Assessment for State Route 153) have found no such extant species.



City of Tempe Community Development Department

Rio Salado Project

The U.S. Fish and Wildlife Service has been consulted and have not identified endangered species or their critical habitat within the project area.

IMPACT. Today only a few cottonwoods and willows survive at the margins of the scoured and desiccated riverbed. Perhaps because of their isolation, these pockets of greenery support a surprising amount of life, especially during bird migrations. Beyond the river~~ain~~ine environment, it is likely that the Lower Sonoran, Upland Division habitats of Papago Park are very similar to the way they were one hundred years ago.

MITIGATION. The creation of wildlife and aquatic habitats proposed in the Rio Salado Project could greatly increase the probability of reintroduction of endangered or threatened species within sanctuaries and refuges within the project area.

5. **Biological availability of possible contaminants in dredged or fill material:**

Flood control and erosion protection measures propose use of native soils from within the project area exclusively. No imported soils are anticipated to be required.

Native soils within the study area are potentially subject to contamination from several sources. First, during storm events, runoff makes its way into the Salt River channel either by overland flows or through collector systems. Overland flows transport various materials including sediment, oils, and lawn fertilizers typically associated with the surrounding urban setting. Minimal toxicity would be expected from overland flows.

Discharge from storm water collection systems would include potentially toxic materials generally associated with leakages from automobiles such as heavy metals, coolant, grease, oil, and gasoline. Six storm water discharge points exist within the project area and are subject to EPA National Pollutant Discharge Elimination System requirements. Five of the six points discharge into the river along the south bank.

These points are located west of Rural Road, west of Farmer Avenue, near the A.S.U. golf course, and at two points near McClintock Drive. The northern source is located east of Rural Road. Municipal testing at these storm water discharge points has not indicated contaminants in sufficient quantities to discount use of soils from the river channel in project construction.

Illegal surface dumping continues to be a problem along neglected areas of the river. As mentioned in Section E of this report, six former landfills are located within the project area. These landfills contain construction rubble, lawn and tree trimmings, and miscellaneous debris (Dames & Moore, 1987). Two of these sites have been developed over by Arizona State University.

Due to known ground water contamination, a portion of the project area between Rural Road and McClintock Drive has been designated as a Superfund site. Groundwater in this area is not anticipated to contact in-situ or relocated channel material as a result of project activities.

There are no known sources of persistent pesticides and no municipal records of petroleum spills within the project area. No information has been uncovered to indicate the probability of contamination of soils from storm water discharge, illegal dumping, landfills, or Superfund activities within the project area.

IMPACT. Pursuant to 40 CFR 230.60 (c), the discharge site is adjacent to the extraction site and subject to the same sources of contaminants, and materials at the two sites are substantially similar. Therefore, the fact that the material to be discharged may be a carrier of contaminants is not likely to result in degradation of the disposal site.

The proposed project will utilize relocated on-site soils for the construction of drainage control structures. No other discharge of dredged or fill material in waters of the United States is proposed. As such, the action under consideration is the redistribution of existing soil within the project area.

MITIGATION. Design for fill placement shall control dissolved material and suspended particulate to prevent carrying pollutants to less contaminated areas of the project.

Because the proposed action involves disturbance of large volumes of soil within the project area, the potential exists to encounter undocumented contaminated material. A complete testing program of groundwater and soils shall be undertaken during the design and construction phases to identify contaminated materials.

In the event that contaminated materials are encountered, immediate notification of the Arizona Department of Health Services, the Arizona Department of Environmental Quality, and the U.S. Environmental Protection Agency, will be coordinated to determine additional mitigation measures.

E. Human Use Characteristics and Impacts

1. Existing and potential water supplies

Within the project area, the City of Tempe has one municipal well site, however, no groundwater is anticipated to be used within this area.

Groundwater studies conducted by K.D. Schmidt and Associates indicated that the depth to groundwater within the project area varied from 30-50 feet.

Impact. Flood and erosion control will have a positive effect on existing and potential water supplies. Bank stabilization will create a barrier between existing landfills and the Salt River to prevent leachate from entering the floodflows and infiltrating the aquifer.

Stabilization of the river will reduce sediment transport. The types of bank protection and grade control will minimize erosion reducing turbidity levels.

Mitigation Measures. No mitigation measures are warranted at this time.

2. Water Conservation

Off-Channel features have been designed to create floodwater storage areas adjacent to the river floodway. The objective is to establish locations of dynamic flood storage and provide new riparian habitat. These non-conveying water storage areas will expand the natural riparian setting outside of the floodway boundaries and greatly enhance wildlife habitat values.

Only native, drought tolerant plantings will be used within the floodway and habitat areas.

Impact. Flood control and erosion control will indirectly impact the study area. Contouring of floodplain creates the opportunity to direct and control floodflows to better facilitate groundwater recharge.

Revegetation of the study area will require various levels of responsible maintenance based on knowledge of different areas ranging from wildlife and riparian areas to recreation uses. Revegetation will stabilize erosion in the study area.

Additionally, groundwater recharge could be enhanced in the study area by responsible maintenance of vegetative material.

The possibility exists for storing treated effluent in underground storage sites in the study area and would further aid the overall water conservation. This possibility exists as indicated in the report by K.D. Schmidt.

Mitigation Measures. None required at this time. Future plans for revegetation will need to be compatible with the intended uses and reflect a commitment to water conservation by use of low water use plant materials.

3. Recreational or commercial fisheries

There are no recreational or commercial fisheries in the study area. Tempe has discussed with the Arizona Game and Fish Department the potential for creating a urban fishing program after completion of the flood and erosion control programs required along the Salt River.

The City of Tempe has had discussions with the Arizona State University Center for Environmental Studies regarding the potential for reintroducing fish habitat areas. Permanent aquatic features could provide the opportunity for introducing the kinds of fish suitable to support recreational fishing, or they could be native species re-introduced in behalf of conservation.

