

**SUMMARY
FEASIBILITY REPORT**



**RIO SALADO
FEASIBILITY REPORT**
U.S. Army Corps of Engineers, Los Angeles District
Non Federal Sponsors:
City of Phoenix
City of Tempe

PUBLIC SUMMARY REPORT

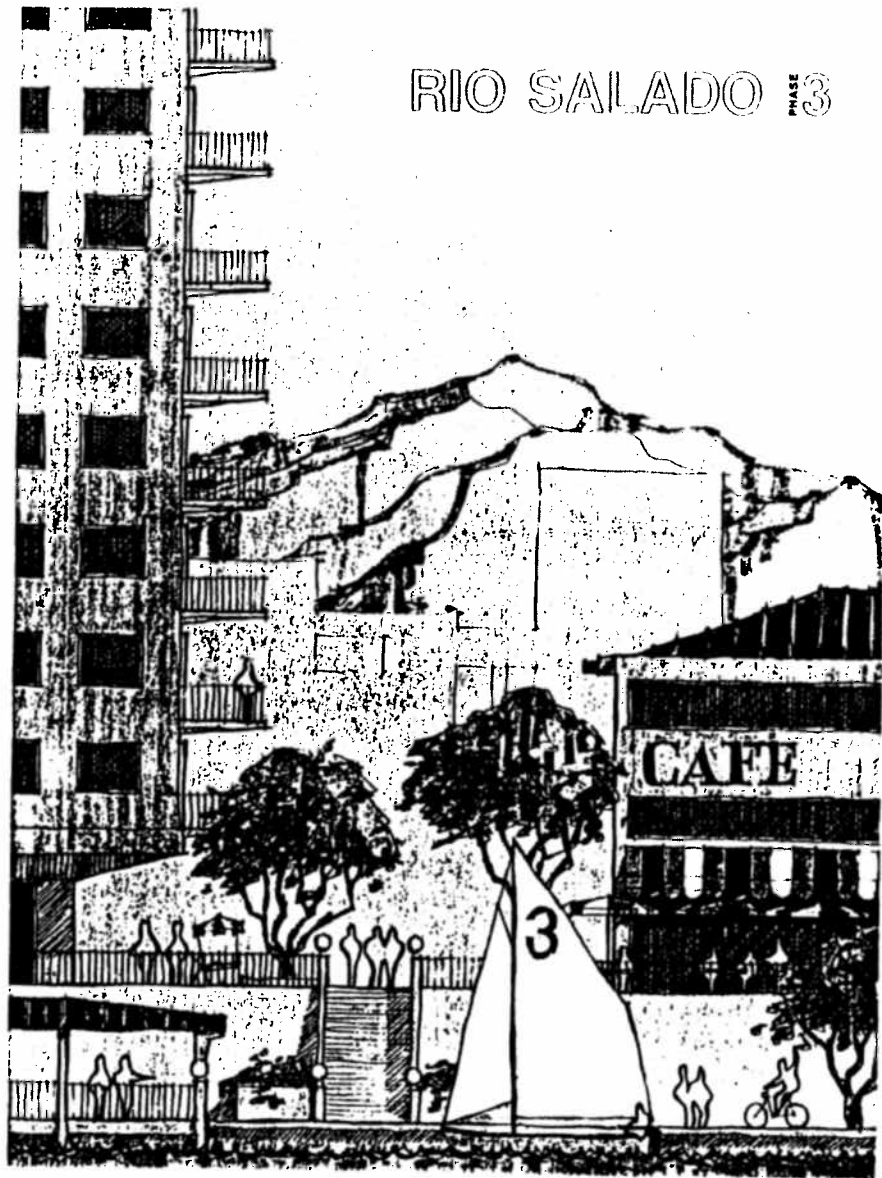
Summary Report prepared by the Phoenix Planning Department
December 1997

INTRODUCTION

The time is at hand to fulfill the long-held dream of restoring the Salt River corridor, by implementing the Rio Salado Project. Just released by the U.S. Army Corps of Engineers is a draft Feasibility Report for construction of habitat restoration features in Phoenix and Tempe. The study, upon final approval by the Corps, will be the basis of the request for federal authorization to build this first phase of the Rio Salado in Phoenix. The two cities are the non-federal sponsors of the Corps' project and have partnered in creating the designs for construction of the Rio Salado. In Tempe, the project will be located in the Tempe portion of Indian Bend Wash and upstream and downstream from the Tempe Town Lake, now under construction, and in Phoenix, from the Interstate 10 bridge crossing of the Salt River, next to Sky Harbor Airport, west to 19th Avenue.

Release of the draft Feasibility Report initiates a 45 day public comment period during which the Corps solicits comments on the plan from the general public. The purpose of this report is to present a summary of the plan and supporting data for more convenient review by interested persons.

The Corps Feasibility Report is a 1000-plus page technical report assembling a comprehensive summary of data on the river corridor, presenting an array of alternatives for restoration of the river along with a recommended plan, and listing estimated costs and other significant data to support the plan. The report also includes an environmental impact statement. Copies of this report are available for review at the Phoenix Central Library and the Ocotillo and Harmon branch libraries as well as at the Phoenix Planning Department. In Tempe, copies are at the Tempe Public Library, Arizona State University main Campus Library and in the Tempe Rio Salado offices.



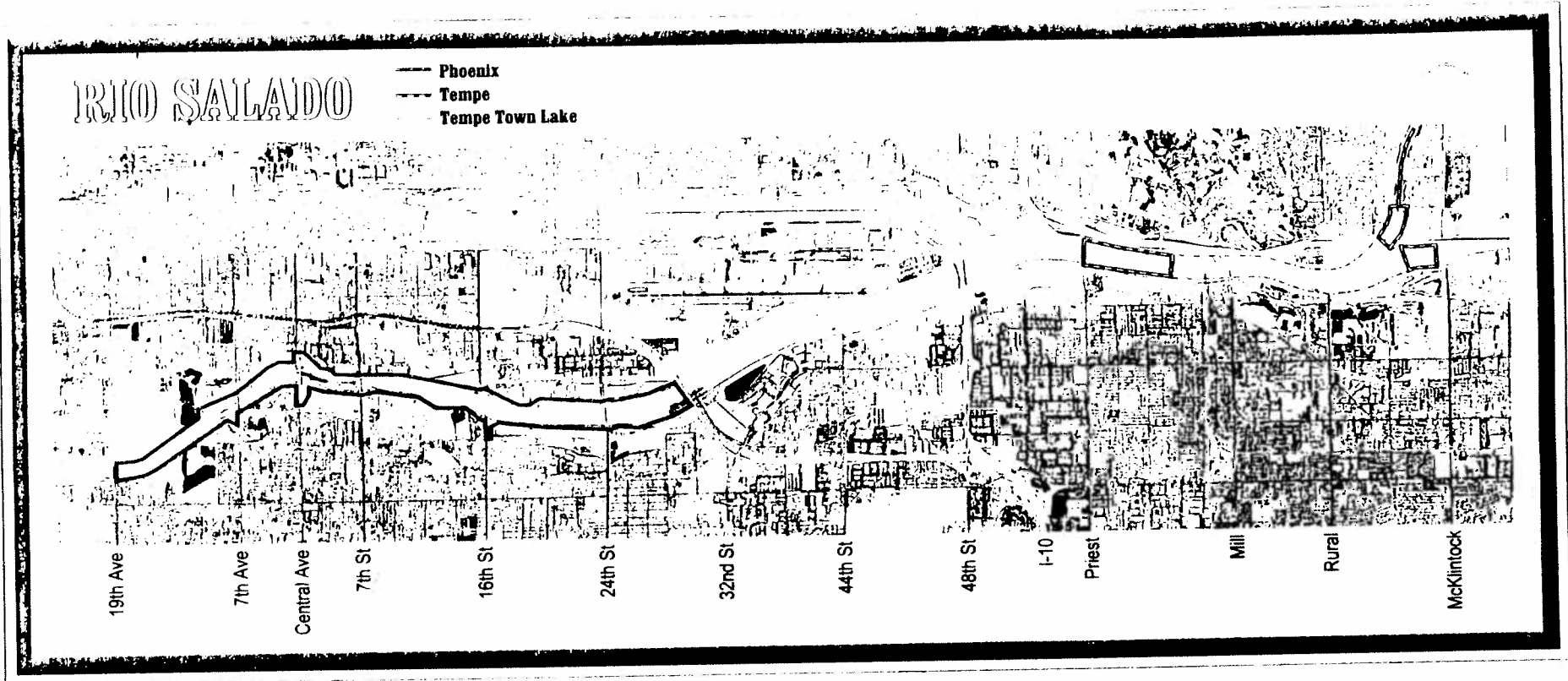
BACKGROUND

The Rio Salado Vision

The landmark reclamation dams on the Salt River, built by the U.S. Bureau of Reclamation shortly after the turn of the century, literally set the stage for the later explosive growth of the Salt River valley. Completion of Roosevelt Dam effectively eliminated the flood danger that had periodically wiped out diversion dams, supplying water to a growing network of canals that made possible the county's flourishing agricultural industry. It also provided a reliable supply of year-round water and power for farming and later for urban uses.

