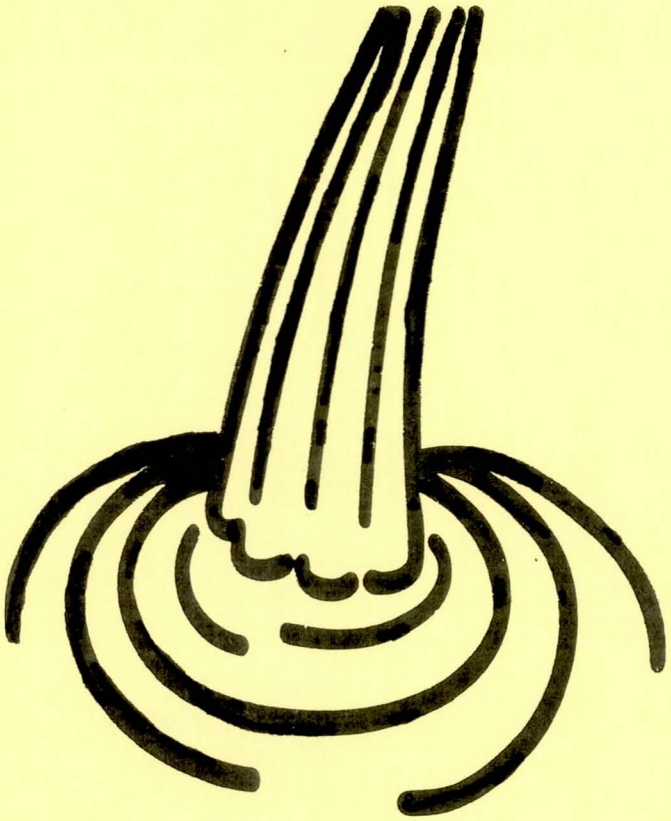
Flood Control District of Maricopa County



Comprehensive Flood Control Report/Plan

1997

001.109

Flood Control District
Of
Maricopa County

Comprehensive Flood Control Program Report/Plan

Board of Directors of the Flood Control District

Don Stapley, Chairman, District 2
Fulton Brock, District 1
Betsey Bayless, District 3
Jan Brewer, District 4
Mary Rose Garrido Wilcox, District 5

Flood Control Advisory Board

Melvin Martin, Chair
Russell G. Stephens, Member
Gilbert "Shag" Rodgers, Member
John E. Miller, Jr., Member
Samuel K. Wu, P.E., Member
Paul Cherrington, P.E., Salt River Project, Ex Officio Member
James Matteson, P.E., City of Phoenix, Ex Officio Member

Chief Administrative Officer
David R. Smith

Chief Engineer and General Manager (Interim)
Stanley L. Smith, Jr., P.E.

1997

TABLE OF CONTENTS

INTRODUCTION 1

HISTORICAL PERSPECTIVE 2

Plate A, Maricopa County Watershed Index Map 4

Plate B, Southeast County Watershed Map 5

FLOOD CONTROL STRUCTURES IN SOUTHEAST COUNTY 6
Existing Structures 7
CIP Projects 12

Plate C, Northeast County Watershed Map 14

FLOOD CONTROL STRUCTURES IN NORTHEAST COUNTY 15
Existing Structures 16
CIP Projects 20

Plate D, North Central County Watershed Map 25

FLOOD CONTROL STRUCTURES IN NORTH CENTRAL MARICOPA COUNTY 26
Existing Structures 27
CIP Projects 29

Plate E, Southwest County Watershed Map 32

FLOOD CONTROL STRUCTURES IN SOUTHWEST COUNTY 33
Existing Structures 34
CIP Projects 36

Plate F, Northwest County Watershed Map 38

FLOOD CONTROL STRUCTURES IN NORTHWEST COUNTY 39
Existing Structures 40

EXISTING FLOOD CONTROL PROGRAMS 42

FLOOD WARNING AND DATA COLLECTION PROGRAM 42

FLOODPLAIN ADMINISTRATION PROGRAM 45

DRAINAGE ADMINISTRATION PROGRAM 47

MAINTENANCE PROGRAM 51

PLANNING PROGRAM 53
Area Drainage Master Study (ADMS) Policy 54

Plate G, Maricopa County ADMS Map 55

Coordination with County Planning Activities 57
Prioritization Procedure 59

CAPITAL IMPROVEMENT PROGRAM 62

PUBLIC INVOLVEMENT PROGRAM 69

ENVIRONMENTAL PROGRAM 70

OPEN SPACE PROGRAM/PLAN 75

CONCLUSIONS AND RECOMMENDATIONS 78

APPENDIX

GLOSSARY OF TERMS A-1

CONTRIBUTIONS FOR COMPLETED PROJECTS TABLE B-1

ENCLOSURES: *Map 1, "County Structures Map"* . . . . . Rear Pocket
Map 2, "Five Year Capital Improvement Map" . . . . . Rear Pocket

COMPREHENSIVE FLOOD CONTROL PROGRAM REPORT/PLAN FOR MARICOPA COUNTY: 1997

I. Introduction

The Comprehensive Flood Control Program Reports of 1963 and 1991 were the culmination of several general area studies that identified flooding problems in Maricopa County. At that time 35 watersheds were delineated on which flooding problems were defined and potential structural solutions proposed. The 1963 plan listed 40 flood control projects. The Comprehensive Plan has been the cornerstone for most work performed by The Flood Control District of Maricopa County to date.

The 1963 Report designated through engineering economics, which of the 40 projects were considered viable at that time and which should be deferred for future consideration. The plan also included potential federal funding mechanisms that could be used in conjunction with local funds for project construction. In 1963, the District operated under the authority of ARS Article 5 45-2351 to 45-2371, and was charged with the responsibility of building, operating, and maintaining the projects recommended in the report. It was further recognized that the District would ultimately construct, operate, and maintain other projects not identified in the plan. In addition, projects built by others, such as McMicken Dam, would be operated and maintained by the District, thereby increasing the expenditure of operation funds.

Since 1963 Maricopa County and the District have changed considerably. Some of those changes include:

- The population is now 2,200,000 (versus 614,000 in 1963 and 2,069,000 in 1991).
- Non-structural flood control programs are now used in conjunction with structural solutions.
- The District operates and maintains 49 flood control facilities.
- Annual tax revenues have increased from $250,000 in 1961 to a high of $51,000,000 in 1989; along with tax rate increases from $0.05 to $0.50 per $100 assessed value. In 1995 a tax rate of $0.33 generated $32,401,380.
- The District has constructed entirely or in part 15 of the 40 projects listed in 1963 (five projects have been incorporated into other projects or eliminated, and 20 other projects have not been constructed).

However, two things have not changed: Maricopa County continues to experience rapid growth resulting in increased flooding problems; and, a number of the flooding problems identified in 1963 and 1991 have not been resolved.

The objectives of this report are to:

1. Update and report on the current status of projects and programs intended to implement the *Comprehensive Flood Control Program Reports of 1963 and 1991*; and

2. Identify potential projects from sources more recent than the 1991 Comprehensive Plan.

Future Efforts

The flooding problems, in terms of potential projects, identified in this status report will be analyzed by the District's Planning and Project Management Division. The Planning and Project Management Division will proceed with project implementation for each of the projects which receive a favorable evaluation. Project implementation will include, but not be limited to: identifying potential partners interested in project funding participation; managing project and design studies; incorporating these projects into the Five-year capital improvement budget; developing land acquisition schedules; and coordinating all project activities. The Planning and Project Management Division will be assisted as required by all other divisions of the District.

The Watershed Management Branch of the Hydrology Division, in coordination with the Planning and Project Management Division, has prepared a list of additional flooding problems for each of the 35 watersheds. These watershed boundaries, with some modification, follow the boundaries used in the 1963 and 1991 Comprehensive Plans. The Watershed Management Branch will suggest alternative structural and non-structural solutions for each problem. The problem definition phase will include the development and/or use of watershed hydrology, floodplain mapping, flood damage reports, and other sources from which potential flood damages can be assessed.