Impact. Flood control and erosion control may provide the opportunity for future restoration of permanent aquatic features within the project area.

Mitigation Measures. No mitigation measures are warranted as part of flood and erosion control. On going lake design and water quality studies will provide a methodology for determining future aquatic opportunities.

4. Water-related recreation

There are no current water-related recreation activities in the study area. As previously mentioned, Tempe is studying the opportunities for the creation of water-based recreation within the project area.

Impact. Flood control and erosion control will provide an opportunity for future water-related recreation activities.

Mitigation Measures. No mitigation measures are warranted at this time.

5. **Aesthetics of the aquatic ecosystem**

Under present conditions, there is, at best, sporadic or seasonal emergence of various ephemeral aquatic ecosystems of negligible aesthetic value to the general public and property owners.

Impact. Flood control and erosion control provide for the future establishment and control of a sustainable aquatic ecosystem within the study area.

Mitigation Measures. No mitigation measures are warranted at this time.

6. **Parks, national and historic monuments, national seashores, wild and scenic rivers, wilderness areas, research sites, etc.**

There are no national/historic monuments, national seashores, wild and scenic rivers, wilderness area or research sites in the study area.

A small southerly portion of Papago Park is located between the East Papago Freeway and the Salt River. Location of the freeway was determined by the desire to protect as much of the park system as possible. This has resulted in the constraint of the Salt River just east of Mill Avenue. As the Papago Butte extends south towards the river, the East Papago Freeway follows this natural geomorphic form.

To assure access from the park to the Salt River, a series of bridge spans (approx. 600') were provided as well as two pedestrian/equestrian underpasses.

Impact. Flood control and erosion protection measures provide a mechanism to minimize any detrimental effect of floodwater on the Papago Park area.

Mitigation Measures. The master mitigation plan being developed will assure that the Papago Park area is connected to the Salt River wildlife corridor.

Additional study will be necessary to ensure that the flood and erosion control measures provide adequate protection of existing park lands.

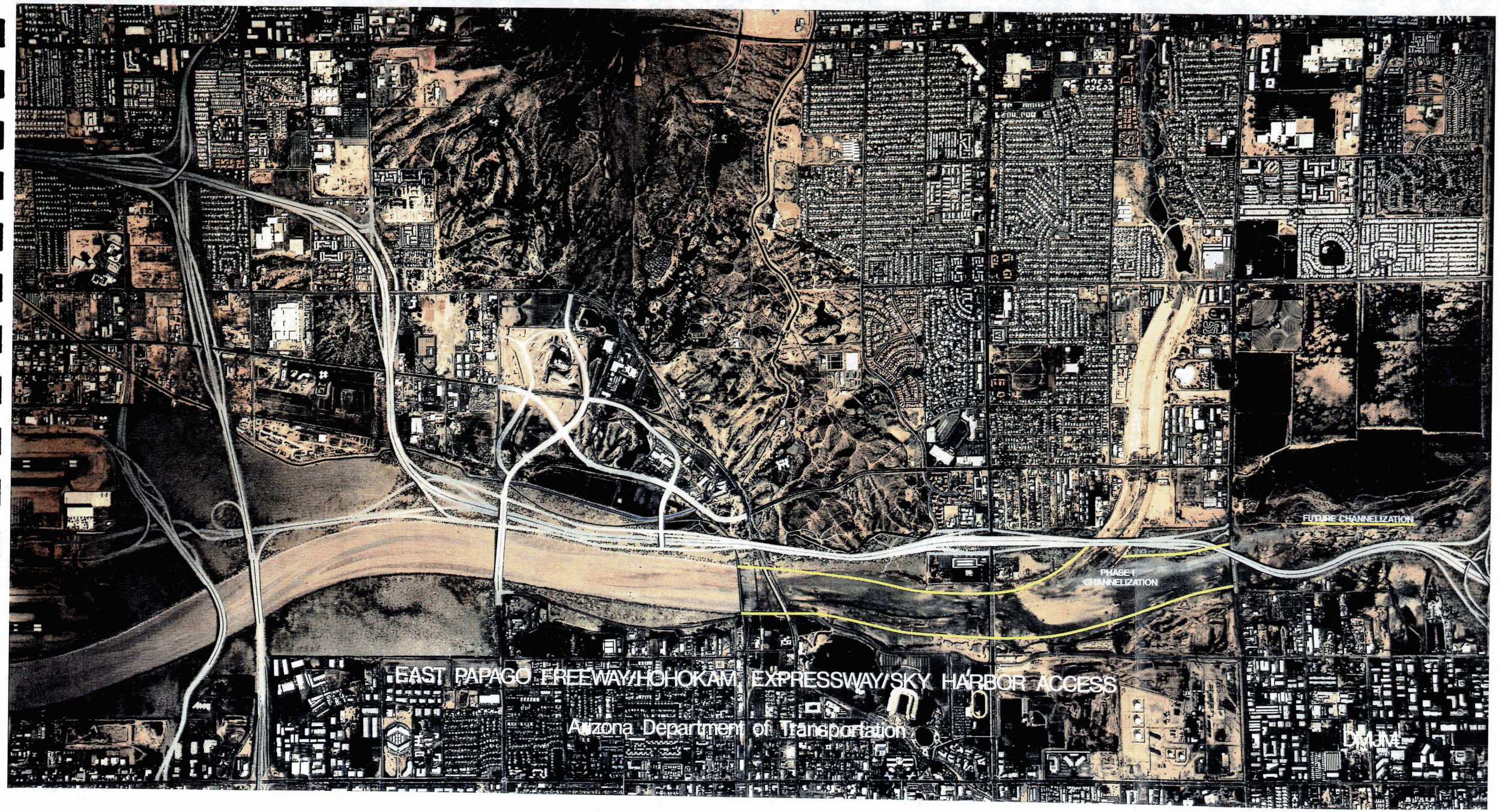
7. Traffic/transportation patterns

The traffic/transportation pattern, in the north-south directions are handled by major arterial streets and have three bridge crossings over the Salt River. At Mill Avenue, secondary dry-weather crossings are located within the Salt River.