The price paid for this progress was a loss of water in the Salt River. Diverted into canals at Granite Reef Dam, the riverbed is now dry except during times of flood flows. As a result, the lush desert, riparian vegetation and wildlife disappeared from the river throughout its length in the Phoenix metropolitan area. The river became dry and bleak, covered only with sand and stone cobbles. Over time, the original flood plain was filled in with landfills, dumps and low valued industrial uses. Now located near this riverbed are mainly older neighborhoods, unused or unusable landfill areas, sand and gravel mining pits and auto junk yards.

Ever since being proposed by a series of 1960's Arizona State University student projects, the vision of a Rio Salado project has been a goal of many people and communities along the river. These studies envisioned restoration of the river and nearby areas. A stream connecting a series of lakes and water features would line the riverbed while parks and open spaces would weave along the channel. As a result, new urban development would be attracted to significant locations acquired along the river. It proposed a major recreation-oriented lake near downtown Tempe and an island in the river to house public institutions, housing, shopping and recreation south of downtown Phoenix, focusing on Central Avenue. The plan culminated in a public vote on a county-wide property tax to support implementation of the concept. However, with questions about the billion dollar project cost, benefits to outlying communities, and benefits to neighborhoods and adjacent property owners, the proposal was defeated. The Rio Salado lay dormant throughout the county, except in Tempe where the original vision of a recreation lake was carried forward into today's Town Lake construction.



A New Start Toward the Project

Even as a desolate scar, the Salt River continued to leave its mark through the valley during floods. In 1990, the Flood Control District of Maricopa County started a six year project to control flood waters and reduce damages in adjacent communities. The channelization also recovered over 800 acres of developable land in the floodplain, setting the stage for a future Rio Salado project. A unique opportunity arose in late 1993 when Congress decided that the mission of the Corps should be broadened to include restoration of areas which may have suffered damage by past Corps actions. This new Congressional mission for the Corps allowed Phoenix and Tempe to include consideration of water quality, recreation and habitat restoration in a request to study restoration needs in the Salt River.

The Corps had studied the Salt and Verde Rivers for years, but had never found the basis for a project based only on flood control criteria. Applying to Congress under the new authorities, Phoenix and Tempe

were successful and a one year Reconnaissance Study was authorized to begin in early 1994. A reconnaissance study is conducted by the Corps to determine if there is sufficient federal interest in a potential project to go forward with the major project design feasibility study.

During the remainder of 1994, a study team, with representatives from Phoenix, Tempe, the Corps and the Maricopa County Flood Control District, formulated the concepts that became the basis for the Rio Salado Environmental Restoration plan. Although the entire river through the metropolitan area was researched, the initial Rio Salado project was recommended to occupy a five mile stretch of the river in central Phoenix and in three locations adjacent to Tempe's planned Town Lake. Rather than the original, extensive urban renewal oriented Rio Salado concept, this restoration theme would create an accurate desert riparian habitat, adapted for the highly altered physical conditions found in the river's channel as it passes through the heart of the metropolitan area.

Essential features of the reconnaissance analysis were designing a project that would use available economic water supplies and maintaining existing flood capacity. The study identified options for water supplies, using locally available sources, and designed the project to work in conjunction with the naturally occurring flood characteristics to create a flood management concept.

The Reconnaissance Report was completed in the spring of 1994. This plan, one of the first to respond to the new environmental restoration theme, was supported within the Corps organization. The effect of their approval was to authorize preparation of the next step, a formal Feasibility Study, in which the concepts would be detailed and analyzed to see if they could be actually applied to create this project. Because of a need to meet the federal water projects funding schedule, the timetable for the Feasibility Study was fast-tracked to complete the study in time to be submitted in the spring of 1998.

Begun in early 1996, the draft of the Feasibility Study has now been completed and is ready for public review and comment.

Public Comment Process

With release of the Feasibility Study report, the Corps is calling for comments from any interested person or group about the proposed project. Full copies of the report are available in Phoenix for review at the Phoenix Central Library, 1221 N. Central; Harmon Branch Library, 411 W. Yavapai Street; and Ocotillo Branch Library, 102 W. Southern Avenue. Additional copies of this summary report are available at the Phoenix Planning Department, Phoenix City Hall, 200 W. Washington or by phone at 495-7030. In Tempe, copies are available at the Tempe Public Library, 3500 S. Rural Road, the Arizona State University Main Campus Library and at the Rio Salado office at 31 E. 5th Street.

Anyone is welcome to send a written comment during the period which begins on December 5 and ends on January 20, 1998. Comments should be directed to the U.S. Army Corps of Engineers, 3636 N. Central Ave, Phoenix, AZ 85012-1936. In addition, the Corps is hosting two public open houses on January 7 and 8, 1998 to present the plan and to receive comments. The Tempe meeting will be held on the 7th in the Tempe

Police Auditorium (Garden Level) at 140 E. 5th Street at 7 pm. The Phoenix meeting will be held on January 8th at the Phoenix City Council Chambers, 200 W. Jefferson St. in downtown Phoenix. The meeting will begin with a display of materials from the plan and with staff available to answer questions from 6 p.m. to 7 p.m. At 7 p.m. a formal presentation of the plan will be made by the Corps staff which will be followed by a comment period. All comments received in writing or at the public meeting will be addressed in the final report. Changes to the report may be made as a result of the comments received.

Steps to Construction

The path leading to construction of Federal projects is long and involved, requiring approvals at several levels. After local comments have been collected and responses prepared where appropriate, the Feasibility report is in its final form and the Los Angeles District office submits it to the Corps Division office in San Francisco. The District office is also authorized to begin design for the project after the report is submitted by the Division office to the Corps Washington headquarters for the final approval.

At that time, with support from members of the Arizona Congressional delegation, the project is added to the list of projects up for consideration in the 1998 Water Resources Development Act (WRDA). WRDA approval then officially creates the Rio Salado as a U.S. Army Corps of Engineers project. Funding for each year of construction still must be approved, but traditionally, the funds for construction of approved projects are included in the President's annual budget proposal to Congress. However, as the project will be built over several years, funding must be approved for each year of construction. With inclusion in the 1998 WRDA bill, the project could be started by the end of the year 2000, and completed sometime in the year 2003.

As a Corps project, the federal government will pay 65% of the project construction cost as well as financially participating for the first few years to ensure that it functions as planned.

Basis for Phoenix Involvement in the Rio Salado Project

Even with the federal government paying a substantial amount of the project costs, a valid question is whether the commitment of local funds to construct and maintain the project is justified. Following are some of the reasons for support by the Phoenix community:

First, a major impact of the loss of water in the river and destruction of the riparian habitat is the negative character that has been the result of this change to the river. Rather than being an attractive, desirable feature, the corridor along the river has become under used, blighted, environmentally degraded and a location for only the lowest valued land uses. There has been a consensus that until the conditions in the river are reversed, there will be no incentive to replace existing activities with new uses. However, if river conditions can be reversed, this location, in the heart of the city, close to downtown and the airport, has the potential for great revitalization of nearby neighborhoods and for substantial new development.