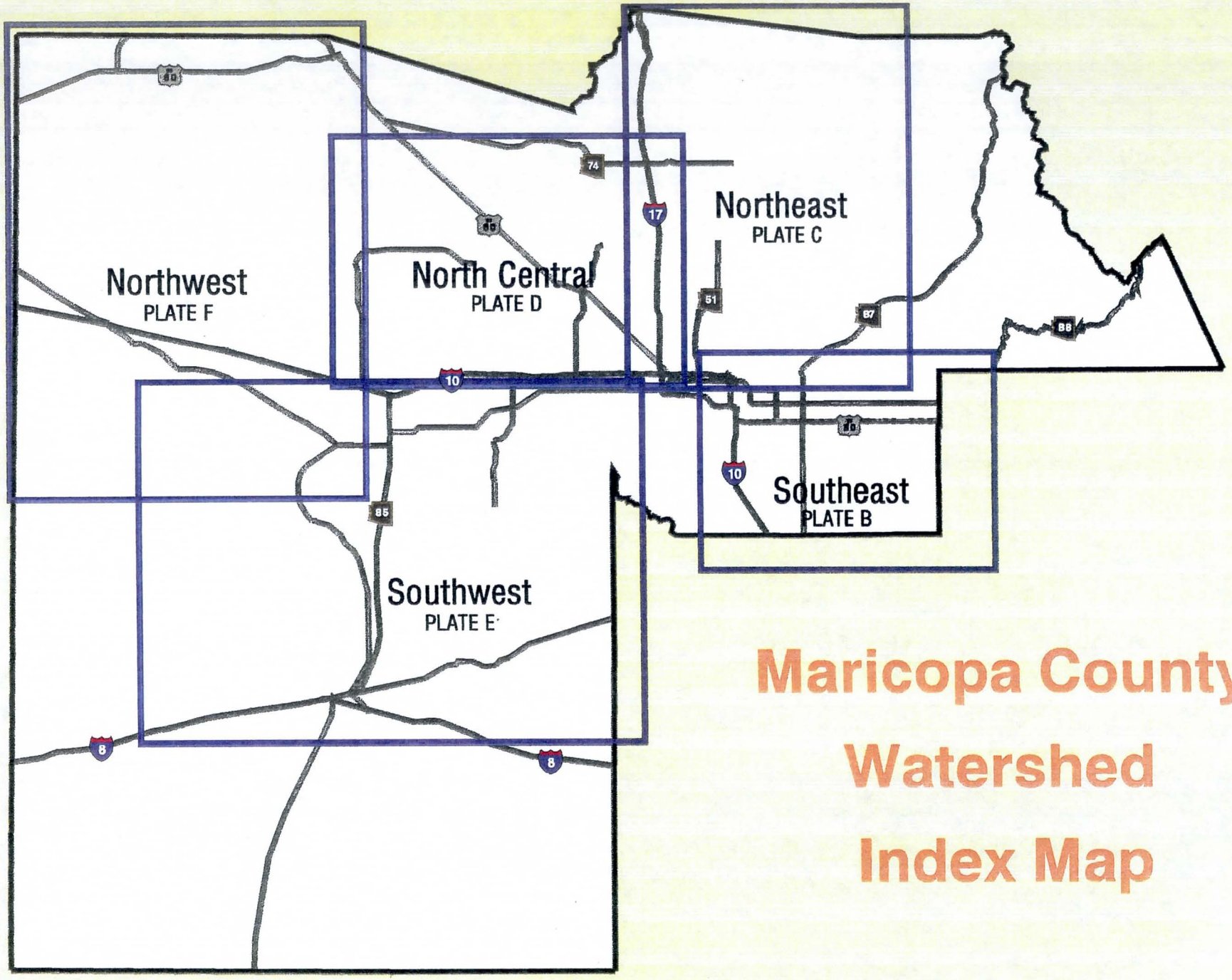
II. Historical Perspective

Background

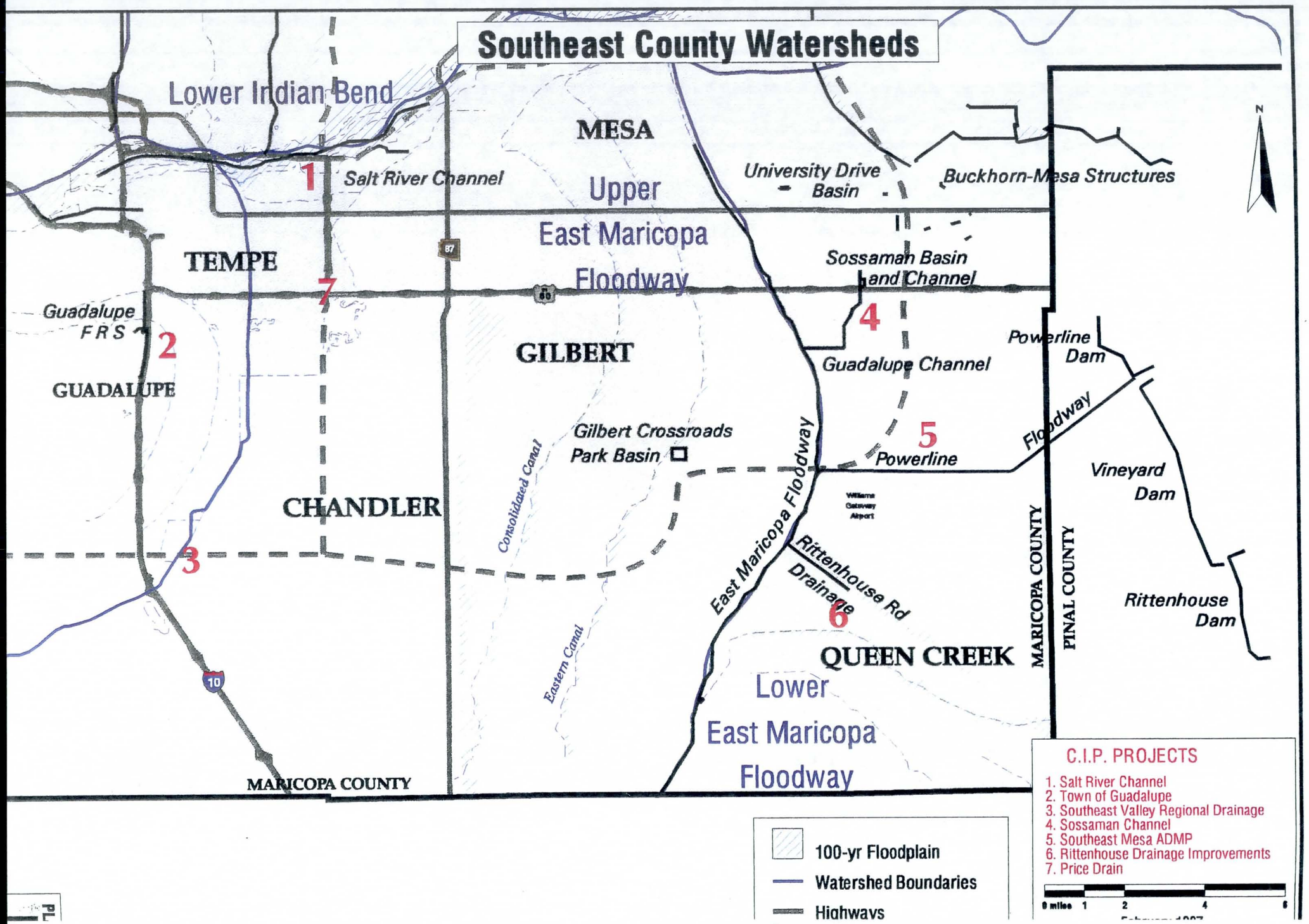
Even before the *Comprehensive Flood Control Program Report of 1963* was published, there had been many contributors to the study of flood control in Maricopa County. On October 31, 1957, the Flood Protection Improvement Committee was appointed by the City of Phoenix, the Board of Supervisors of Maricopa County, and the Board of Directors of the Salt River Project. This committee was directed to prepare a general plan of flood control for the greater Phoenix area and recommend methods for financing, construction, and operation of major flood protection works for the benefit of all. Creation of this committee constituted one of the first organized efforts to solve Maricopa County's flooding problems. This also provided the main impetus for formation of the present Flood Control District to serve the entire County; the Flood Control District was created on August 3, 1959, by the Board of Supervisors.

The *Comprehensive Flood Control Program Report of 1963* listed the major flood control problems for Maricopa County (all 9,226 square miles). In addition, the report contained recommendations to prevent or minimize damage and cost estimates for necessary structures. Although the prime objective of the report was to identify flood control problems, other concerns included: erosion control, recreation, irrigation, water storage, and ground water recharge.

Because the Gila and Salt River Basin is the main natural drain system for the County, virtually all storm water flows to the southwest into this system. The main tributaries are: the Verde River, Indian Bend Wash, Cave Creek, Skunk Creek, New River, the Agua Fria River, the Hassayampa River, and Centennial Wash. Then, as now, the major flooding problems occurred near the urban population concentrations.



Maricopa County Watershed Index Map


Southeast County Watersheds
Lower Indian Bend
MESA
Upper
East Maricopa
Floodway
Salt River Channel
University Drive
Basin
Buckhorn-Mesa Structures
TEMPE
Sossaman Basin
and Channel
Guadalupe
FRS
GUADALUPE
GILBERT
Guadalupe Channel
Powerline
Dam
Gilbert Crossroads
Park Basin
Consolidated Canal
Powerline
Floodway
Vineyard
Dam
CHANDLER
Williams
Gateway
Airport
East Maricopa Floodway
Rittenhouse Rd
Drainage
MARICOPA COUNTY
PINAL COUNTY
Rittenhouse
Dam
Eastern Canal
QUEEN CREEK
Lower
East Maricopa
Floodway
MARICOPA COUNTY
N
1
2
3
4
5
6
7
87
60
10
100-yr Floodplain
Watershed Boundaries
Highways
C.I.P. PROJECTS
1. Salt River Channel
2. Town of Guadalupe
3. Southeast Valley Regional Drainage
4. Sossaman Channel
5. Southeast Mesa ADMP
6. Rittenhouse Drainage Improvements
7. Price Drain
0 miles 1 2 4 6

FLOOD CONTROL STRUCTURES IN SOUTHEAST COUNTY

Existing Structures	Programmed Capital Improvements
Buckhorn-Mesa Structures:	1. Town of Guadalupe Drainage Improvements
Apache Junction Dam & Floodway	2. Salt River Channel (Dobson-Country Club)
Bulldog Floodway	3. Sossaman Channel Improvements (U.S. 60 to Baseline Rd.)
Signal Butte Dam & Floodway	4. Rittenhouse Drainage Improvements (Phase 1 & Phase 2)
Pass Mountain Diversion	5. Southeast Mesa ADMP & Ellsworth / Germann Improvements
Spookhill FRS & Floodway.	6. Price Drain
Sossaman Basin & Channel	7. Southeast Valley Regional Drainage System
East Maricopa Floodway	
Rittenhouse FRS	
Powerline FRS	
Powerline Floodway	
Guadalupe FRS	
48th Street Drain	

EXISTING STRUCTURES :

BUCKHORN-MESA STRUCTURES

The Buckhorn-Mesa Watershed is located in eastern Maricopa and northwestern Pinal Counties with a drainage area of approximately 109 square miles. During major storm events, floodwaters rush down the west slopes of the Superstition, Goldfield and Usery Mountains onto a wide alluvial fan where slopes are flat and washes become less defined. The drainage pattern is in a southwesterly direction towards the urbanized portion of the City of Mesa. The Buckhorn Mesa Watershed Project is a series of four earthen floodwater retarding dams with interconnecting floodway channels. The dams capture floodwater and route it through the floodways to a single outlet which flows to the Salt River.

The original project proposal included construction of a dam, east of Apache Junction, with an adjoining floodway that would outfall into the reservoir behind Apache Junction Dam. This segment of the project, however, has yet to be constructed. The completed portion of the project was built between 1979 and 1988 when the East Mesa and Apache Junction area underwent tremendous growth, increasing the need for flood protection. The City of Mesa has an agreement to develop recreational features behind Spookhill Dam. The initial Arizona Department Of Transportation (ADOT) plan for the Red Mountain Freeway proposes to cross Spookhill Dam at McDowell Road. Care must be taken to ensure that the final design accommodates access, a minimum of twelve feet wide and eight feet high, for District maintenance vehicles. This would also allow a continuous east and west trail connection for equestrian and bicycle access underneath the freeway.

Apache Junction Dam and Floodway

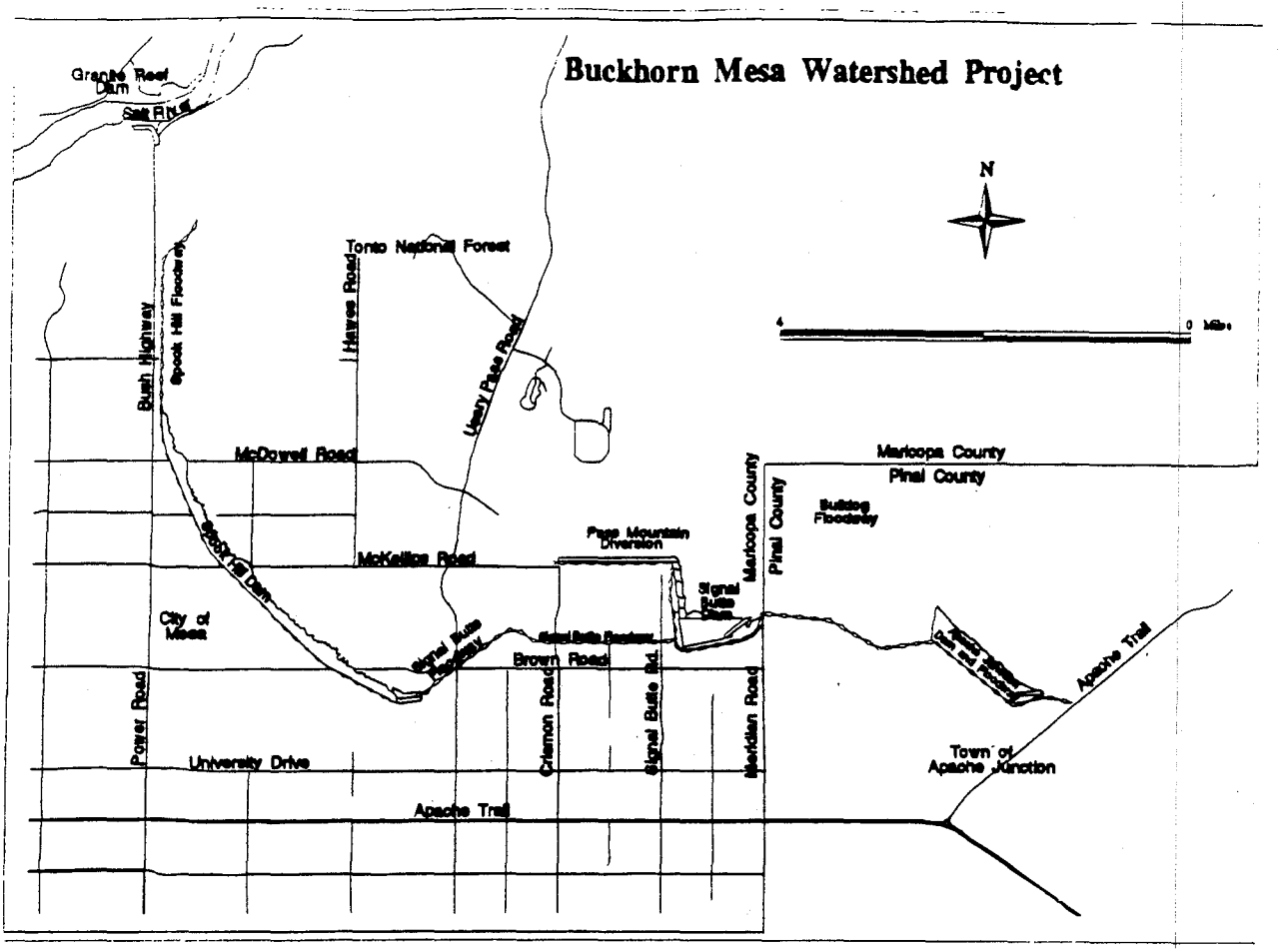
The floodway starts west of the Apache Trail, State Route 88 in Pinal County, and diverts floodwater from a wash above the dam into the reservoir area. The 1,500 foot floodway is a reinforced rectangular concrete channel with a maximum width of ten feet and a length of 1,537 feet. There are side inlets to intercept flows from washes and drain them into the dam reservoir. The dam was built in 1988 to serve a drainage area of six square miles with a storage capacity of 552 acre feet. The maximum height of the dam is twenty-two feet and its length is 1.6 miles. The top width is fourteen feet and has a reinforced concrete emergency spillway and principal outlet.