The East Papago Freeway will provide a ten (10) lane transportation facility along the north bank running east and west. This one of the primary transportation components within the Phoenix metropolitan area. The East Papago Freeway connects to the I-10 to the west and the Outer Loop, Red Mountain, Pima and Superstition Freeways to the west. This important transportation corridor connects the entire East Valley Communities with the greater Phoenix area (See Figure 4).

When flooding occurs, the north-bound traffic on Mill Avenue is re-routed onto the one-way Mill Avenue bridge. The result is a 50% reduction in transportation capacity.

The Rio Salado Parkway is an east-west arterial that parallels the south bank of the river above the 100 year flood level except for the Mill Avenue area. At this location, the Rio Salado Parkway dips down into the river bed to pass under the existing Southern Pacific Railroad, Ash Avenue and Mill Avenue bridges. In a major flood event, this roadway is closed at Mill Avenue.


FUTURE CHANNELIZATION
PHASE I
CHANNELIZATION
EAST PAPAGO FREEWAY/HOHOKAM EXPRESSWAY/SKY HARBOR ACCESS
Arizona Department of Transportation

The bridged crossings at Rural Road and McClintock Drive are designed in such a manner that the approaches to the bridges are washed out in a major flood event. This places a severe constraint on the Mill Avenue bridge.

Impact. The proposed channelization will necessitate the removal of the at-grade river crossings at Mill Avenue. A proposed second bridge at Mill Avenue however, could alleviate this problem.

The channel dynamics as studied could provide considerably more flood protection at the arterial crossings on Rural Road and McClintock Drive. This flood control project would eliminate the potential loss of these crossings by containing the river flow under the bridges.

The Rio Salado Parkway is currently located within the channel bottom. The recommended channel cross-section would place the Rio Salado Parkway on a terraced shelf. This location would provide flood protection of this arterial street to the 50 year flood event level. The proposed location would provide a significant upgrade from existing conditions.

The location of the East Papago Freeway is such that it conflicts with the current river alignment in several locations. This flood and erosion control project will provide for the safe operation of this major transportation facility.

Channelization will have an impact on the existing bridges at Mill Avenue.

Mitigation Measures. Channelization will require the replacement of the at-grade crossings at Mill Avenue. Continuation of current studies for the location of a second bridge should be given a high priority to minimize impacts on the arterial street traffic.

Additional study should be undertaken to ensure the structural integrity of the existing historical bridges at Mill Avenue.

8. Utilities

The Salt River has a history of being used as a utility corridor. The municipalities of Phoenix and Tempe use it as a location for storm sewer, water and wastewater trunk lines. The Arizona Public Service and Salt River Project use it as a primary corridor for the distribution and transmission of electricity.

An existing irrigation canal is located parallelling the north bank just outside of the study area and provides a source for irrigation water.

Southwest Gas Corporation, Dimension Cable TV, Southern Pacific Railroad as well as Mountain Bell also contain facilities within the project area.

Impact. Flood control will have an impact on utility facilities and their ultimate location/protection in the study area. While some facilities will need to be relocated, the majority are provided with an additional level of bank protection and erosion control.

The relocation of the overhead utilities out of the Salt River channel will add to their overall protection during a flood event while improving the overall aesthetic appearance of the environment. The potential for loss of electricity will be significantly reduced.

The major sewer and water trunk lines within the channel and bank area will be protected from erosion and damage. Of primary importance is the multi-city sewer line that has been ruptured in the past during flood flows. Rupture of this facility could have a significant impact on water quality.

Economic impacts will be associated with the protection or realignment of major utilities.

Mitigation Measures. Coordination with all the utility concerns has been maintained through regular Rio Salado Task Force meetings, and many other meetings, to assure that all utility services are maintained.

Channel design will need to address the location, protection and potential relocation of these facilities.

9. **Navigation**

The location and original basis of Tempe, as revealed in its name of origin, was Hayden's Ferry. It was established to provide a crossing of what was then a navigable river, based on seasonal flows of the Salt River int his study area. However, the building of dams in the early 1900's, changed the character of the river. By the mid 1940's the river ceased to flow. With no regular flow of water, it is essentially a dry river bed with the only flows occurring when water was released upstream. These release occur during critical times of excess water in the overall system, or with seasonal or periodic desert rainstorms that naturally accumulate in the riverbed, added to by the directed run-off from overall urban development.

Impact. The need for water storage and flood control mandate that the river bed will not return to it's previous status as a navigatable waterway. This project will insure that stability of the Salt River by providing flood and erosion control to minimize the detrimental effects on floodwater on the study area.

Mitigation Measures. No mitigation measures are warranted.

10. Safety

Safety is of utmost concern in the study area, in trying to protect the individual user of property.

Under present flood conditions, there is little pro-protection for property as the flood waters slowly climb the unprotected banks. On occasions, out of frustration, there have been attempts to cross the flooded river, and the result has been loss of life and property.

In previous years, substantial damage as been inflicted on the study area. The bridges at Rural Road and McClintock Drive have been destroyed and replaced. The Arizona State University constructed a parking lot too close to the Salt River, only to see it destroyed by erosion within a year of construction.

Impact. Flood and erosion control will have a positive impact on the study area. The construction of a planned system of bank protection will insure the safety and availability of all bridged river crossings. The protected banks will also minimize any damage of floating debris to bridges.

The containment of flood flows within a specific channel will provide for the safety of private and public properties surrounding the river. Bank protection will ensure that developments adjacent to the river will not be lost or damaged.

The protection of all bridged crossings will eliminate traffic congestion due to the loss or restriction of the area's transportation system during flood flows. The general health, safety and welfare of the community will be enhanced by the containment of the Salt River within a specified channel.