Second, the Rio Salado will create a major open space facility within the heart of the city, accessible to residents from nearby neighborhoods, to people living throughout the region and to out of town visitors. Whether enjoying informal hiking, biking, horseback riding or participating in the more structured environmental education trips and activities, there will be unlimited opportunities to enjoy and explore this riparian habitat. In the desert, most life springs from flowing rivers, and a restored Salt River offers our citizens a unique opportunity to participate in the life of a desert riparian environment located in the heart of our metropolitan area.

Third, there has been an almost unanimous call from the community to restore the Salt River to the position it held as the giver of life to the valley. This river is tied to the ancient Indian heritage that showed our forefathers how to make this desert valley flower. The river literally provided the life support for the first valley settlers and was the basis for the agricultural industry that led to the settlement of Phoenix and other valley cities. The Salt River remains a visual symbol of the valley to visitors and residents alike, whether arriving at Sky Harbor or crossing the river in their travels through the valley.

Re-creation of the desert riparian environment was recommended as most appropriate, based on costs, use of scarce water and other resources



and to reflect the heritage and history of this river. This plan exemplifies the adaption of nature to this special environment. When built, the project will attract much of the wildlife that at one time occupied this major river corridor, located between Arizona's high country and the Colorado River.

Basis for Tempe Involvement in the Rio Salado Project

The 30 year old vision of Rio Salado has always included designs for habitat restoration, river beautification and outdoor recreation. Tempe is rapidly bringing the dream to reality; however vital elements of the original plan are yet to be fully implemented. By bringing water back to the Salt River in the form of a Town Lake, Tempe is providing the mechanism for aesthetic enhancement and recreation. The addition of riparian and bosque vegetation upstream and downstream of Town Lake

provides added beauty and much needed habitat. This Feasibility Study could lead to construction of the habitat in the Salt River Channel as well as finishing off the last segment of the Indian Bend Park Greenbelt, extending from Scottsdale to its confluence with the Salt River. This would provide a recreational connection to the Town Lake and other habitat areas. The habitats provide wildlife opportunities within an urban area and increase outdoor classroom experiences. This plan illustrates the significance and historic context of the Salt River and its role in sustaining the vitality of the Valley.

THE RIO SALADO PLAN

The draft Feasibility Report recommends two initial projects, a five mile portion of the river in Phoenix extending from the I-10 freeway bridge, near Sky Harbor Airport on the east, to 19th Avenue on the west. In Tempe, the project consists of three smaller areas adjacent to the upstream and downstream dams for Town Lake and on the lower end of Indian Bend Wash as it enters Town Lake.

The Phoenix project would be located entirely within the banks of the Salt River plus a 50 foot wide area on the top of each of the banks. No streets presently lie adjacent to the river, but several major bridges cross it at 24th Street, 16th Street, 7th Street, Central Avenue, 7th Avenue and 19th Avenue in addition to the I-10 bridge. Elements of the project include:

- Flood management feature, a low flow channel constructed in the bottom of the present river, designed to pass the more frequent storm releases. The low flow channel including grade control structures to minimize the water's velocity during stormwater releases.
- Wells and a water delivery system to bring water to the trees and other vegetation, wetlands, ponds and stream.
- Habitat elements including riparian tree species, volunteer riparian grasses and shrubs, wetlands, open water ponds, and a small flowing stream.
- Three public parking, access and project information facilities.
- Recreation and interpretive trail system.
- We will describe each of these features in more detail.
- Description of the Desert Riparian Habitat

The basis for the Rio Salado project falls under the authority of the Corps to restore altered or degraded ecosystems. In our area, the Salt River was the most significant natural resource in this low Sonoran Desert, and it was the basis for enabling human settlement in what would otherwise have been an inhospitable desert region.

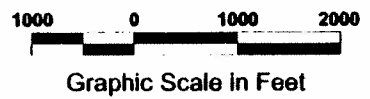
Prior to dam construction in the early 1900's, the Salt River riparian vegetation was dominated by cottonwood, willow and the various species of mesquite trees. Mesquites occurred along the outer bank of the river and defined the outer edge of the natural riparian vegetation zone. Willow and cottonwoods were located inward of the mesquites, adjacent to the river bottom and closer to where there was a more continuous flow of water. Some channel areas were barren, while others had vegetation in strips along the river bottom and in abandoned high flow channels.

The historic bottom lands of the Salt River valley supported a variety of vegetation, including trees, shrubs, marsh plants and some grasses. Beyond the cottonwoods and willows, grew alders on the margins of the river and Palo Verde. Sagebrush joined the mesquite on the low riverside terraces. Vegetation grew so densely in some places it was impossible to cross the bottom lands, while in other locations vegetation was open and more scattered. There were several species of fish in the river's waters, similar to those found in the lower Gila River.

The lower Salt River was originally a perennial stream, fed by the snowmelt from the mountains to the east and highlands to the northeast. Its clear, streaming waters contrasted with the muddy, sluggish waters of the Gila River. Flows in the river had a distinct seasonal pattern, with the highest flows occurring in December and January and the lowest in October. The river had many channel meanders, sand bars and backwater areas that were conducive to riparian plant and wildlife growth.

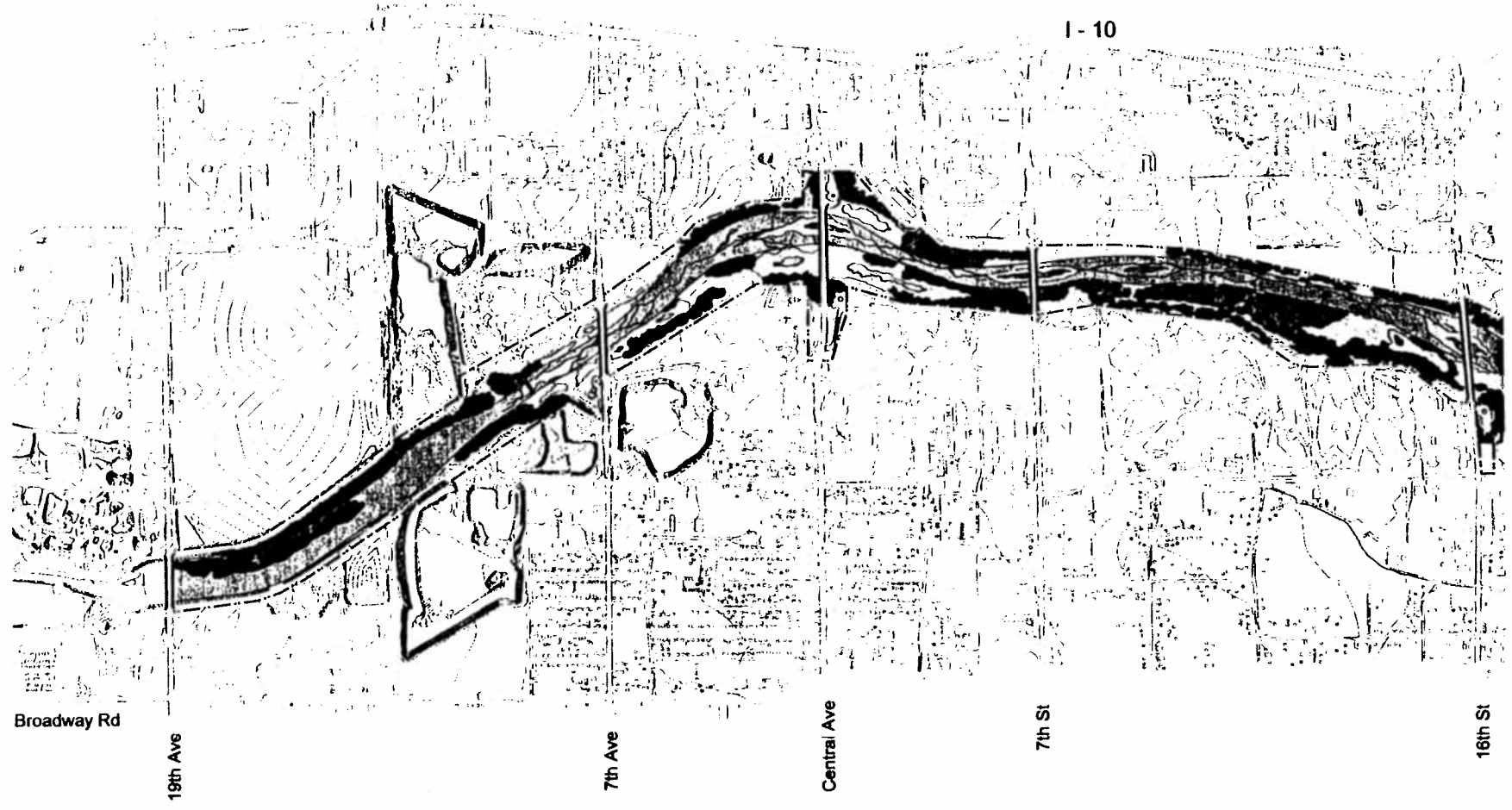
The Phoenix Rio Salado project will re-create the low flow channel and a first terrace within the existing outer banks of a five mile long channelized portion of the river through central Phoenix. Previously occurring vegetative habitat will be incorporated and a water supply system built to support the habitat. The total area of the five mile long project will be about 550 acres.