Bulldog Floodway

The floodway was completed in 1988, and is located east of the Maricopa-Pinal County line north of Brown Road and is a reinforced concrete rectangular channel with a length of 1.7 miles and maximum width of fifty feet. The floodway transports stormwater impounded behind Apache Junction Dam into the reservoir behind Signal Butte Dam. There is a drop structure with a stilling basin to reduce erosive velocities where the floodway enters the Signal Butte Dam reservoir.

Signal Butte Dam and Floodway

This dam and floodway consist of a 1.3 mile earthen dam dedicated in 1987 and 2.7 mile floodway completed in 1984. Together, they convey floodwaters discharged from Signal Butte Dam and Pass Mountain Diversion Dam to an outlet behind Spookhill Dam. The structure drains sixteen square miles above the Apache Trail near the Maricopa-Pinal County line. The storage capacity of the reservoir is 1,365 acre-feet. The maximum height of the dam is thirty-nine feet and the length is 1.3 miles. The top width is fourteen feet and there is a reinforced concrete emergency spillway and



principal outlet. The outlet is a drop structure with a stilling basin at the bottom. There are weir type side inlets along the length of the channels to catch incoming runoff. Special drains supply water to native vegetation that previously relied on naturally occurring washes before construction of the structure. The floodway channel is unlined and trapezoidal in shape with a bottom width of thirty-two feet.

Pass Mountain Diversion Dam and Floodway

This dam consists of a 1.2 mile long earthen embankment and a 2,800 foot outlet that drains floodwaters from a four square mile area downstream to the Signal Butte Dam. The maximum height of the diversion dam is thirteen feet with a top crest width of fourteen feet. Runoff from the north drains to an unlined channel parallel to the diversion dam. From there the flows pass through an outlet consisting of a series of six drop structures constructed of both grouted and loose riprap to dissipate energy before draining to the Signal Butte Dam reservoir. The diversion Dam and Floodway were completed in 1987.

Spookhill Flood Retarding Structure (FRS) and Floodway

This structure is located east of Bush Highway, up slope of the Central Arizona Project (CAP). The FRS was completed in 1979 and has a storage capacity of 866 acre-feet which stores runoff from a drainage area of fourteen square miles. Discharges from the Signal Butte Floodway drain to the reservoir of the earthfill FRS. The length of the FRS is 3.9 miles with a maximum height of twenty-

five feet. There is a reinforced concrete emergency spillway and the principal outlet is a concrete pipe, seven feet by 7.5 feet. The seven foot by 11.5 foot outlet is embedded in reinforced concrete. All outlet flows drain to an unlined trapezoidal channel two miles long that was built in 1980 and discharges into a wash which crosses the Bush Highway.

The capacity of the wash west of Bush Highway was improved by placement of vertical concrete walls with grouted riprap at the bottom. The outlet channel's length is 856 foot and the bottom width is forty feet. The flows enter a sediment basin for detention before reaching the final outlet at the Salt River. Water from the sediment basin and final outlet supports a riparian area of approximately five acres. The Buckhorn Mesa Watershed Project provides important multipurpose functions incorporating many scenic and recreation amenities.

SOSSAMAN DRAIN

Storm runoff from farms, residential areas and street flooding drains into an unlined trapezoidal channel located parallel and east of Sossaman Road. The channel starts from a detention basin north of Baseline Road and terminates at Guadalupe Road to the south. The bottom width varies from forty to sixty feet and is 1.1 miles long. There are seven drop structures along the channel to dissipate the erosive energy of moving water. Flows from Sossaman Channel are conveyed to the EMF Floodway by the Guadalupe Channel at the intersection of Guadalupe Road and Power Road. This flood control feature was built in 1977.

EAST MARICOPA FLOODWAY (EMF)

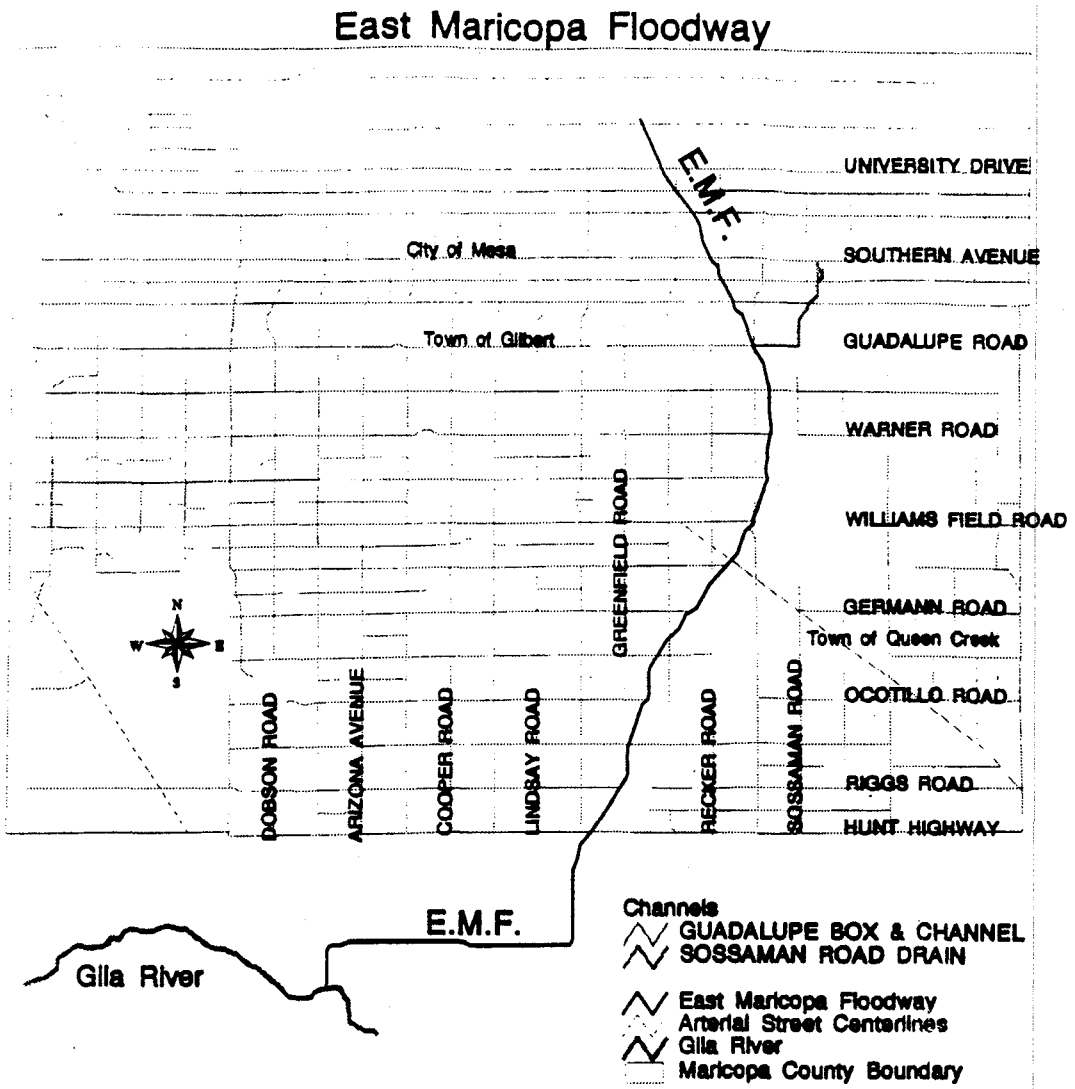
The floodway channel is 27.5 miles long and was completed in 1989. The floodway receives storm runoff from the Buckhorn-Mesa, Apache Junction-Gilbert and Williams watersheds. The EMF diverts the water to the Gila River through the Gila River Indian Community, east of Interstate 10. The origin point is a detention basin 200 feet north of Brown Road. The floodway then runs parallel to the Roosevelt Water Conservation District (RWCD) irrigation canal in a north to south alignment to the Hunt Highway. The termination point is at an outlet at the Gila River on the Gila River Indian Reservation. There are a total of six reaches and majority of the channel is unlined and trapezoidal in shape except at Reach 4 where it is concrete lined. Major tributaries to the EMF are Queen Creek, Guadalupe, and Sossaman Channels, the Superstition Freeway Channel and Powerline Floodway. A section of the channel, located between Guadalupe Road to Broadway Road, is utilized as a golf course.

Rittenhouse FRS

This FRS was built in 1969 to collect stormwater runoff from a 51 square mile area. Stormwater runoff is temporarily impounded in the reservoir of the FRS and released to a 33 inch principal outlet pipe leading into Vineyard FRS. The structure is compacted earthfill with a storage capacity of 4060 acre-feet. The maximum height is 20 feet and the length is 3.6 miles.

Powerline FRS

Stormwater runoff is collected from a 60 square mile area is temporarily impounded in the reservoir of the FRS. Water is released into a 36 inch principal outlet pipe that flows into the Powerline Floodway. The structure was completed in 1967 and is made of compacted earthfill with a storage capacity of 4194 acre-feet. The maximum height is 24 feet and the length is 13,358 linear feet.



Powerline Floodway

The floodway starts near the principal outlet of Powerline FRS and crosses the CAP Aqueduct. It then follows a southwesterly direction across the southern end of General Motors Proving Grounds bordering the northern edge of Williams Air Force Base. Stormwater is impounded in the reservoirs of Rittenhouse FRS, Vineyard FRS, and Powerline FRS which drains into a common channel discharged into the Powerline Floodway. The floodway channel receives additional runoff throughout its entire length through side inlets. The unlined section varies in width from 50 to 60 feet with riprap side slopes with a depth of six feet and a length of 1.8 miles. The width of the concrete-lined section is six to eight feet with a depth varying from 4.5 to 6.5 feet and length of approximately seven miles. The Floodway was completed in 1968. All stormwater collected is eventually discharged into the East Maricopa Floodway.