Mitigation Measures. Channel design should take into consideration all aspects of public safety. Channel capacity should be such as to ensure that private/public property and major transportation systems are protected from flood damage.

11. Air quality

This project will have no impact on air quality upon completion. During construction, mitigation measures will be required to provide adequate levels of dust protection.

12. Noise

Noise in the study area is generated from a variety of sources. Aircraft, trains, cars, buses, trucks, motorcycles, lawn mowers, air conditioning, compressors, constructions, as well as any number of outdoor activities contribute. Many of these noises and their generators are accepted as indigenous noise levels associated with urban life.

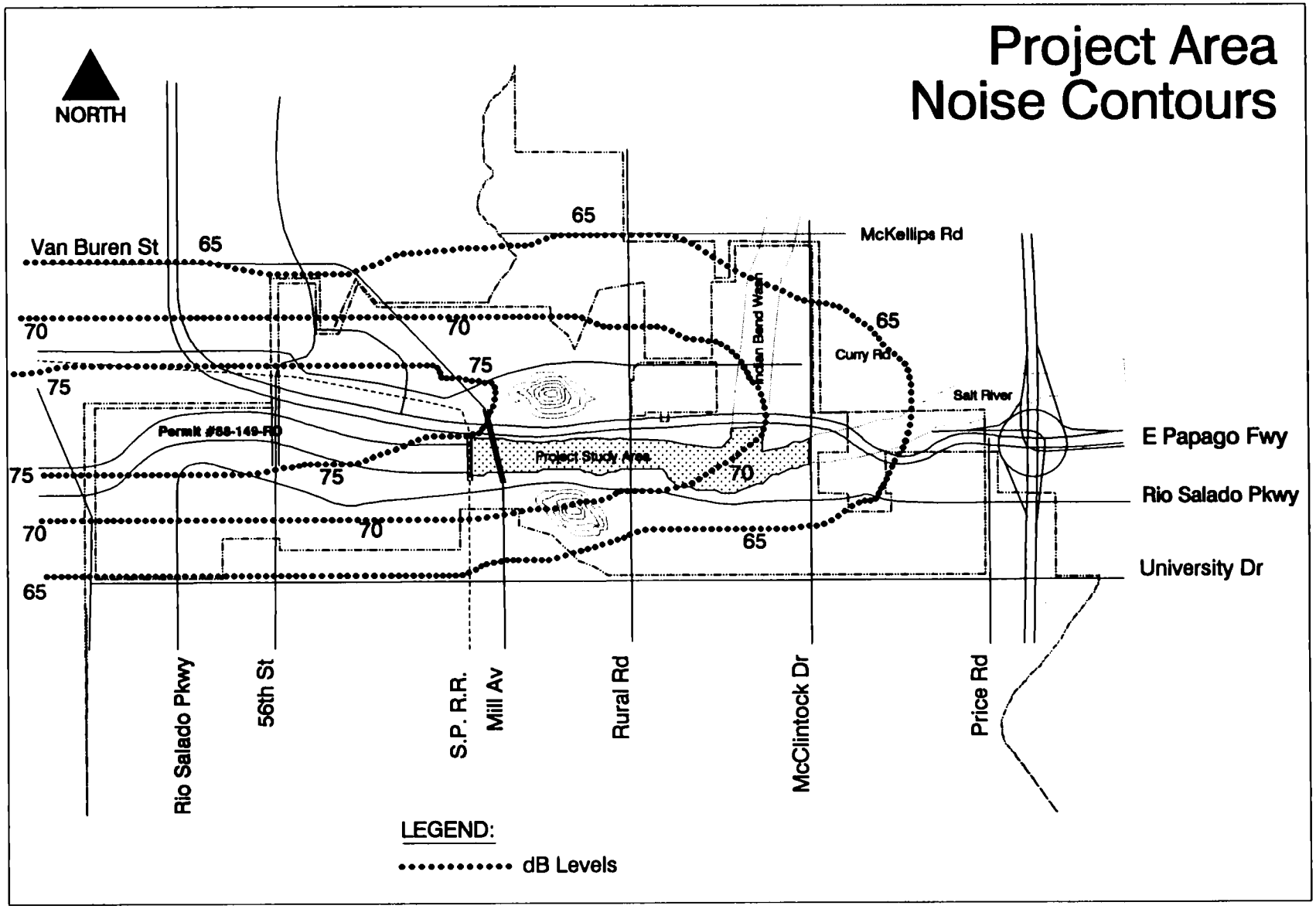
The northern portion of Tempe, as well as the Salt River channel are in the flight paths of Sky Harbor International Airport. An extensive Noise Compatibility Study, mandated by part 150 of the Federal Aviation Regulations, was performed by Coffman Associates, as part of the expansion of Sky Harbor International Airport.

The study area is within the three noise contours ranging from 75 Ldn at the Southern Pacific RR Bridge to 65 Ldn at Hayden Road, (see Map number 6).

Impact. The proposed flood control and erosion control project will have no impact on noise in the study area.

Mitigation Measures. No mitigation measures are warranted.

Project Area Noise Contours



City of Tempe Community Development Department

Rio Salado Project

13. Historic/Archeological Properties

This study area has several historic structures. These are:

1) The Tempe Concrete Arch Highway Bridge (commonly referred to as the Ash Avenue Bridge), which was constructed in 1911-13. It is listed in the National Register of Historic Places.

2) The Salt River Southern Pacific Railroad Bridge, which was constructed in 1912. It is listed on the National Register.

3) The Tempe Mill Avenue Bridge, which was constructed in 1931. It is listed on the National Register.

4) A series of four concrete piers. These piers were supports for the steel bridge, constructed in 1902-1903 for the Phoenix and Eastern Railroad. The railroad line linked Phoenix, Tempe and Mesa to the mining town of Winkelman, Arizona. The bridge was apparently abandoned in the early 1920's. It was removed and scrapped in 1926.