PHOENIX RIO SALADO



I - 10

SECTION



Broadway Rd

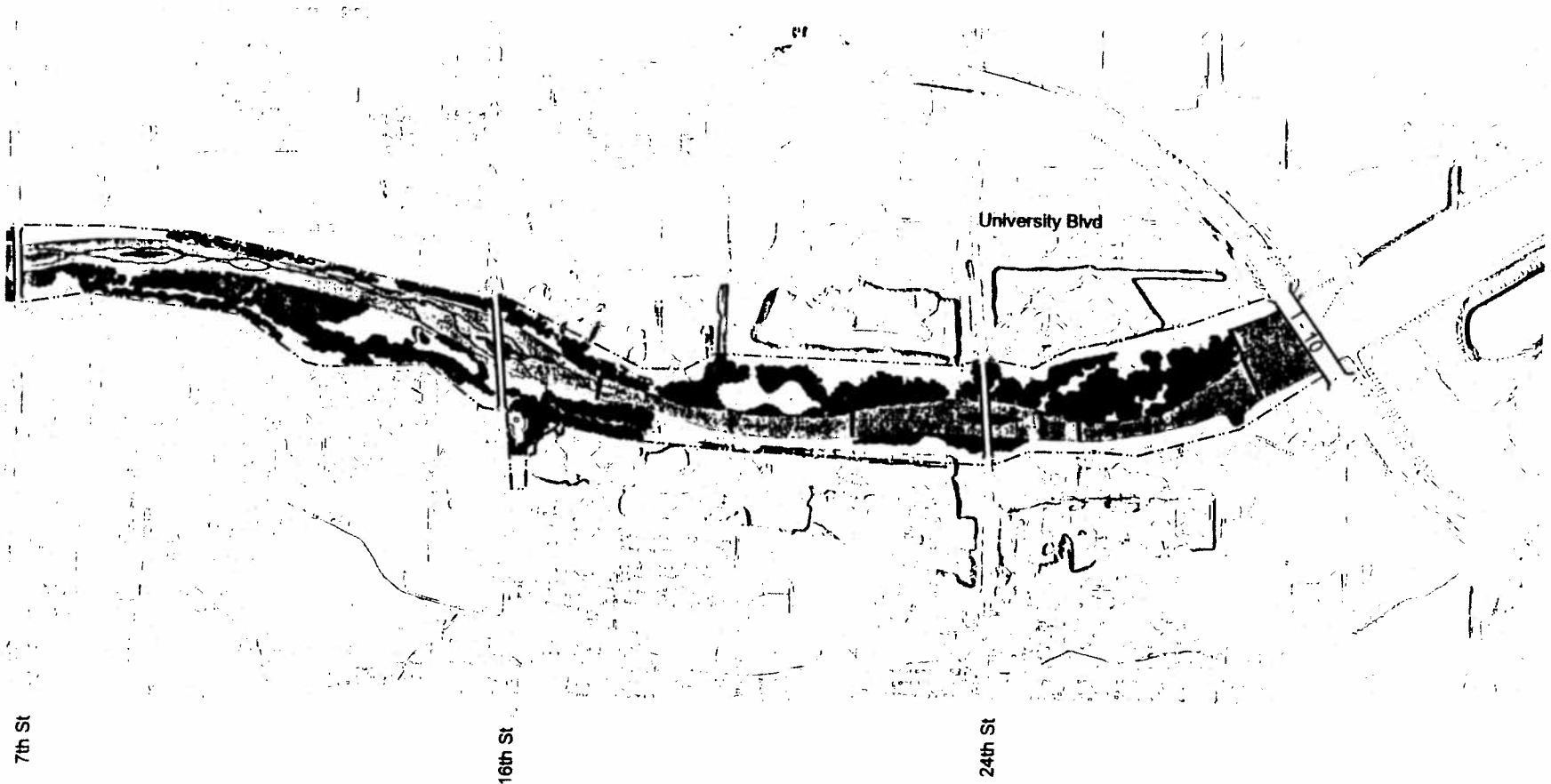
19th Ave

7th Ave

Central Ave

7th St

16th St



7th St

16th St

24th St

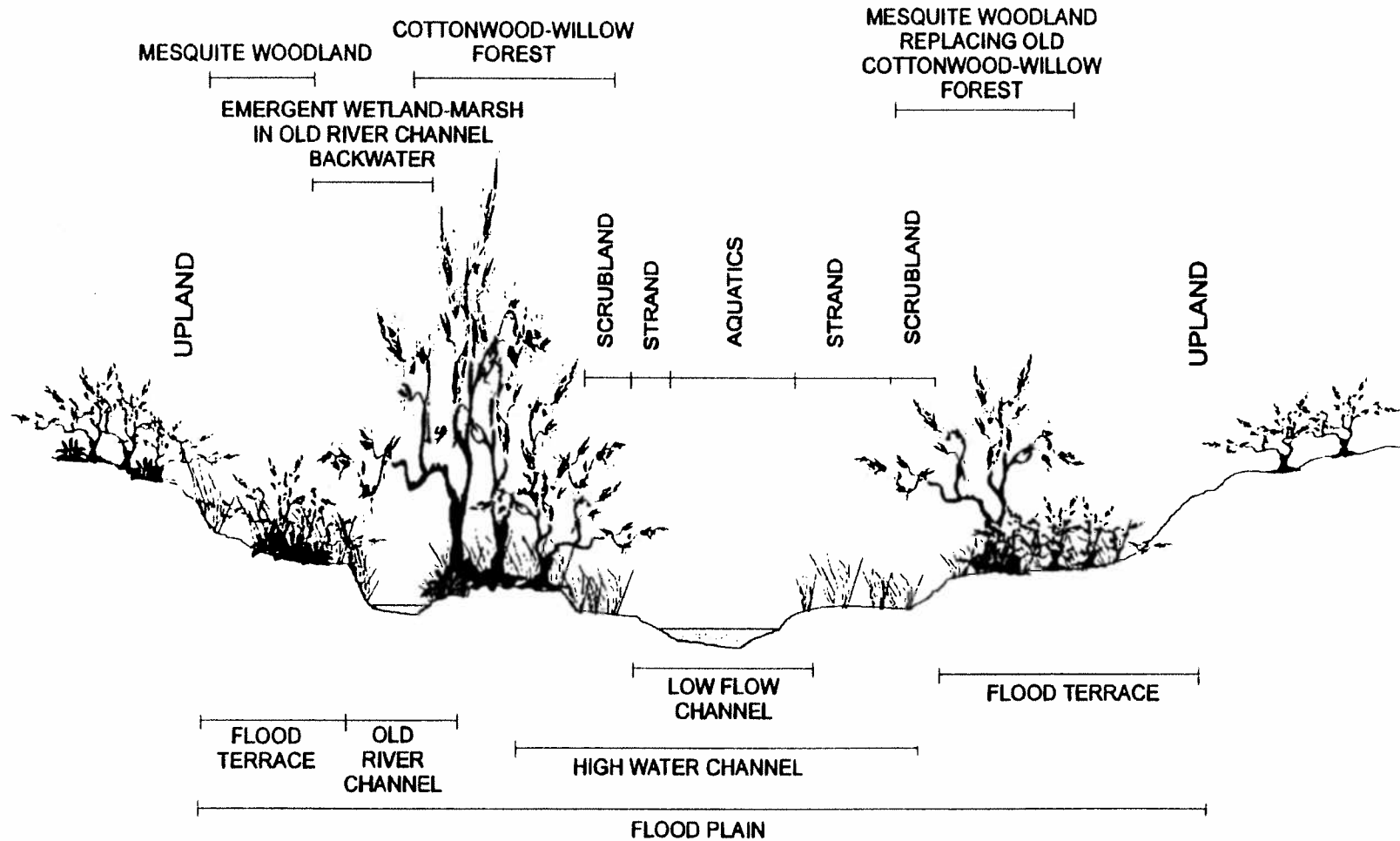
University Blvd



Prepared by:
City of Phoenix, Planning Department August 1997

- | | |
|------------------------|--------------------------|
| --- Project Boundary | Wetland Habitat |
| Low Flow Channel | Braided Stream |
| Channel Drop Structure | Cottonwood / Willow Zone |
| Channel Island | Mesquite Zone |
| Open Water | |

SONORAN DESERT RIPARIAN ZONE



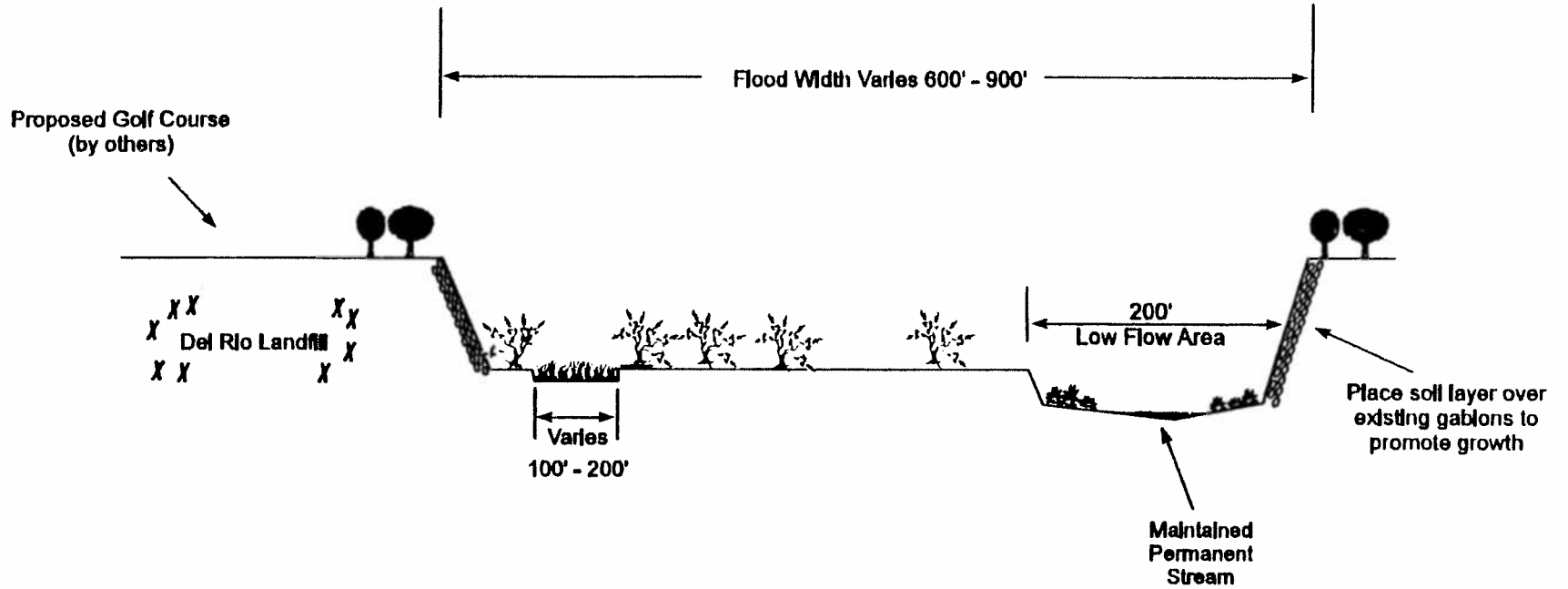