GUADALUPE FRS

The Guadalupe Flood Retention Structure (FRS) has a drainage area of 1.9 square miles which includes the steep slopes of the southern and eastern edges of South Mountain. The FRS was built in 1975 and consists of four levees which, together, comprise the reservoir area. The total length is 2,910 feet and the maximum height is 34.5 feet with a top crest width of fourteen feet. The storage capacity of the reservoir is 298 acre-feet. An unlined spillway, excavated through granite, extends between two levees. The principal outlet structure is a complex reinforced intake tower designed

to prevent heavy silt from discharging. A thirty inch RCP attached to the structure allows discharges into an open basin and a twenty-four inch RCP drains water from the basin into the outlet.

48TH STREET DRAIN

This structure receives storm runoff from surrounding city streets, the Hohokam Expressway and irrigation waste waters from the San Francisco Canal, and transports them to the Salt River near 32nd Street. The channel is concrete-lined trapezoidal in shape with a bottom width of ten feet and length of 1.9 miles. The Drain was completed in 1981.

CIP PROJECTS:

Guadalupe Drainage Improvements

The project will provide a storm water collection, three retention basins located along the Highline Canal and outfall system for runoff originating within the Town of Guadalupe. Runoff from within the Town results in flooding of low lying houses and collects along the Highline Canal. The ponded water results in flooding of adjacent homes and causes damage to the canal and to downstream properties within Tempe.

The costs for design and construction of the project are estimated to be $3,900,000. Based upon the appraised price of the two parcels currently for sale, the rights-of-way for the project are estimated to be $2,120,000. The town is not currently able to contribute financially to the project but will assume maintenance responsibilities for the basins. Additionally, the Town will seek grants and other means to participate in the construction phase.

Salt River Channel–Dobson to Country Club

This project includes improvements to the south bank of the Salt River to provide 100-year level of protection (215,000 cfs) from Dobson Road east to Country Club Drive. The project, which is being constructed as part of the Red Mountain Freeway project, will provide protection for an area containing light industrial and commercial development and multiple landfill sites. This project is the last segment of work that will be constructed by ADOT along the Salt River. Using criteria provided by the District, ADOT will construct and fund the project to be completed in early 1998. The District will assume future operations and maintenance of the bank protection/levee.

Sossaman Channel

This project is located in east Mesa, between Sossaman Road and Hawes Road and the Superstition Freeway (U.S. 60) to Baseline Road. The existing channel section does not have sufficient capacity to convey the 100-year peak discharge of 2400 cfs. The project will improve the channel from U.S. 60 to Baseline Road.

District staff is projected to design the Channel sometime in FY 96-97. The $600,000 allocated to the project will be reviewed after completion of the design. At that time, the project construction date may be revised, depending on the availability of funds.

Rittenhouse Drainage Improvement

The project consists of an earthen channel adjacent to the Southern Pacific Railroad between the Queen Creek School east of Ellsworth Road and the East Maricopa Floodway west of Power Road. The six mile long project includes portions of Queen Creek, Mesa and Gilbert. The channel will provide 100-year protection for the school, contain the FEMA 100-year floodplain, and provide an outfall for future storm drain construction. In accordance with an IGA, the Town of Queen Creek will acquire the project rights-of-way. District costs for construction are estimated at $5.0 million (100%).

Approximately $650,000 in project costs have been saved through advance construction of a portion of the channel by the Air Force Base Conversion Agency near Williams Gateway Airport. This construction was completed by the Agency in exchange for the District's purchase of the necessary rights-of-way. Phase I construction started in July of 1996 and is estimated to cost $1.5 million.

Southeast Mesa ADMP and Ellsworth/Germann Improvements
This project was requested by the City of Mesa to help alleviate flooding along Ellsworth and Germann Roads. The flooding along Ellsworth Road disrupts the primary access route to the General Motors Proving Grounds and along Germann Road to TRW's South Mesa Airbag Production Facility.

Hydrology for the 76.5 square mile study has been prepared in-house. A consulting firm has been contracted to determine solutions to the flooding problem using the hydrology prepared by the District. Funds have been budgeted in FY 96-97 to identify the design alternatives. The Ellsworth/Germann Improvements are scheduled for FY 99-00. It is anticipated that other projects will be identified and implemented with other interested cost-sharing partners.

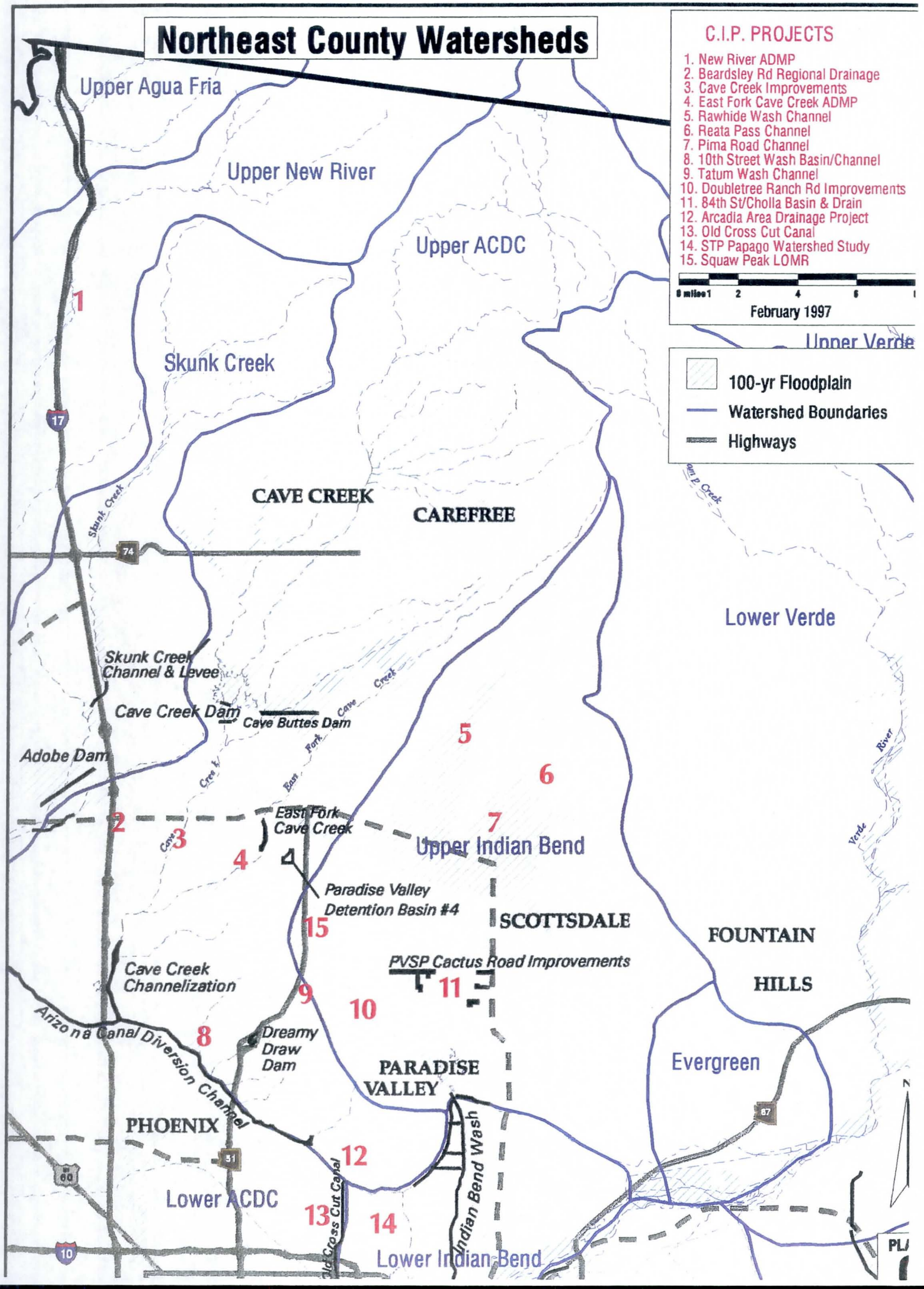
Price Road Drain
In 1987, ADOT, the District, Mesa, and Chandler entered into an Intergovernmental Agreement for the design, construction, and construction management of the Price Road Drain. This storm drain project extends south from the Salt River to Carriage Lane Park in Mesa. It is designed to serve ADOT's Price Road Freeway drainage needs and serve as an outfall for Mesa and Chandler storm drains, accommodating up to 230 cfs from the region. The drain varies in diameter from 9-18 feet and is buried up to 60 feet in depth. The outfall, at the Salt River, is a combination of a U-shaped channel and box culvert.

The total cost of the project is $49,600,000. The District's share is $8,900,000. Construction of the Carriage Lane Outfall pipe, from U.S. 60 south to Carriage Lane Park, will be completed in early 1997. This is the last component of the Price Road Drain and it will be fully operational upon the completion of the Carriage Lane Outfall.

Southeast Valley Regional Drainage System
The Southeast Valley Regional Drainage System (SEVRDS) includes a 100-year drainage system (900 to 2800 cfs) to be built within the San Tan Freeway corridor between Price Road and a connecting channel from the basin near 56th St. to the Gila Drain Floodway west of I-10. When combined with contributing flows from the Price Freeway drainage system (south of Ray Road), the SEVRDS will intercept and convey municipal and freeway drainage from 58 square miles in Chandler, Tempe, Gilbert and Maricopa County. The project will also protect areas of the Gila River Indian Community (GRIC) located south of Pecos Road and west of Price Road from off-Community flows.

The SEVRDS is addressed in the Gilbert/Chandler ADMS and is an integral component of Chandler's storm water master plan. Total cost ~~is~~ estimated at $24 million. Alternatives to the original concept are being developed in cooperation with ADOT, the GRIC, Chandler and SRP. The District's cost share is estimated at $10.6 million. Chandler will provide interim O&M until the San Tan freeway is constructed by ADOT.

Northeast County Watersheds



CONCLUSIONS AND RECOMMENDATIONS

This portion of the Comprehensive Report/Plan identifies and describes conclusions and recommendations drawn from the preceding section concerning the existing Flood Control District programs.

Flood Warning and Data Collection Program:

Data collected by this effort serves to calibrate the District's models for rainfall and flooding. Since all engineering designs are based on the need to contain certain size floods, having accurate information about those floods is key to efficient engineering. This program insures that District structures are not under designed (which doesn't solve the flooding problem), but yet are not over designed, which would be a waste of tax payers' money.

- District staff will continue to research and collect rainfall/runoff data in order to sustain this vital link in the calibration and continued refinement of hydrologic models which are the basis for engineering designs.

Floodplain Administration Program:

The identification of floodplains and an administrative effort to minimize development in those areas is essential to a pro-active stance towards preventing flood damages to property, rather than trying to retrofit expensive, structural engineering measures, after the fact. A FEMA (Federal Emergency Management Agency) floodplain ensures that flooding problems are addressed during the development of the property.

- District staff will continue to develop, support, and enforce an aggressive floodplain management program which has resulted in a 20% discount of flood insurance premiums, the second highest discount in the country.

Drainage Administration Program:

Many flooding problems associated with older residences are a result of the homes being constructed at grade or level with the surrounding ground. This allows flooding from very shallow sheet flows which can inundate houses causing significant damage. The drainage regulations currently in place preclude that from occurring with new construction. The existing regulatory program prevents flooding problems by insuring that adequate safeguards are in place prior to construction. This method is significantly less expensive to address the problem rather than allowing unregulated construction and then rectifying the problem afterwards.