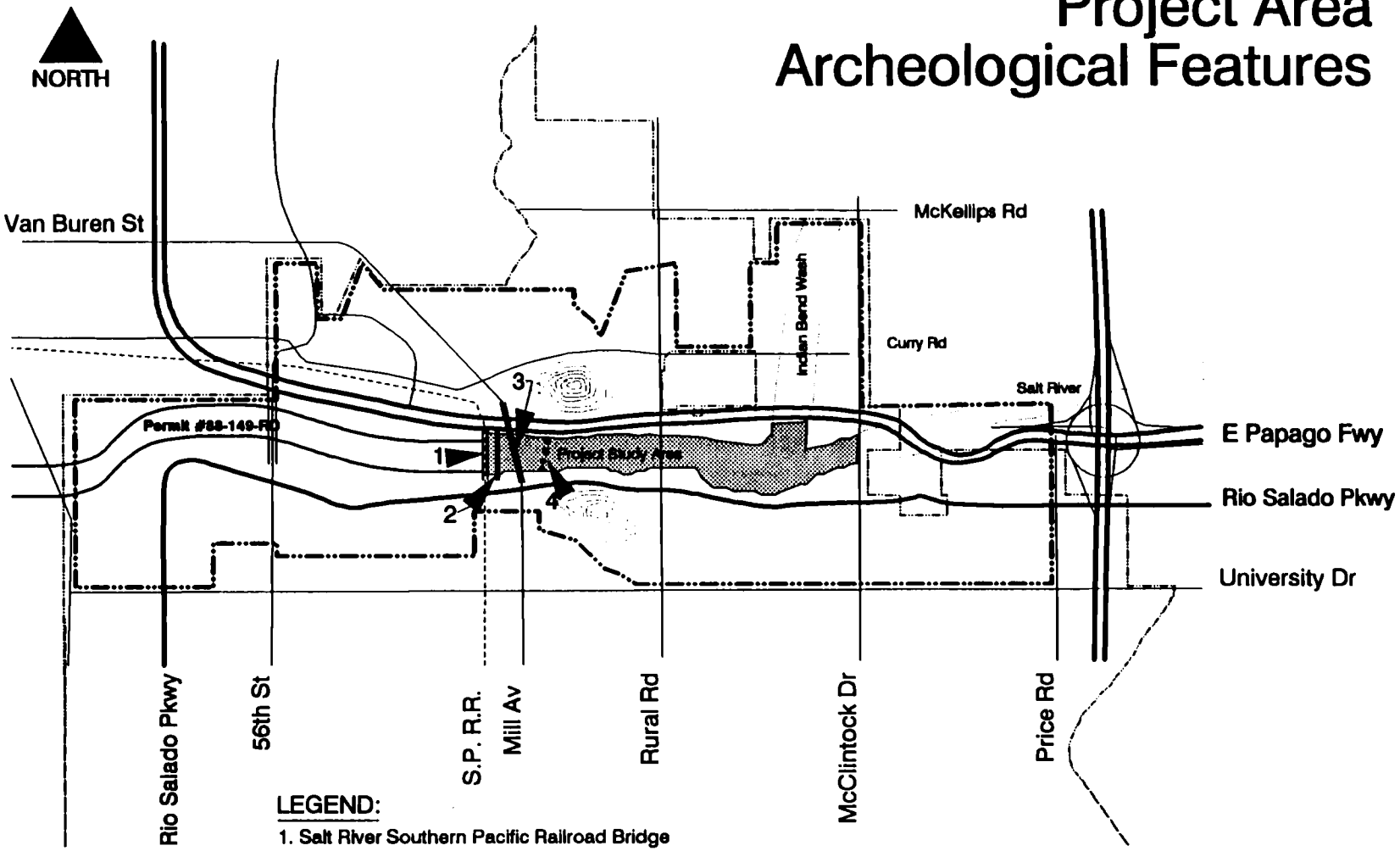
There are no other known historical/archeological properties in the study area, (see Map number 7).

Impact. The Stone study indicates that the bridges do not appear to be directly impacted by flood control and erosion control. The P & E Railroad Bridge will be directly impacted by this project.

The direction of flow and velocity have a direct impact on the historic structures.

Mitigation Measures. The Stone study recommends that if impacts on the bridges can be identified as study area plans develop, mitigation measures should be pursued as appropriate. The City of Tempe has currently initiated a structural survey of the Ash Avenue bridge.

Project Area Archeological Features



LEGEND:

1. Salt River Southern Pacific Railroad Bridge
2. Tempe Concrete Arch (Ash Avenue) Highway Bridge
3. Tempe Mill Avenue Bridge
4. Site AZ U:9:80 (ASM), Pears from P/E Railroad

Pers

City of Tempe Community Development Department

Rio Salado Project

The P & E Railroad piers, according to Stone, would not qualify for the National Register of Historic Places. However, the report does go on to state that the site would qualify for the Arizona Register of Historic Places. Mitigation in this case would involve documentation according to the standards established by the State Historic Preservation Act (A.R.S. Section 41-863) as revised April, 1987. Documentation would also include a brief narrative history of the Phoenix and Eastern Railroad.

14. **Land Use Classification**

North side of the Salt River. The immediate area between the Southern Pacific RR Bridge and Mill Avenue is presently vacant. The site will have no vehicular access and is currently planned as a transition area to a passive recreation park located immediately west. The area east of Mill Avenue is dominated by Tempe Papago Park.

A relatively small area is reclaimed between the channel and existing industrial/commercial development on the west and east sides of Rural Road. This area is currently vacant and designated as mixed use commercial in the Tempe 2000 General Plan. The remaining north bank will be occupied by the East Papago Freeway currently under construction.

South Side of the Salt River. From the Southern Pacific RR Bridge to Mill Avenue the land is in City parkland known as Tempe Beach Park. This project has minimal impact on this facility.