PAGE 10

NOT TO SCALE





GENERAL INVESTIGATIONS - SURVEYS
FLOOD DAMAGES PREVENTION STUDIES

RIO SALADO, SALT RIVER, AZ
RIPARIAN HABITAT
MODEL

LOS ANGELES DISTRICT
SOUTH PACIFIC DIVISION
August 1997



LEGEND

-  MESQUITE HABITAT
-  WETLAND/MARSH HABITAT
-  COTTONWOOD/WILLOW HABITAT
-  AQUATIC STRAND/SHRUB HABITAT

GENERAL INVESTIGATIONS-SURVEYS
 FLOOD DAMAGE PREVENTION STUDIES

**RIO SALADO, SALT RIVER, AZ
 PHOENIX REACH
 SECTION C - C**

LOS ANGELES DISTRICT
 SOUTH PACIFIC DIVISION
 May 97

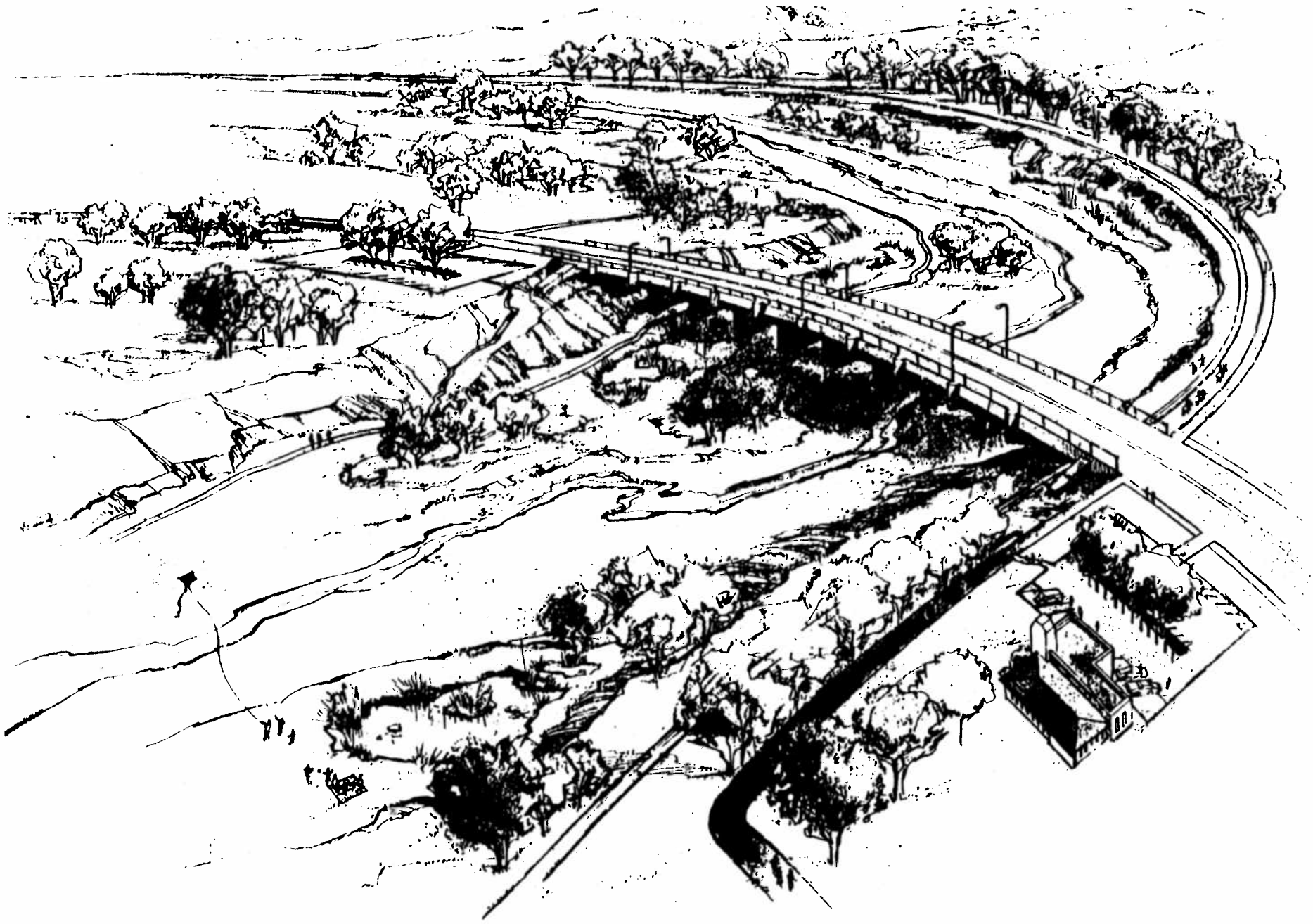
What would the project look like to the visitor?