- District staff will continue to develop, support, and enforce pre-emptive regulatory programs which are a less expensive way to deal with potential flooding problems. This is borne out by the fact that the District rarely has to "fix" flooding problems resulting from new construction.

Maintenance Program:

Increased public awareness of environmental issues and recreational opportunities has led to the inclusion of multi-purpose objectives in the development of some flood control structures. Generally, this involves a different type of landscaping and maintenance program. In those cases where the recreational activities are active (e.g., planned uses), much of the maintenance component is taken over by the other agency cost sharing the project, for whom recreation is the primary objective. This trend could reduce the overall need for the District to perform 100% of the maintenance on all of its structures. This program may also decrease District maintenance by having the "active users" of the structure be responsible for the non-structural maintenance

- District staff will encourage and support the multiple-use of District structures/property provided that the primary flood control purposes are not compromised nor additional costs to the District incurred.

Planning Program:

As a result of reviewing land use and demographic projections for the next twenty years, the ADMS schedule has been changed to reflect anticipated high growth areas of the County. A primary purpose of the ADMS' is to "get out ahead" of development by characterizing flooding potential. This is desirable so that development can take appropriate steps to preclude flooding problems through improved design and construction.

- District staff will review current population projections for growth in the County and change the development schedule for Area Drainage Master Plans so that storm water planning is targeted towards and encompasses potential high growth areas.

Capital Improvement Program:

After the fourth round of Capital projects prioritization, there is a need to update and adjust the criteria and the weighting scheme, so that "local" projects are properly characterized and rank ordered accordingly. Previously, the District's CIP has focused almost totally on solving regional drainage and flood control problems.

- District staff will review and appropriately revise the qualifying criteria for the Prioritization Procedures and will modify the existing standards to reflect differences between local projects and those regional in nature. A separate program within the CIP will be proposed to address local problems.

Environmental Program:

Increased federal and state requirements for environmental mitigation have put a premium on the need to incorporate those requirements early-on into the design of a project. Environmental permitting is often a time consuming process. Environmental permits, such as 401 and 404 permits, issued by the Corps of Engineers may require six to eight months for processing. District staff has increased their awareness of changing rules for permits. Staff strives to establish realistic project time lines to acquire required permits and/or clearances allowing construction to move forward without delay.

- District staff will comply with environmental regulatory programs to obtain required permits, including implementation of mitigation features, necessary to construct flood control projects, and will consider environmental enhancements where practicable without compromising the primary flood control purposes or increasing the costs.

Property Management Program:

Several cities have approached the District about the right to use District property for groundwater recharge. In response, the District has developed a policy for that use. Other entities have become interested in the potential for recharge on District lands. This interest has resulted in a new policy for land utilization which could provide a new potential source of revenue for the District.

- District staff will review and support requests from municipalities for the potential water recharge of District property.

While the following two programs, Public Involvement and Open Space, are not budgeted programs they are included because they embody important activities or objectives supported by the District.

Public Involvement Program:

The public demands to be increasingly involved in District projects. In the past, public involvement has been perceived as lost time on a project. Efforts to include the public in the planning process have, however, proven to be much more efficient and the District gains public credibility. District staff has developed an increased awareness of the need for public involvement. Time and materials are built in to every project so that public input can be accommodated. Multi-use of flood control projects increases the value and utility of projects from the public's perspective. In the long run, public involvement is more efficient, and the District gains credibility when the public becomes part of the planning process.

- District staff will increasingly involve the public in the planning and implementation of District projects.

Open Space Program:

The concept for preservation of open space is compatible with several District activities. The District encourages other agencies and communities to utilize and develop District property and facilities for recreational or multiple-use amenities. Through active participation during a projects planning and design phase, multiple-use objectives can be facilitated without adversely impacting flood control objectives.

- District staff will continue to consider and cooperate with interested parties to achieve the goals included in the Desert Spaces Regional Open Space Plan where practicable and without compromising the primary flood Control purposes or increased costs of planned facilities.

NOTE: The Public Involvement and Open Space "Programs" are not included in our defined & budgeted programs. Why are they included in this section? 4/2/97

CONCLUSIONS AND RECOMMENDATIONS

This portion of the Comprehensive Report/Plan identifies and describes conclusions and recommendations drawn from the preceding section concerning the existing Flood Control District programs.

Flood Warning and Data Collection Program:

Data collected by this effort serves to calibrate the District's models for rainfall and flooding. Since all engineering designs are based on the need to contain certain size floods, having accurate information about those floods is key to efficient engineering. This program insures that District structures are not under designed (which doesn't solve the flooding problem), but yet are not over designed, which would be a waste of tax payers' money.

- District staff will continue to research and collect rainfall/runoff data in order to sustain this vital link in the calibration and continued refinement of hydrologic models which are the basis for engineering designs.

Floodplain Administration Program:

The identification of floodplains and an administrative effort to minimize development in those areas is essential to a pro-active stance towards preventing flood damages to property, rather than trying to retrofit expensive, structural engineering measures, after the fact.

- District staff will continue to develop, support, and enforce an aggressive floodplain management program which has resulted in a 20% discount of flood insurance premiums, the second highest discount in the country.

Drainage Administration Program:

Many flooding problems associated with older residences are a result of the homes being constructed at grade or level with the surrounding ground. This allows flooding from very shallow sheet flows which can inundate houses causing significant damage. The drainage regulations currently in place preclude that from occurring with new construction. The existing regulatory program prevents flooding problems by insuring that adequate safeguards are in place prior to construction. This method is significantly less expensive to address the problem rather than allowing unregulated construction and then rectifying the problem afterwards.

- District staff will continue to develop, support, and enforce pre-emptive regulatory programs which are a less expensive way to deal with potential flooding problems. This is borne out by the fact that the District rarely has to "fix" flooding problems with new construction.

Maintenance Program:

Increased public awareness of environmental issues and recreational opportunities has led to some of the flood control structures to include ~~having~~ multi-purpose objectives. Generally, this involves a different type of landscaping and maintenance program. In those cases where the recreational activities are active (e.g., planned uses), much of the maintenance component is taken over by the other agency cost sharing the project, for whom recreation is the primary objective. This trend could reduce the overall need for the District to perform 100% of the maintenance on all of its structures. This program may also decrease District maintenance by having the "active users" of the structure be responsible for the non-structural maintenance

- District staff will encourage and support the multiple-use of District structures/property provided that the primary flood control purposes are not compromised nor additional costs to the District incurred..

Planning Program:

As a result of reviewing land use and demographic projections for the next twenty years, the ADMS schedule has been changed to reflect anticipated high growth areas of the County. A primary purpose of the ADMS' ~~are~~ is ~~intended~~ desired to "get out ahead" of development ~~while~~ by characterizing flooding potential. This is ~~necessary~~ desired so that development can take appropriate steps to ~~avoid~~ preclude flooding problems ~~in the first place.~~ through improved design and construction.

- District staff will review current population projections for growth in the County and change the development schedule for Area Drainage Master Plans so that storm water planning is targeted towards and encompasses potential high growth areas.

Capital Improvement Program:

After the fourth round of Capital projects prioritization, there is a need to update and adjust the criteria and the weighting scheme, so that "local" projects are properly characterized and rank ordered accordingly. Previously, the District's CIP has focused almost totally on solving regional drainage and flood control problems.

- District staff will review and appropriately revise the qualifying criteria for the Prioritization Procedures and will modify the existing standards to reflect differences between local projects and those regional in nature. A seperate program within the CIP will be proposed to address local problems.

Public Involvement Program:

The public demands to be increasingly involved in District projects. In the past, public involvement has been perceived as lost time on a project. Efforts to include the public in the planning process have, however, proven to be much more efficient and the District gains public credibility. District staff has developed an increased awareness of the need for public involvement. Time and materials are built in to every project so that public input can be accommodated. Multi-use of flood control projects increases the value and utility of projects from the public's perspective. In the long run, public involvement is more efficient, and the District gains credibility when the public becomes part of the planning process.

- District staff will increasingly involve the public in the planning and implementation of District projects.

Environmental Program:

Increased federal and state requirements for environmental mitigation have put a premium on the need to incorporate those requirements early-on into the design of a project. Environmental permitting is often a time consuming process. Environmental permits, such as 401 and 404 permits, issued by the Corps of Engineers may require six to eight months for processing. District staff has increased their awareness of changing rules for permits. Staff strives to establish realistic project time lines to acquire required permits and/or clearances allowing construction to move forward without delay.

- District staff will comply with environmental regulatory programs to obtain required permits, including implementation of mitigations features, necessary to construct flood control projects, and will consider environmental enhancements where practicable without compromising the primary flood control purposes or increasing the costs.

Property Management Program:

Several cities have approached the District about the right to use District property for groundwater recharge. In response, the District has developed a policy for that use. Other entities have become interested in the potential for recharge on District lands. This interest has resulted in a new policy for land utilization which could provide a new potential source of revenue for the District.

- District staff will review and support requests from municipalities for the potential water recharge of District property.

Open Space Program:

The concept for preservation of open space is compatible with several District activities. The District encourages other agencies and communities to utilize and develop District property and facilities for recreational or multiple-use amenities. Through active participation during a projects planning and design phase, multiple-use objectives can be facilitated without adversely impacting flood control objectives.

- District staff will continue to consider and cooperate with interested parties to achieve ~~the presentation~~ goals included in the Desert Spaces Regional Open Space Plan where practicable and without compromising the primary flood Control puporses or increased costs of planned facilities.

FLOOD CONTROL STRUCTURES IN NORTHEAST COUNTY

Existing Structures	Programmed Capital Improvements
Cave Buttes Dam	1. Upper New River Mitigation
Adobe Dam	East Fork Cave Creek:
East Fork of Cave Creek	2. Rosemont Drive Lateral
Cave Creek Channelization	3. Utopia Rd. Lateral
Arizona Canal Diversion Channel	4. Grovers Ave. Lateral
Dreamy Draw Dam	5. Campo Bello Drive Lateral.
Old Cross Cut Canal	6. Rawhide Wash Improvements
10th St. Wash Detention Basin	7. Reata Pass Channel
Indian Bend Wash	8. Pima Rd. Channel
Cave Creek Sediment Basin & Channel	9. 10th St. Wash Basin #2
	10. Tatum Wash Channel & Basin
	11. Doubletree Ranch Rd. Drain
	12. 84th St./Cholla Basin & Storm Drain
	13. Arcadia Area Drainage Project
	14. Old Cross Cut Canal (McDowell to Arizona Canal)
	15. Squaw Peak LOMR
	16. STP Papago Watershed Study

EXISTING STRUCTURES :

CAVE BUTTES DAM

Runoff from Cave Creek Wash and Old Cave Creek Dam is impounded behind Cave Buttes Dam. This reservoir has a storage capacity of 46,600 acre-feet and a drainage area of 191 square miles. The Dam has a maximum height of 190 feet with a top crest width of 20 feet and a length of 2,275 feet. A 7.25 foot by 7.25 foot principal outlet concrete structure is connected to a 45 foot diameter conduit 529 feet in length. Controlled releases from the reservoir drain downstream to Cave Creek Wash. This structure was dedicated in 1980.