Along the east side of Mill Avenue the property is owned by the City of Tempe and currently vacant. This site is located below the 100 year flood event level and subject to inundation during major flood flows.

Further east, extending to Rural Road, property owned by Arizona State University extends into the middle of the Salt River. Portions of this property contain surface parking for the university, as well as numerous athletic facilities.

The land between Rural Road and McClintock Drive is primarily owned by Arizona State University. The one exception, is a private property owner, Tempo Investments. This site has recently received a 404 permit to construct a similar flood and erosion control project to the recommended channel alignment reflected in this document. The university property is developed as an 18 hole golf course and associated parking. Portions of this course are constructed within the existing floodway.

Impact. Flood control will impact land use in this study area to the extent that it will extend recreational amenities and opportunities in areas previously unprotected. Flood and erosion protection will be possible for all surrounding properties in excess of the standard project flood.

As proposed, the project will provide a level of flood protection for the golf course beyond that which it currently has.

Mitigation Measures. No mitigation efforts are warranted.

15. Economics

The containment of the Salt River within the project area will have a significant economic impact on existing development. As illustrated in figure 2, a substantial area is removed from both the standard project flood and the 100 year flood event. Millions of dollars have been lost due to destroyed bridges, roads, utilities and existing development.

Because of the current potential for flooding, the land adjacent to the Salt River has historically contained transient type uses with low to substandard development levels.

The enhancement of the area will provide significant economic development opportunities to the City of Tempe and existing property owners. The majority of the land reclaimed by channelization is owned by one of the largest universities in the country. This land was previously used as a overflow parking for the university related athletic facilities. It is anticipated that this land will be used for the benefit of the university.

Impact. This project will have a positive effect on the economic development of the area. The stabilization of the Salt River within Tempe will be a catalyst for upgrading existing landuses and developments.

Upon completion, this project will provide for potential recreation-oriented uses and specialty commercial use in the study area on current flood prone lands.

Mitigation Measures. Mitigation measures are not warranted.

16. **Prime and unique farmland** (7CFR Part 658)

There is indication that the study area has had a history of agricultural activity, but none remains today.

17. **Food and fiber production**

There is no production of food and/or fiber presently, nor is there any plan for production, in the study area.

18. General water quality

Water in the study area will come from varied sources. These include random and collected/directed stormwater runoff, surface water from the river.

The general flow of groundwater in the study area is to the west-southwest. Groundwater levels vary from 30-50 feet according to a report done by K.D. Schmidt and confirmed by the report prepared by Salt River Project.

Low level contaminants of varying types and degrees have been discovered. Due to the migratory nature of water in the study area, as verified in the Schmidt and SRP reports, sources have not been readily determined.

There has been considerable study done by the EPA at monitored well sites along the Indian Bend Wash, to determine the effects of landfills on water quality. Extensive study has shown that groundwater, due to its depth of 130 feet, has not been contaminated by tested landfills in the study area. The levels of compounds referenced under the Primary Drinking Water Standards were acceptable in the study area.

Additional study was done by the Salt River Project on landfills used by SRP. One landfill, labelled the Hayden Road landfill, is in the study area. Test analysis indicated that, according to the standards of the Secondary Drinking Water Standards, the water was in compliance.

Impact. There are no anticipated impacts on quality of water as a result of this project.

Mitigation Measures. No mitigation measures are warranted.

19. **Mineral needs**

Geologic study and field investigation indicate an abundance of sand, gravel, cobbles and boulders. At present, there are no active sand and gravel mining operations within the study area.

No petroleum, coal or precious metals have been detected in the study area.

Impact. There are no anticipated impacts associated with the construction of this project as it relates to mineral needs.

Mitigation Measures. No mitigation measures are warranted.

20. Consideration of Private Property

The proposed flood control project is a coordinated effort between governmental and private property owners.

There is a single private property owner within the study area. This site consists of approximately 80 acres with 33 acres developable after channelization. The owner applied for and received a 404 permit #88-031-RD in 1988, however work has been delayed pending approval of this application.

Impact. Located just west of the ASU golf course, this private property will benefit greatly from the construction of the proposed flood and erosion control. As it presently exists, the majority of the site falls within the floodway. Upon completion of channelization, over 25 acres of land is reclaimed.

Mitigation Measures. No mitigation measures are warranted.