Upon approaching one of Phoenix' major street crossings of the river, one would first see a line of tall cottonwood trees following the banks of the river, opening only for the bridge crossing. Looking along the line of trees, you will note a small, tree lined irrigation canal, similar to the canals and cottonwood trees that once paralleled major roads throughout irrigated areas of the valley.

Growing on the side banks and more thickly at their bottom are mesquite trees, forming groves, or bosques, in many locations. Farther out on the terrace, you will note some open water areas and nearby wetlands, green with bulrush and other water loving plants. Along the banks of the ponds and wetlands and lining much of the banks of the main channel itself are mixed groves of cottonwood and willow trees. The cottonwoods in particular are growing very tall, reaching toward their ultimate height of 60 feet or more and are already providing shade to the wetlands and ponds. Between groves of trees, the terrace is covered by low shrubs such as sage or brittlebush, while in some areas there are open, sandy areas.

Meandering through the center of the first terrace is the river bottom or low flow channel. Two and sometimes three hundred feet wide, the low flow channel lies five to ten feet below the first terrace. In major desert rivers, the river bottom is where the most frequent storm flows have washed out large trees and shrubs while leaving the most open channel for carrying the stream's permanent waters and seasonal high water runoff.

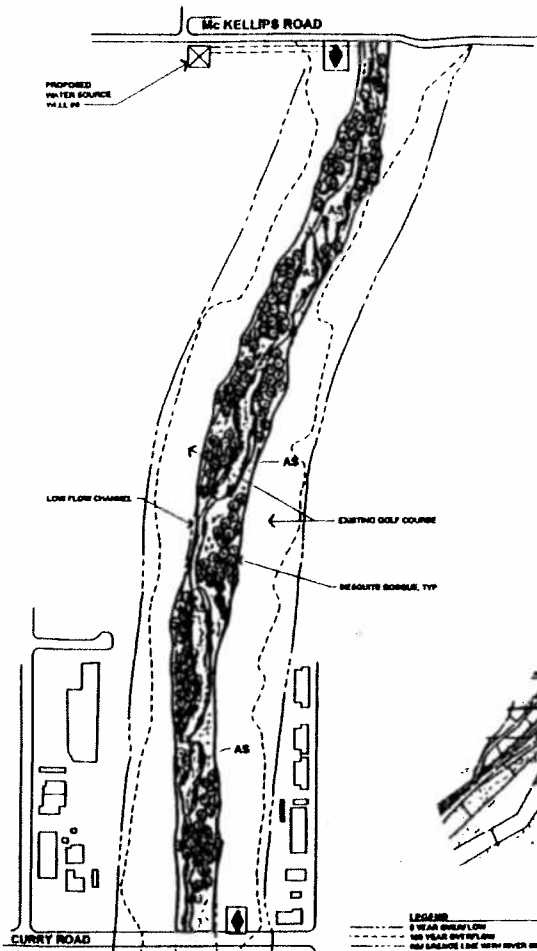
The channel is dominated visually by a small stream flowing through much of the project and supports small ponds, shrubs and grassy areas along its length. Major storm releases will alter the stream's location within the low flow channel and the vegetation may have to reestablish itself after these larger flows. Although the scale of the Rio Salado stream is smaller, its response to storm flows will be similar to that occurring in the upstream Salt River after flood flows.



In Tempe, the planning objectives are to restore riparian habitat; bringing the area to a more natural condition through the installation of plant species that are native to, and occurring historically in riparian streams and washes in the region; identify water supplies which will sustain riparian habitat in restored areas; increase passive recreation opportunities incidental to the restoration; contribute to other qualitative environmental objectives. The Tempe project would be located within the banks of the Salt River channel and in Indian Bend Wash. The street boundaries of the area include McClintock Road at the east, Priest Drive at the west, Rio Salado Parkway on the south and McKellips Drive on the north. Elements of the project include:

- Braided streams and small ponds, possibly lined to contain water within the habitat areas.
- Water delivery system for the streams and irrigation.
- Habitat elements including riparian tree species, planted native grasses and shrubs, wetlands with aquatic vegetation, bosque tree and shrub species removed from the direct water path.
- One public parking area with other parking provided by nearby development, project information and interpretive signage, kiosks, ramadas and picnic facilities.
- Recreational interpretive trail system for wildlife watching, plant identification, habitat monitoring and field trips.

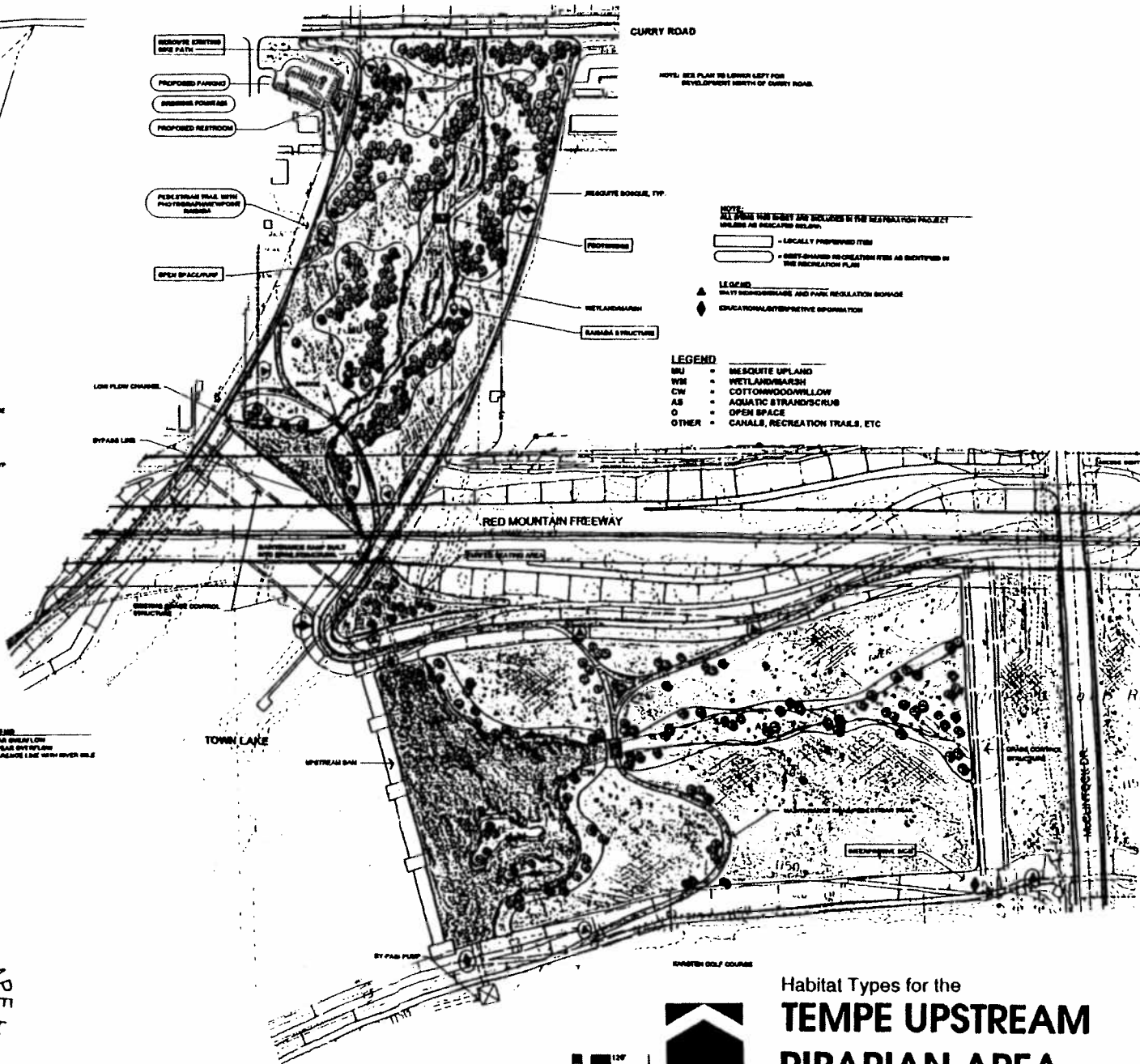
The Tempe project will not contain a low flow channel or terrace. The habitat will be designed within the existing channel, extending from levee to levee. Native vegetation will be planted along constructed streams and ponds. The total area of the three sections is 140 acres.