ADOBE DAM

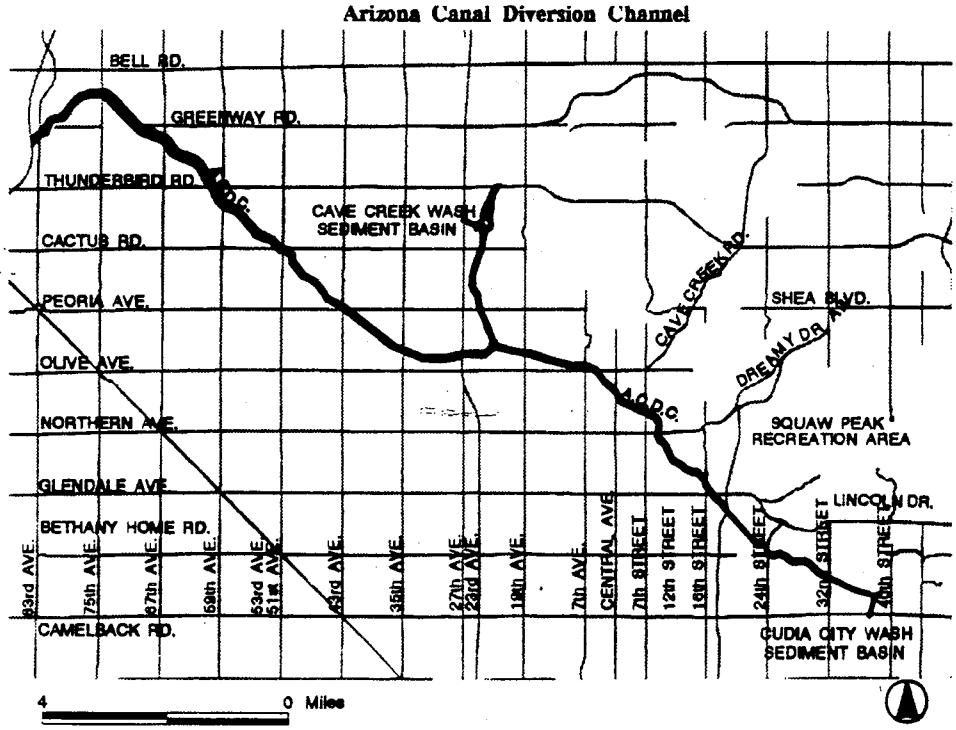
This structure is a compacted earthfill dam with a maximum height of 63 feet and a length of 11,245 feet. The top crest width is 20 feet and the storage capacity is 18,350 acre-feet. The principal outlet concrete structure is 6 feet by 9 feet and is constructed with a headwall and flared wingwalls. The length of this conduit is 290 feet long. The drainage area is over 90 square miles in size. Controlled releases from the reservoir drain to Skunk Creek. The structure was completed in 1982.

EAST FORK OF CAVE CREEK

This project supports a drainage area of 16.5 square miles and is a combination of five detention basins, channels and storm drains. Stormwater runoff from these structures eventually reaches Cave Creek Sediment Basin and the ACDC. These structures were completed in 1987.

ARIZONA CANAL DIVERSION CHANNEL (ACDC)

The ACDC is a channel 16.5 miles long that was completed in 1994. The Diversion Channel serves a watershed encompassing 152 square miles of high-density urban development. The Channel runs



parallel to the Arizona Canal from the Cudia City Wash sediment basin to Skunk Creek. The concrete lined channel is open for most of its length and rectangular in shape. There are covered sections of the channel along the Biltmore Hotel and at the intersection of Central and Dunlap Avenues. The channel transitions into grass-lining at 53rd Ave. North of Cactus Road which continues to the outlet at Skunk Creek. The ACDC receives runoff from major washes and storm drains and from controlled releases from sediment basins at Adobe and Dreamy Draw Dams.

DREAMY DRAW DAM

This dam is composed of compacted earthfill with a maximum height of 56 feet and 448 feet in length. The drainage area is 1.3 square miles and the storage capacity behind the dam is 317 acre feet. The top crest width is 20 feet and the size of the principal outlet structure is 6 feet by 6 feet concrete and 36 inches RCP. A detached spillway is located in a saddle about 400 feet east of the principal outlet. The structure was completed in 1973.

OLD CROSSCUT CANAL

The drainage area that flows into the Old Crosscut Canal is four (4) square miles and includes Camelback Mountain on the north and the Arizona Canal on the south, from 40th Street to 68th Street. The channel receives storm runoff from the east through overland flows and from the west through storm drains. Excess water from the Arizona Canal is discharged into the Cross Cut Canal. The structure is being improved to a rectangular concrete channel 3.6 miles long which continues south to an outlet to the Salt River. This improved channel should be completed south of Indian School Road in 1999.

10TH STREET WASH DETENTION BASIN

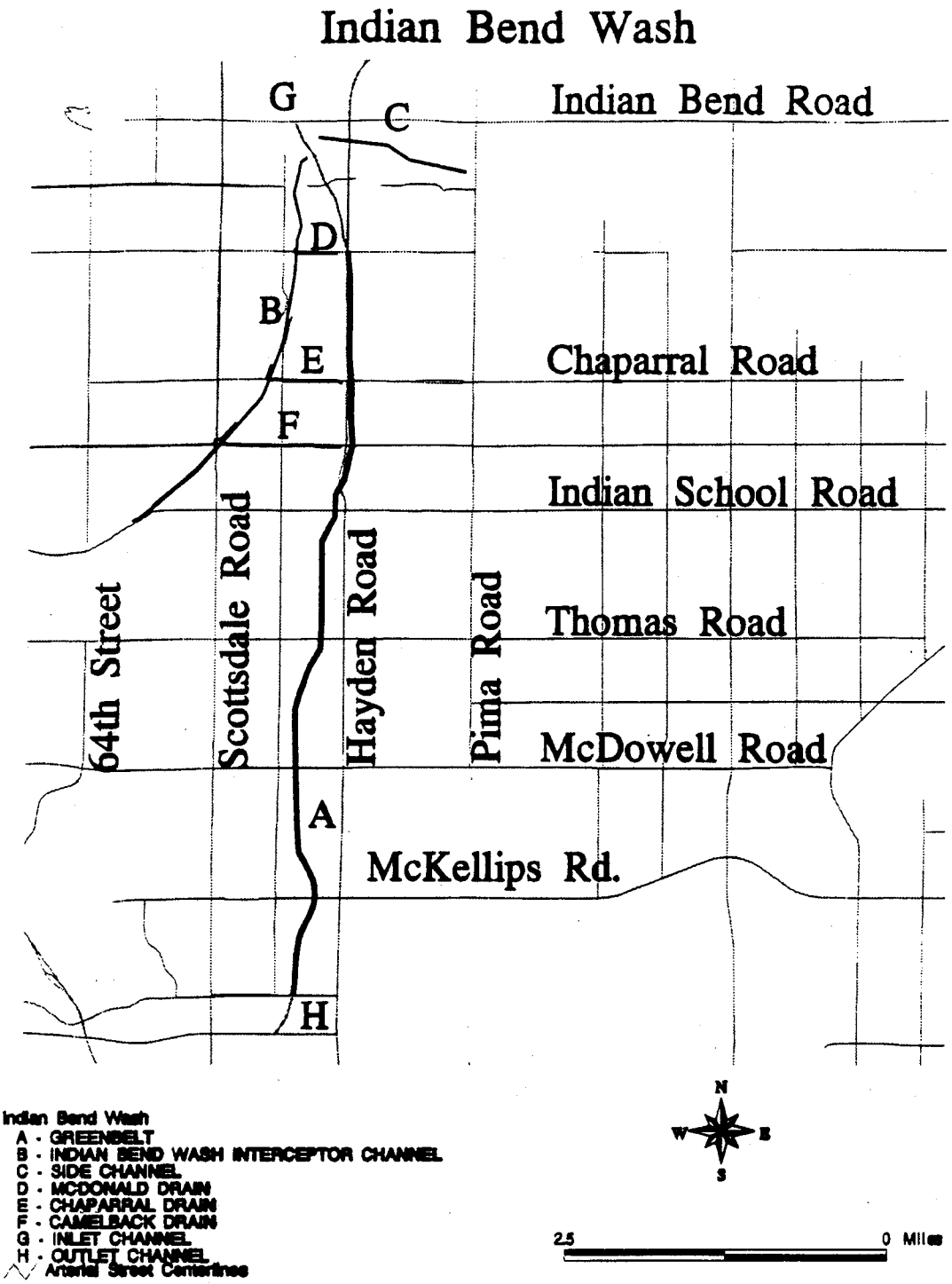
Phase 1 of this project was completed in 1995 and consists of a single detention basin. The basin connects with the northern portion of 10th Street Wash and serves a drainage area a half-mile in size. The wash itself originates in the North Mountain Preserve and flows in a north to south alignment. Flows from 10th Street Wash drain to the ACDC.

INDIAN BEND WASH

The most outstanding feature of the Indian Bend Wash Project (IBW) is the greenbelt stretching through the City of Scottsdale. Completed in 1985 as a flood control channel, the IBW conveys flood flows through Scottsdale to the Salt River. As a recreational amenity, it provides open space, grassy areas, golf courses, ball fields, hiking and bicycle trails, picnic areas and other features enhancing the quality of life for area residents. The project was designed and constructed by the U.S. Army Corps of Engineers with the Flood Control District as the local flood control sponsor and the City of Scottsdale as the recreation sponsor.

The concept for the IBW was to confine flooding to its natural path through the use of structural elements and then enrich the natural flood path with complementary recreation features. The heart of the concept is the greenbelt which is a 4.5 mile long grassy swale, ranging from 600 to 1,100 feet in width. The IBW is designed to safely accommodate a 100 year flood, which is a major flood with a percent chance of occurring in any given year.

The IBW drainage system starts south of the Arizona Canal, in Scottsdale, near Indian Bend and Hayden Roads and terminates at the Salt River. The drainage area is approximately 65 square miles which includes portions of Scottsdale, Tempe and Phoenix. Floodwaters draining into the IBW



originate in the Pinnacle Peak, Paradise Valley, and Phoenix Mountain Park areas. The greenbelt extends from McDonald Drive, in north-central Scottsdale, to McKellips Road. A channel conveys flood flows an additional to an outlet at the Salt River.

Extending from the west side of the Arizona Canal at Camelback Road to the north side of the Canal, south of Indian Bend Road, is a series of collectors, side channels and underground pipes. These structures collect stormwater and prevent ponding and water from overtopping the Canal. The collectors and side channels were completed in 1985.

The IBW Inlet is an unlined earthen channel, trapezoidal in shape, stretching one mile from Indian Bend Road south to McDonald Drive. The bottom width varies from 420 to 640 feet with depths ranging from twelve to fourteen feet. Runoff from the slopes of the Arizona Canal and surrounding area drain first to the main channel and then spill over into the greenbelt floodway. This feature was completed in 1979.

A Siphon transports water in the Arizona Canal west of Hayden Road under the Indian Bend Wash. It was designed to permit diversion of canal flows in the wash, but it also prevents wash flows from entering the Arizona Canal. This structure is an underground reinforced concrete box four feet by eleven feet at a maximum depth of 16.5 feet.

The Outlet Channel is an unlined earthen channel, trapezoidal in shape, stretching from McKellips Road to the Salt River. The bottom width varies from 540 feet to 600 feet with depths ranging from 3.5 feet to 9.5 feet. The outlet channel was completed in 1979.

The Interceptor Channel collects storm runoff from the north side of the Arizona Canal and east of the Wash between Pima and Hayden Roads. It intercepts and disposes of floodwaters that pond behind the north bank of the Arizona Canal. There is a spillway section where the Arizona Canal can overflow into the interceptor channel rather than overtopping its south bank and causing flood damages. It is an unlined trapezoidal channel with a width of 100 to 150 feet and depths ranging from seven to ten feet.