21. **Landfills.**

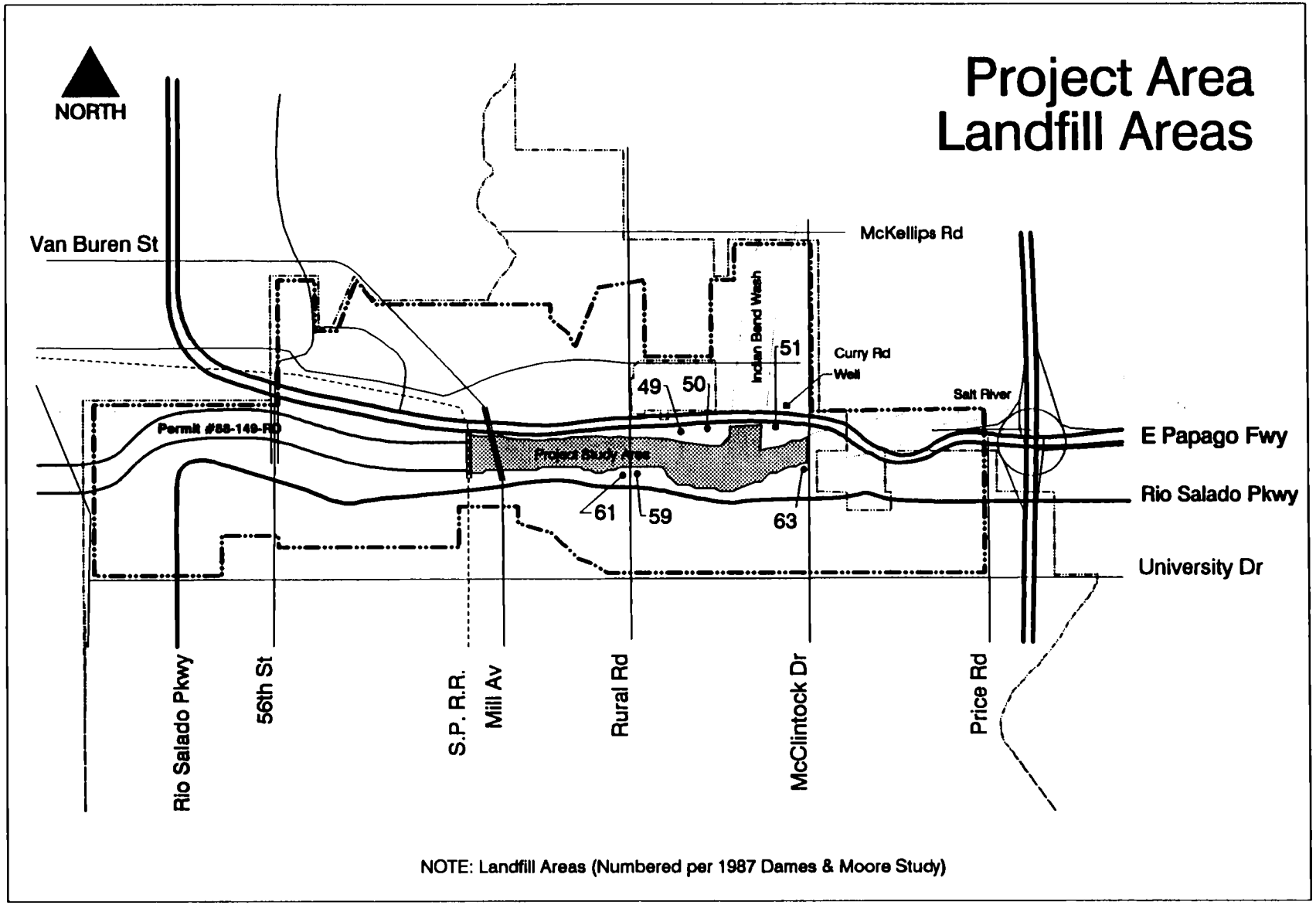
The Dames and Moore study identified six landfill sites in the study area. The numerical listing according to the report is as follows: #49, 50, 51, 59, 61, and 63.

UNTRUE

Two of the identified sites, #59 and #63, have been incorporated into the Arizona State University's Karsten Golf Course. Prior to construction an environmental assessment was prepared with recommended mitigation measures. The Dames and Moore report indicated that it contained construction rubble and debris.

Site #61 is presently part of an Arizona State University parking lot. The Dames and Moore report indicated that its contents were construction rubble and debris. Specific contents unknown.

Site #49, #50 and #51 are in, or adjacent to, the East Papago Freeway (State Route 217) right-of-way. This project's Environmental Assessment was prepared by John Carollo Engineers with recommended mitigation measures. The Dames and Moore report did not list any hazardous waste materials or chemicals as being present at these three sites, (see Map number 8).



City of Tempe Community Development Department

Rio Salado Project

Impact. This flood and erosion control project will provide a positive barrier between located landfills and potential sources of water.

Project construction could encounter landfill materials during excavation. Delays in construction could lengthen construction timing and add to project costs.

Mitigation Measures. As previously discussed, soil sampling will be completed prior to construction.

Should construction activity in the channel expose problems in the landfills, further geotechnical testing will be undertaken to determine extent and contents in these landfills. The appropriate agencies will be notified and a methodology for treatment and removal will be implemented.

22. **Visual considerations**

Under present conditions the study area offers little if any visual consideration for the general public. It carries with it the appearance of a wasteland, pocketed with scrub plant material and utility lines.

However, there are times when the vastness and openness that is a characteristic of the desert makes its presence felt. This conjures up a mental image reinforced by photographic images of times when the Salt River flowed freely and served to nourish and sustain riparian vegetation.

The Papago and Tempe Buttes offer a scenic backdrop to one of the largest open spaces remaining within the community.

Impact. Urbanization and the elimination of the flowing river in the 40's has altered the panoramic view that settlers to the area enjoyed. This project for flood and erosion control provides an opportunity to restore and enhance the forgotten Salt River.

Future opportunities for the development of permanent aquatic features and riparian landscaping in conjunction with active and passive recreation are exciting opportunities.

Bank protection can take on many forms, both negative and positive. The requirements for stability must be weighted in conjunction with construction costs, aesthetic appearance and habitat value.

Mitigation Measures. The sloping of the channel at a 3:1 slope and incorporating ramps and terraces, using soil plating within the channel will assist in the visual appearance of the project. Utilizing bank stabilization measures such as soil cement and gabions provide the opportunity to enhance the effort of straight-forward, engineered flood control. Stabilizing the study area allows for improvement of its overall visual character.

Sensitive treatment of grade control structures, utility relocations, roadways, etc. provide for positive enhancement of the project area.

There is at present an on-going effort between various firms and agencies studying riparian areas and plant material within the study area to further the effort of visually re-establishing the character of the Salt River.

Effort should be made to work with the utility companies to further study ways to mitigate the visual impact of their facilities on the project area. The Salt River Project and Arizona Public Service Company should be encouraged to underground or relocate overhead utility lines where ever possible.

F. Summary of Secondary and Cumulative Effects

Secondary Effects

Flood and erosion control in the study area will have the long-range impact of re-introducing, or better yet, re-incorporating a generally ignored, undesired, unkempt and unruly, as well as unpredictable element of nature, into the complex urban fabric of Tempe, Arizona. The goals of the Rio Salado Project are to aid in, water conservation, groundwater recharge, to further an array of visual considerations, to establish recreational and educational opportunities as well relocating/eliminating potentially detrimental land uses that currently exist along the Salt River.