NOTE: SEE PLAN AT UPPER RIGHT FOR DEVELOPMENT SOUTH OF CURRY ROAD.



NORTH OF CURRY ROAD ONLY



11/12/87



Habitat Types for the
**TEMPE UPSTREAM
RIPARIAN AREA**

Water Supply

With no flow in the river other than during storm releases, a reliable supply of water is needed to support the project's habitat. It is estimated that on average slightly less than six million gallons of water per day will be needed. Because of seasonal variations in water demand, the pumps and distribution system will be sized to about twice that capacity to handle the peak water demands.

For the Phoenix project, three alternative sources were investigated: purchase of CAP water, wells tapping into the shallow aquifer lying just under the river and wells tapping into a deeper aquifer. (An aquifer is a water bearing layer of rock, sand or gravel lying under ground.)

Central Arizona Project (CAP) water could be delivered through the SRP canal system, although a local connection would have to be made to the project. Flow would be interrupted during the annual SRP month long dry up and clean out period.

Wells could be drilled into one of three aquifers that are found in deep alluvial deposits that underlay the valley. All contain significant amounts of water and have been used to support agricultural, industrial and domestic needs for many decades. The uppermost aquifer lies close to the surface and is 300 to 400 feet thick. Beneath that is what is termed the Middle Aquifer Unit and is from 100 to 1600 feet thick. The upper aquifer is not used near the project area for urban water supplies since it contains varying concentrations of pollutants resulting from farming and urban activities. The second and third alternative sources, noted above, use either the upper aquifer, which has low pumpage costs but which may require some wellhead treatment to meet water quality standards, or the middle aquifer, which is of good quality but would have significantly higher pumpage costs.

Depending on the amount of water treatment needed to make the water useable, an analysis was conducted of initial and of ongoing operation and maintenance costs for each alternative. For purposes of the feasibility analysis, shallow groundwater was assumed to need treatment to remove volatile organic compounds, but this source was recommended as the most feasible and least expensive. The following table summarizes operation and capital costs, assuming usage of ten million gallons per day:

Source	Cost per Acre Foot of Water
1. Shallow Groundwater, assuming wellhead VOC treatment, total	\$ 335
<i>Capitol Costs</i>	205
<i>O&M Costs</i>	130
2. Deep Groundwater, assuming no VOC treatment, total	420
<i>Capitol Costs</i>	124
<i>O&M Costs</i>	155
<i>Replenishment costs</i>	121
3. Surface Water	401
<i>Capitol Costs</i>	358
<i>O&M Costs</i>	143

Six wells would be located, three on each side of the river at 24th Street, 16th Street and Central Avenue. Each pair would be connected by a pipe to provide for redundancy in the case of servicing one of the wells. Each well would have a maximum capacity of about two million gallons per day.

Water from the wells would be pumped into canals, located on both sides of the river. Canal water would be allowed to flow by gravity down channels in the river banks into ponds and wetlands on the terrace and then into the stream and ponds in the low flow channel. In addition, a pressurized system, for habitat irrigation, would be located along both sides of the top of the bank. The alternatives for delivering water to the habitat will be analyzed during the engineering design of the project.

In order to minimize the need for well head treatment, pilot or test wells will be drilled during the engineering and design phase of the project in order to locate sites which require little or no treatment. Review of well records has indicated this may be feasible. The monitoring wells will also be used to signal any future pollutants in the groundwater that may be migrating towards the production wells.

To reduce water losses from infiltration into the gravelly river bottom, most water areas within the project will have a liner. Wetlands and open water ponds will be lined while a liner will also be laid beneath the stream. This stream liner will be designed to catch some of water that

soaks into the ground under the stream and ponds. This "perched" layer of water will be near enough to the surface to be reached by roots of plants establishing themselves along the stream. It will be placed deep enough in the ground to minimize being disturbed by scour during high flow events.

In total, about 40% of the water used in the project will be lost to evaporation and transpiration from plants. The remainder will soak back into the ground and eventually returned to the water aquifer.

In Tempe, several water sources were also considered. The recommended source is to use City of Tempe Well #6. This is a high volume well and should be able to provide ample quantities of water for the project. Well-head treatment would be required to meet NPDES discharge requirements for volatile organic compounds. Through air stripping and filtration, water would be treated prior to entry in the Indian Bend Wash reach of the project. From this area, water would be gravity fed through the habitat to a pipe at the confluence to then feed the upstream habitat area. A diversion pipe around the lake would deliver water to downstream portions of the project.

Town Lake, considered to be part of the "without project" conditions, is being constructed for recreation and aesthetic purposes. In order to allow water based recreation, EPA and ADEQ require that the water quality be safe for partial body contact. This requirement is not one that is measured upon initial filling of the lake, but must be maintained throughout the life of the project. Therefore alternative plans for the habitat restoration must prevent water from the Salt River or Indian Bend Wash from entering and mixing with the monitored lake water.

Flood Control

The Salt River and Indian Bend Wash serve to convey flood waters throughout the Phoenix metropolitan area. They are relatively barren and devoid of vegetation. Alternatives considered must not compromise the level of flood protection currently provided by reduction of the channel capacity. Likewise, the constructed habitat must be maintained after major flood events. The design of the project should accommodate low to moderate flows without significant damage to habitat while

conveying high flows. Both the Phoenix and Tempe projects follow similar flood control criteria, however each has different design requirements.

Damage from floods occurs in one of two ways. First, high volumes of water move swiftly and at a certain velocity begin to scour the ground surface and uproot vegetation. Scour occurs when the energy of the water is enough to lift materials on the river bottom, often redepositing them downstream. Scour can result in lowering or raising the bed of the river, filling ponds and lakes with silt, and endangering bridges by digging out around bridge abutments.

The second form of damage occurs when waters inundate vegetation for long periods of time, in effect, drowning it.

Flooding through Phoenix on the Salt River is from runoff from both the Salt and Verde River basins. However, this flooding does not occur in the same fashion as in unaltered rivers. On the Salt River, the SRP maintains dams containing 2.46 million acre feet of storage, including 0.56 million acre feet of recently completed flood storage. On the Verde River, the Project maintains storage capacity of 0.31 million acre feet. This means that flood flows through the Phoenix area usually have two components. With little storage behind dams, floods on the Verde River pass down river, peaking quickly and then tailing off relatively swiftly. Runoff from major storms on the Salt are held in the much greater storage capacity there and are then released in controlled quantities of relatively constant volume. These releases can last for a long time as flood storage capacity is rebuilt behind the dams.