CAVE CREEK SEDIMENT BASIN AND CHANNEL

This sediment basin receives storm runoff from Cave Creek Wash, Moon Valley Wash, Greenway Parkway Channel and several storm drains. The basin is earthlined and landscaped with bushes and trees. The basin is 340 feet wide, 1,500 feet long with side slopes varying from 3:1 to 10:1 to produce a wavy appearance. The spillway, at the downstream end of the basin, consists of a concrete crest section with a downstream concrete chute. The flows reach the ACDC through a 1.8 mile long concrete channel which was completed in 1991. This channel is trapezoidal in shape with bottom widths ranging from 50 to 84 feet with 2:1 side slopes. The channel transitions for a length of 400 feet into a rectangular shape 65 feet wide for a distance of a quarter-mile.

CIP PROJECTS :

Upper New River Flood Mitigation

There is a potential threat of loss of life for citizens residing in the floodplain the Upper New River, between New River Road and Table Mesa Road. In 1989, the District conducted a floodplain delineation of this river reach.

During a 100-year event, flows were calculated to be up to 11 feet deep moving at 18-22 feet per second. Water of this depth and velocity is capable of floating houses off their building foundations, eroding material from under the foundations, or carrying large boulders which would destroy the structures. In January, 1993, flows estimated to be a 50-year event were recorded. A house was flooded, the channel bank of the river was eroded, and access to several dozen homes cut.

The recommended project alternative was to purchase the houses and relocate the residents rather than build a structure. The District contacted 34 property owners of which 15 accepted the buy-out offer. The cost of the buy-out and relocation, to date, has been $1.9 million. The purchased houses are being demolished and the area will be allowed to return to natural conditions. The District is seeking a Resource Agency to oversee the property and manage it as natural habitat.

Rosemont Drive Lateral

This project includes buried drainage conduit to convey the 100-yr. runoff to Detention Basin # 2. The lateral begins in Rosemont Dr. east of 12th Street In all, the components of the East Fork Cave Creek project (5 basins, 1 channel and 4 laterals) will collect runoff from 16-square miles.

Utopia Road Lateral

This project includes buried drainage conduit to convey the 100-yr. runoff to the East Fork Cave Creek channel. The lateral begins east of 32nd Street and runs west underneath Utopia Road to the EFCC channel.

Grovers Avenue Lateral

This project includes buried drainage conduit to convey the 100-yr. runoff to Detention Basin #3. The lateral begins west of 32nd Street and runs west under Grovers Avenue to the west side of Cave Creek Road Basin

Campo Bello Drive Lateral

This project includes buried drainage conduit to convey the 100-yr. runoff to Detention Basin #5. The lateral begins at 18th Street and runs east under Grovers Avenue to 12th Street, where it turns south to Basin #5. Most of the construction has been completed and the budgeted funds reflect the final payment to Phoenix.

Rawhide Wash Improvements

The current project option includes a 100-year channel (11,000 cfs) between Jomax Road and Pinnacle Peak Road that will protect 240 homes, 25 commercial structures and a 160-acre theme park from flows 1-3 feet deep. A second option being considered is a large detention basin facility on property owned by the State Land Department north of Jomax Road. This option would potentially eliminate the need for large-scale channel improvements downstream to the CAP. The project will allow for

future removal of 4.5 square miles of 100-year floodplain in Scottsdale and 6.1 square miles in Phoenix.

Under either project scenario, flows will be conveyed into a regional detention basin upstream of the CAP canal, which will allow for potential recharge and water quality enhancements. The project is also planned to serve future recreational needs. Total costs for the project are estimated at $14.4 million for the channel option (to Pinnacle Peak Road only) and $15.6 million for the detention basin option. Funding and maintenance responsibilities may vary substantially between the two options.

Reata Pass Channel

This project includes a 100-year channel (11,500-16,700 cfs) between Pinnacle Peak Road and the Central Arizona Project canal detention basin at Westworld that will protect 750 existing homes and 760 multi-family units from flows 1-3 feet deep. The project is a major component of the UIBW ADMP and will allow for future removal of 8.5 square miles of 100-year floodplain. Flows will be conveyed into regional detention basins at the CAP allowing for potential recharge and water quality enhancements. The project is planned to provide a future recreational corridor connecting the Westworld area with the McDowell Mountains. The Reata Pass Channel also reduces drainage requirements along the Pima Road and Loop 101 corridors.

Total costs are estimated at $22 million, with approximately 50% by the District. Phase I channel design has begun under an IGA with Scottsdale. The City will provide for future operations and maintenance of the constructed features.

Pima Road Channel

This project includes a 100-year channel (6,100 cfs) between Jomax Road and the CAP detention basin at the TPC Golf Course that will protect 1250 homes, 40 commercial structures and a water treatment plant from flows < 1 foot deep originating in a watershed of seven square miles. The project is a major component of the UIBW ADMP. Flows will be conveyed into a regional detention basin allowing for potential recharge and water quality enhancements. The project is planned to serve future recreational needs. The channel also reduces drainage requirements along the Pima Road and Loop 101 corridors.

Total costs for the project are estimated at $28.1 million, with up to 50% by the District. Phase I channel design has begun under an IGA with Scottsdale for the area between the CAP and Deer Valley Road.

10th Street Wash Basins/Channel Study

10th Street Wash originates in the North Mountain Preserve and has a drainage area that encompasses 2.8 square miles. The wash flows to the south through an urbanized area in the Sunnyslope portion of Phoenix. Approximately 575 buildings (294 acres) are located within the delineated 100-year floodplain. The project has been separated into two phases. Phase I includes the design, rights-of-way acquisition, and construction of two detention basins that will reduce the floodplain approximately 70% and preparation of a Feasibility Study to develop alternative wash improvements to remove the remaining floodplain. Phase II may implement channel improvements recommended in the Feasibility Study.

Total Phase I costs are estimated at $5.25 million (100% District). The District has worked with local residents and the City to develop locally-maintained, mixed-use applications within the basins.

Construction of detention basin I is complete. Construction of basin II began in April 1996 and will be completed in May of 1997.

Tatum Wash Channel

This project will develop solutions for the flooding problems that exist within a residential area of the City of Phoenix. Several homes located northwest of Tatum and Shea Boulevards have experienced severe flooding during recent storms. The flooding has been severe enough for the Phoenix to recognize this area as one of its worse flooding areas.

The watershed begins in the Phoenix Mountain Preserve south of Shea Boulevard and flows north-northeast to Indian Bend Wash. There are no delineated flood plains within the project area. It is estimated that, however, more than 350 structures would be flooded by the 100-year flood event. The 100-year flood event would have a peak discharge of 2,000 cubic feet per second and flood more than 500 acres of residential and commercial property.

A majority of the pre-design and design costs will be assumed by the District. An IGA will be developed between the District and Phoenix to identify & determine cost-sharing and maintenance (O&M) responsibilities.

Doubletree Ranch Road Drain

This project will develop solutions for the flooding problems that exist within a mostly built out residential area of the Town of Paradise Valley. Several homes along Doubletree Ranch Road have experienced flooding during recent storms, and children have been stranded at a local grade school which becomes inaccessible during heavy rains.

Two major watersheds, Doubletree Ranch Road and Cherokee Wash, exist within the project area. Doubletree Ranch Road watershed begins in the Phoenix Mountain Preserve west of Tatum Boulevard and flows eastward along Doubletree Ranch Road to Indian Bend Wash. Cherokee Wash, which is located south of Doubletree Ranch Road watershed, also begins in the Phoenix Mountain Preserve west of Tatum Boulevard, but then flows northeast to Indian Bend Wash.

The District has committed funding for the pre-design study, and the design of the preferred alternative. An Intergovernmental Agreement still needs to be developed between the District and the Town of Paradise Valley to identify funding sources for the construction cost. The Town of Paradise Valley will be responsible for providing maintenance (O&M) for the project.

84th Street/Cholla Basin & Storm Drain

The 84th Street/Cholla Basin and Storm Drain project includes improvements (650 cfs) in the Cholla Wash watershed of north Scottsdale between Cactus Road and Shea Boulevard to provide a 100-year level of protection. The project improves flood protection for approximately 200 homes and one church in a fully-developed, 250-acre area. Of this figure, twenty-one (21) homes are immediately adjacent to the Cholla Wash floodplain.The project area is part of the City of Scottsdale's Hayden/Shea Area Drainage Master Plan.

The approved IGA includes a funding split of $925,000 for Scottsdale and $750,000 for the District to construct a storm drain system, an open channel, and a detention basin. The final portion of the District's cost share has been budgeted in FY 96-97. Scottsdale will provide future operations and maintenance of the constructed features.

Arcadia Area Drainage Project

The project will develop and recommend storm drain systems which will intercept and convey up to 1,000 cfs through a highly developed residential area between 40th and 64th Streets, north of the Arizona Canal. The project will create a drainage outfall for about four square miles, utilizing the improved Old Cross Cut Canal, and conveying the drainage to the Salt River. The project is a component of the Old Cross Cut Canal master plan.

The cost for the project is estimated at $12,000,000, with the costs expected to be shared between the District and the City of Phoenix at 50% each in accordance with a future IGA. The City will provide the operation and maintenance for the project.

Old Cross Cut Canal–McDowell to Arizona Canal

This project represents the major flood control and regional drainage element of the Old Cross Cut Canal project. It includes approximately 11,000 linear feet of covered concrete channel to convey present storm flows from the Old Cross Cut Canal corridor and to provide an outfall for drainage from the Arcadia area north of the Arizona Canal, taking these flows to the Salt River. The covered channel will enable the City of Phoenix to make future roadway and park improvements within the Old Cross Cut Canal corridor. Total costs for the project are estimated to be $20 million. The District and the City will operate and maintain the constructed project.

The cost for the project will be constructed in phases according to the following schedule: Phase I–Thomas Road crossing (completed in May, 1996); Phase II– south of Thomas Road (begin June 1996); Phase III–north of Thomas Road (scheduled to begin in Spring 1998).

The Squaw Peak LOMR

This project, The Squaw Peak LOMR or Letter Of Map Revision, is a complementary project to the Indian Bend Wash (IBW) channel improvements that will be built as part of ADOT's construction of the Squaw Peak Freeway (SR 51). The Squaw Peak LOMR project includes construction of an additional box culvert at Sweetwater Ave. and submittal of a LOMR to FEMA for the reduced IBW flood plain.