Cumulative Effects

Flood and erosion control in the study area will affect property protection, allow for revegetation, help protect and keep operational the transportation corridors in everyday and critical situations.

References

Amalfi, F.A. 1988. Preliminary Study of Lake Design, Water Quality, and Lake Management Options for the Tempe Rio Salado Project for CRSS, Inc. Aquatic Consulting and Testing, Inc., Tempe, Arizona.

Amalfi, F.A. 1990. Aquatic Ecosystem and Organism Determination for HNTB, Inc. Aquatic Consulting and Testing, Inc. Tempe, Arizona.

Anderson, B.W. and R.D. Omart. 1984. A Vegetation Management Study For The Enhancement of Wildlife Along The Lower Colorado River. for U.S. Bureau of Reclamation contract 7-07-30-V0009.

Arizona Game and Fish Department. 1989. Correspondence dated 12/26/89 to Colonel Charles Thomas: Re: Public Notice 89-272-CL. Phoenix, Arizona.

John Carollo Engineers. 1987. Draft Environmental Assessment for State Route 217, the East Papago Freeway, for the ARizona Department of Transportation and the U.S. Army Corp of Engineers. Phoenix, Arizona.

Coffman Associates. 1987. Federal Aviation Regulations-Part 150-Noise Compatibility Study for Sky Harbor International Airport for the City of Phoenix, Aviation Department, Phoenix, Arizona.

Commission on the Arizona Environment. 1988. Riparian Resource Report - Summer Conference 88. Phoenix, Arizona.

Costle, D.M. 1980. Administrator, Environmental Protection Agency Commentary on Revisions to CFR 230 - Section 404(b)(1) Guidelines for Specification of Disposal Sites For Dredged or Fill Material. Federal Register Vol 45 No. 249 12/24/80.

CRS Sirrine, Inc. 1989. Rio Salado Channel Improvements, Working paper on existing conditions & alignment alternatives perpared for the Rio Salado Task Force, City of Tempe. Phoenix, Arizona.

Dames & Moore. 1987. Plan of Action and Cost Estimates for Investigation and Remediation of Waste Sites within the Master Plan Area for the Rio Salado Development District. Phoenix, Arizona.

Howard Needles Tammen & Bergendorf. 1990. Tempe Rio Salado Project Wildlife Habitat Master Plan and Draft Report for the Rio Salado Task Force, City of Tempe. Phoenix, Arizona.

Ohmart, R.D. 1982. Past and Present Biotic Communities of the Lower Colorado River Mainstem and Selected Tributaries. Vol. IV. Bureau of Reclamation Contract 7-07-30-V009.

References (continued)

Ohmart, R.D., B.W. Anderson, and W.C. Hunter. 1988. The Ecology of the Lower Colorado River from Davis Dam to the Mexico-U.S. International Boundary: A Community Profile. USDI Fish and Wildlife Service and USEPA.

Randall, K. 1990. Center for Environmental Studies, Arizona State University. Affected Environment - Existing Project Area Wildlife - Revegitation Techniques. Tempe, Arizona.

Ruff, P.F. (ed.): 1970. Water Resource Systems: Lecture Series. College of Engineering Sciences, Arizona State University. Tempe, Arizona.

Salt River Project Landfill Task Force/Water Quality and Geohydrology Department. 1987. Landfill Site Characterization Study, Water Quality and Geohydrology Study. Phoenix, Arizona.

K.D. Schmidt and Associates. 1988. Evaluation of Hydrogeologic Aspects of Potential Storage and Reuse of Wastewater Effluent in the City of Tempe for the City of Tempe, Arizona Water/Wastewater Division. Phoenix, Arizona.

Sergent, Hauskins & Beckwith. 1988. Preliminary Geotechnical Report Design Section 7 - Salt River Channelization for East Papago - Hohokam - Sky Harbor Freeways, for Arizona Department of Transportation. Phoenix, Arizona.

Simons, Li and Associates, Inc. 1989. Rio Salado Channel Improvement Mill Avenue to Hayden Road Report for the City of Tempe, Arizona. Tempe, Arizona.

Stone, L.M. 1990. Cultural Resources (Archeological) Survey for the Proposed Channelization/Levee Construction Element of the Tempe Rio Salado Project in Tempe, Arizona, Maricopa County, Arizona. L.M. Stone, Archeological Research Services, Inc., Tempe, Arizona.

Tempe Community Development Department. 1982. City of Tempe Rio Salado Plan covering the goals, objectives and implementation program for the Tempe City Council. Tempe, Arizona.

U.S. Bureau of Reclamation & Salt River Project. 1983. Streamflow losses and changes in ground-water levels along the Salt and Gila Rivers near Phoenix, Arizona. Tucson, Arizona

U.S. Department of Agriculture, Soil Conservation Service. 1974. Soil Survey for Eastern Maricopa and Northern Pinal Counties Area, Arizona. Washington, D.C.

References (continued)

U.S. Environmental Protection Agency. 1980. PART 230-SECTION 404(b)(1) Guidelines for Specification of Dredged or Fill Material. Federal Register Vol 45 No.249 12/24/80.

U.S. Environmental Protection Agency. 1989. Correspondence dated 12/29/89 to Colonel Charles Thomas: Subject: Public Notice 89-272-CL. San Francisco, California.

U.S. Fish and Wildlife Service, Ecological Services. 1989. Correspondence dated 12/22/89 to Colonel Charles Thomas: Re: Public Notice 89-272-CL. Phoenix, Arizona.

Yocom, Thomas G. with R.A. Leidy & C.A. Morris. 1989. Wetlands Protection Through Impact Avoidance: A Discussion of the 404(b)(1) Alternatives Analysis. San Francisco, California.