Salt River Discharge-Frequency Values

Average Return Period (years)	Peak Discharge (cubic feet per second)
100	166,000
50	135,000
20	87,000
10	55,000
5	20,000

Salt River Duration-Frequency Values, cubic feet per second

Frequency	Peak	1 - day	3 - day	5 - day	10 - day	30 - day	60 - day
100 year	166,000	100,000	60,000	40,000	25,000	15,000	7,000
50 year	135,000	70,000	40,000	29,000	18,000	10,000	5,000
20 year	87,000	40,000	22,000	15,000	10,000	5,300	2,800
10 year	53,000	21,000	11,000	7,000	5,200	2,700	1,400
5 year	20,200	8,000	3,500	2,100	1,500	800	0

A key feature of the plan is construction of a low flow channel into today's river bottom. In addition to replicating natural low flow channels, this would add to the flood carrying capacity of the river through the project. This channel, with a capacity of 12, 200 cubic feet per second is sized so that it carries all long term releases, lasting over 30 days, thus preventing drowning of the habitat. Side slopes of the low flow channel will be constructed of soil cement with walls built down to the depth of the scour so that they will remain stable under major flood volumes. Four new drop structures, or small dams, will also be built in the channel to slow the velocity of storm flows. The low flow channel will be located where the highest velocity of storm flows is anticipated, further reducing the speed of water passing over the terrace level, where most of the habitat will be located.

It is recognized that there will be some habitat loss from water velocity and scouring during major storms. During the storms that are of a 25, 50 or 100 year recurrence, velocities will be great enough to destroy grasses, shrubs and eventually, trees. This loss also occurs during similar flooding in natural river systems since the period between these large storms is great enough that much vegetation can grow to maturity during the time since the last major event.

After this occurs and site damage is restored, much of the root system will remain while seeds are naturally distributed by the flood waters. Continuing to supply the project with water will maintain suitable growing conditions. Some habitat will return in short order, other will

take longer. But observation of natural riparian areas indicates that in a short number of years, the losses have been replaced by a new generation of habitat. Funds will be set aside for restoration of trails, signage and other man made features located within the channel. Otherwise, the Rio Salado riparian system will respond to the major floods in a similar fashion as do natural systems.

Public and Recreation Features

Although the primary purpose of the Rio Salado is the restoration of the river's habitat, completion of the project will create an almost unparalleled opportunity for public participation and enjoyment. The Tempe portion of the project provides different experiences in each of the three areas. In the Indian Bend Wash reach, the habitat provides a transition from the park and golf course to the north. Parking is close by providing picnic, bike, jogging or horseback opportunities. This site would be heavily landscaped and provide easy access to plants and animals in the habitat. Upstream of the Town Lake dams, a path through the habitat would provide access from the confluence on the north bank to the south bank. An alternative would be a pedestrian bridge across both dams. Either way, interaction with wildlife would be more limited, allowing better opportunities for viewing wildlife. This would be a more limited access area, with interpretive signage and educational

kiosks explaining the habitat from the banks of the river. The third area, downstream of the dams, would have viewing areas outside the habitat and on the pedestrian bridge crossing the dams. It would provide excellent wildlife viewing opportunities, while preserving the habitat. All three areas offer educational opportunities for awareness programs related to history, water, geology, zoology, and botany.

In Phoenix, the 550 acre project will create the largest open, natural resource facility within the central areas of Phoenix, and like the Mountain Preserves, will provide unique recreational opportunities to residents and out of town visitors alike. Drawing on a valley population of over two million people, it is estimated that visitation to the project could top one half million annually. Primary use times would coincide with the "visitor season" between October and May when temperatures are most moderate.

The goal of the recreation component is to provide opportunities for visitors of all ages and backgrounds to enjoy this unique resource while developing an awareness, knowledge and understanding of desert riparian habitats and their linkages to the larger desert environment. Additionally, we have the opportunity to share the history of the Salt River and its place in the history of our valley and state. Visitors to this will also be able to participate in a wide variety of recreational pursuits ranging from simply enjoying the scenic views to picnicking, hiking, biking, horseback riding, bird watching and exploring the range of habitat within the project.

The project has three zones for public use. Upon arriving at the project, there will be three public access facilities, located on 16th Street, Central Avenue and 7th Avenue. From these, one can travel along the bank, on either side of the project on either a paved or a gravel trail. Visitors can explore the length of the project, stop at overlooks, participate in trail activities such as exercise or par courses. Kiosks and signage displays will assist the visitor appreciate the habitat and wildlife in the project, explain the role of water in the desert and demonstrate the mechanisms used in the Rio Salado to bring water to the habitat and to manage storm releases. Outdoor classrooms will allow groups and classes to prepare for the learning experiences at Rio Salado.

Paths will lead from the banks down to the second zone, the terrace. Here, at the level of the current river bottom, will be the majority of the riparian habitat and wildlife. Accessible to pedestrians only, there will be trails exploring and participating in the experiences of the wetlands

and pond areas, cottonwood woodlands, the mesquite bosques, or forests. Some areas on the terrace will be off limits to humans in order to maintain protected areas for sensitive habitat and wildlife. Additional interpretative material will illustrate the life of the riparian zone, growth and death of plant material, adaptation to the climate and environment, wildlife habits, and the role of water. Demonstration gardens will be used to help explain the operation of the riparian habitat. Trails will allow more opportunities for hiking, interpretation and overlooks of the low flow channel, or riverbed below.

In the low flow channel, the visitor will have the most unstructured experience. In the riverbed itself, a small stream, vegetation and ponds will establish themselves. There will be no formal trail system and one will explore at will over the sands, cobbles and shrubs or grasslands supported by the stream. It is in this area that storm releases will most reshape the features and vegetation. Visitors to this area will leave with a heightened awareness of the fragile relationship between water availability and habitat in the desert.

PROJECT COSTS AND TIME LINE

The majority of the project funding would come from the federal government as a result of authorization in the 1998 Water Resources Development Act. The basic federal share would be 65% of the project cost. Upon completion of the project and conclusion of the warranty period, three to five years, responsibility for operation and maintenance of the project will become the City of Phoenix'. The currently estimated project costs are shown in the following table:

Phoenix: Project Item	Total Project Cost	Non-Federal	Federal
Engineering and Design	\$ 4,500,000	\$ 1,600,000	\$ 2,900,000
Land Costs*	3,700,000	3,700,000	0
Project Construction	70,500,000	22,300,000	48,200,000
Recreation Features	6,800,000	3,400,000	3,400,000
PROJECT TOTAL	\$ 85,500,000	\$ 31,000,000	\$ 54,500,000

* Land acquisition costs are not directly cost sharable, but the qualifying costs are eligible towards the non-federal contribution.

Tempe: Project Item	Total Project Cost	Non-Federal	Federal
Engineering and Design	\$ 360,000	\$ 130,000	\$ 230,000
Project Construction	5,550,000	1,940,000	3,610,000
Recreation Features	690,000	345,000	345,000
PROJECT TOTAL	\$ 6,600,000	\$ 2,415,000	\$ 4,185,000

Project Schedule

Federal authorization for similar U.S. Army Corps of Engineers projects occurs during the biannual Water Resources Development Act, usually considered by Congress, usually during even numbered years. The following schedule was based on requesting congressional approval in the upcoming 1998 bill to ensure the fastest possible time line for construction and opening of the project. Following are the steps that would lead to completion of the Phoenix Rio Salado:

- Public Comment on the draft Feasibility Report - December 5, 1997 through January 20, 1998
- Corps approval of the final Feasibility report - March, 1998
- Initiation of engineering and design for the project - Spring, 1998
- Hearings on the 1998 WRDA bill - Summer, 1998
- Congressional and Presidential approval of the 1998 WRDA bill - Fall, 1998
- Completion of engineering designs and plans - Summer, 2000
- Execution of a Project Construction Agreement with Phoenix - Fall, 2000
- Construction commences - late 2000
- Project completion - mid to late 2003
- Warranty, monitoring period - three to five years from opening of the project