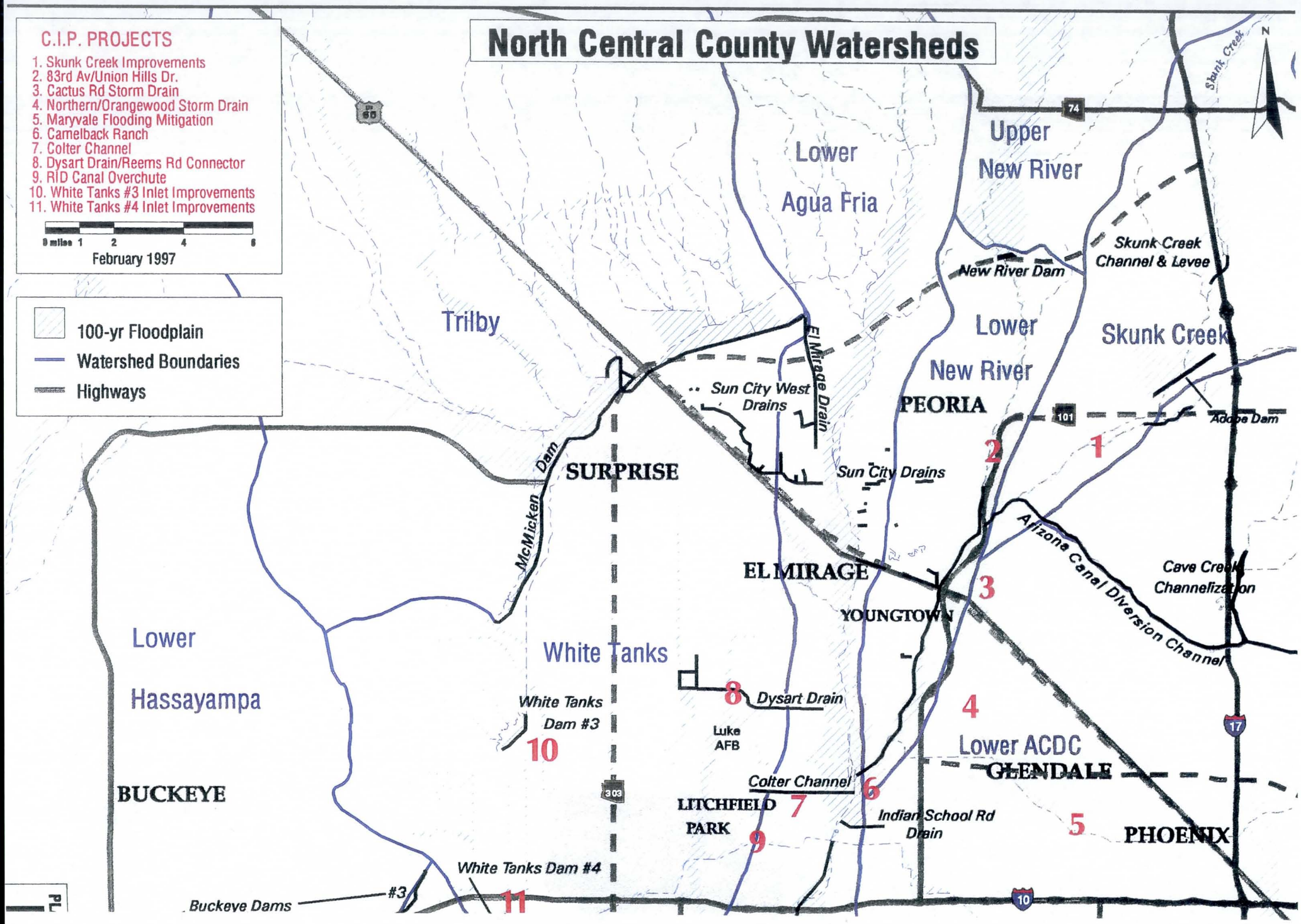
The flood plain will be reduced by more than 360 acres, affecting as many as 1,000 homes. ADOT and the City of Phoenix have a separate IGA for the SR 51 required improvements to the IBW. The District and Phoenix will have an IGA for the additional box culvert and LOMR.

It is estimated that the LOMR will cost $30,000 and the box culvert approximately $60,000. The culvert costs will be shared equally between Phoenix and the District. The District will pay for the LOMR in an existing flood plain re-delineation study.

STP - Papago Watershed Study

The S.T.P. - Papago Regional Flood Control Project study will evaluate planning alternatives and prepare a recommended final planning report for a storm water management system. The area is bounded by the Arizona Canal (NW); Camelback Road (N); Indian Bend Wash (E); McKellips Road (S); and 60th Street (W). The recommended Plan will be developed to alleviate lower frequency flooding problems throughout the project area and reduce or eliminate the limits of an existing "A" Zone flood plain along the west side of the Cross Cut Canal. Close coordination between the Cities of Scottsdale, Phoenix, Tempe, and SRP will be required to insure success of this study. The District is funding 100% of the estimated $750,000 required for this study. Funds for this project have been allocated in FY 96-97 & 97-98.

North Central County Watersheds



FLOOD CONTROL STRUCTURES IN NORTH CENTRAL MARICOPA COUNTY

Existing Structures	Programmed Capital Improvements
Adobe Dam	1. ACDC to Adobe Dam
New River Dam	2. Cactus Rd. Stormdrain
White Tanks Dam #3	3. Northern/Orangewood Stormdrain
White Tanks Dam#4	4. Maryvale Flooding Mitigation
Buckeye FRS # 2	5. Colter Channel (Litchfield Rd. To Agua Fria River)
Buckeye FRS # 3	6. Dysart Drain/Reems Rd. Connector
McMicken Dam	7. RI D Canal Overchute
Skunk Creek Channel & Levee	8. White Tanks #3 FRS Modification
Agua Fria Channelization	9. White Tanks #4 Inlet Improvements

EXISTING STRUCTURES :

ADOBE DAM

This structure is a compacted earthfill dam with a maximum height of 63 feet and a length of 11,245 feet. The top crest width is 20 feet and the storage capacity is 18,350 acre-feet. The principal outlet concrete structure is 6 feet by 9 feet and is constructed with a headwall and flared wingwalls. The length of this conduit is 290 feet long. The drainage area is over 90 square miles in size. Controlled releases from the reservoir drain to Skunk Creek. The structure was completed in 1982.

NEW RIVER DAM

Storm runoff flowing in New River from the north will be detained temporarily behind the Dam before being released at a controlled rate downstream on the New River. The structure is an earthfill dam serving a drainage area of 164 square miles and has a storage capacity of 43,520 acre-feet. The maximum height of the Dam is 104 feet with a length of 2,320 feet. The top crest width is 20 feet and the principal outlet is a box structure 6 feet wide by 9 ½ feet high and 465 feet long. Two dikes are included in the system. The dimensions of one of these structures is 30 feet in height and 5,800 feet in length. The other dike is 14 feet high and 256 feet long. These structures were completed in February of 1985.

WHITE TANKS FRS NO. 3

Stormwater runoff collected from the eastern slopes of the White Tank Mountains is stored temporarily in the 2,655 acre-feet capacity reservoir. Water is released through three gated principal outlets. A diversion dike west of Beardsley Canal starts at Northern Avenue and runs south to the structure. Discharges from the structure enter the Beardsley Canal or adjacent desert washes. The dam is compacted earthfill with a maximum height of 30 feet with a length of approximately 1.5 miles. The drainage area is 24 square miles and the FRS was completed in 1954.

WHITE TANKS FRS NO. 4

Stormwater runoff is collected from the southeastern slopes of the White Tank Mountains and is temporarily stored in the reservoir and released through two gated principal outlets. The drainage area is split by the Interstate-10 freeway and is approximately 14 square miles. The FRS was completed in 1954 and has a storage capacity of 2,250 acre-feet. The structure is compacted earthfill with a maximum height of 20 feet and a length of 1.3 miles.

BUCKEYE FRS #1

This structure is located eight (8) miles northeast of the Town of Buckeye and north of Interstate-10. Storm runoff is collected from a seventy-four (74) square mile drainage area of the western slopes of the White Tank Mountains, including discharges from Buckeye FRS #2 and #3. The runoff is temporarily impounded in the reservoir with a storage capacity of 8,195 acre-feet and released to the Hassayampa River through a sixty (60) inch pipe along an unlined channel 870 feet long. The structure was completed in 1975 and is composed of compacted earthfill with a maximum height of 31.5 foot and length of 7.2 miles.

BUCKEYE FRS #2

This structure collects storm runoff from a 5.7 square mile drainage area adjacent to the western slopes the White Tank Mountains and from discharges from Buckeye FRS #3. The water is temporarily impounded in the reservoir with a storage capacity of 1,920 acre-feet and released to the reservoir of Buckeye FRS #1. The structure was completed in 1975 and is composed of compacted earthfill with a maximum height of twenty-six feet and length of 2.3 miles.

BUCKEYE FRS #3

Storm runoff is collected behind this structure from a 9.3 square mile drainage area along the southern slopes of the White Tank Mountains. This FRS is the eastern most of a group of three structures completed in 1975. The water is temporarily impounded in this reservoir with a storage capacity of 2,098 acre-feet, which releases into the reservoir of Buckeye FRS #2 through a thirty inch principal outlet pipe. The structure is compacted earthfill with a maximum height of thirty-four feet and a length of three miles.

MCMICKEN DAM

The northern half of the structure sits across Trilby Wash and associated tributaries while the southern half is located along the eastern slope of the White Tank Mountains. The drainage area is 247 square miles and the storage capacity behind the Dam is 23,800 acre-feet. The structure is composed of compacted earthfill with a maximum height of 34 feet with a length of approximately 9 miles. Storm runoff collected is routed to the northeast to the principal outlet consisting of two 24 inch pipes and to the Agua Fria River through an open channel. The Dam and outlet channel were completed in 1956.

AGUA FRIA RIVER CHANNELIZATION, REACHES 1 TO 4

Stormwater discharges from ACDC, Skunk Creek, Adobe and New River Dams and local runoff are transported by the Agua Fria into the outlet at the Gila River. The total length of the four reaches is six (6) miles. The channel is compacted earth and the side slopes are soil cement. The bottom width is 400 to 900 feet with average depth of 15 feet. This project was completed in 1988

CIP PROJECTS :

ACDC To Adobe Dam

In an agreement with the U. S. Corps of Engineers (COE), the District is responsible to assure 100-year capacity in Skunk Creek from Adobe Dam to the ACDC. Recent studies indicate that portions of the channel have been restricted, and the 100-year flows break out of the existing channel. Rapid development of the bordering properties has necessitated the completion of a pre-design study to determine 100-year capacity channel designs, including the need for grade control structures and the armoring of the channel banks in remaining unlined reaches.

Public participation has resulted in a multi-use concept designed to incorporate natural vegetation and provide access for pedestrian and equestrian uses, with bank armor buried to preserve a natural appearance. Total costs are estimated at $10 million, with construction anticipated to be completed in two projects above and below Union Hills Drive. IGAs with the Cities of Glendale and Peoria to establish cost sharing and O&M responsibilities have been initiated. Acquisition of rights-of-way has begun and should be completed in FY 96/97.

Cactus Road Storm Drain

This project includes a 10-year storm drain running west in the Cactus Road alignment beginning at 67th Avenue and continuing to New River via the drainage channel constructed for the Agua Fria Freeway (Outer Loop). The project will benefit a 3.5 square mile area in Peoria and Glendale. The drain will also provide an outlet for future municipal storm drains. Phase I, from the Agua Fria Freeway to 83rd Avenue, has been constructed in FY 95-96. Phase II is now under construction from 83rd Avenue to 75th Avenue. Phase III will follow in one year.

Total cost is estimated at $9.5 million (50% by the District, 50% by Glendale and Peoria). Peoria will provide operations and maintenance for this project. Design has been completed by the District. An IGA with the Cities of Glendale and Peoria was approved in April 1994.

Northern/Orangewood Storm Drain

This project includes a 10-year storm drain, running west between the Orangewood Avenue and Northern Avenue alignments from 67th Avenue to New River. The project will benefit nine square miles of existing development in the unincorporated County, Glendale and Peoria that have been subjected to several flood events in the past four years. The drain will also provide an outlet for future municipal storm drains and ADOT's Grand Avenue project. The District plans to construct three detention basins (possibility two in Glendale and one in Peoria) along the drain corridor in order to reduce pipe costs while increasing the future level of protection and providing water quality and recharge benefits.

Total costs are estimated at $17 million (50% the District, 50% by Glendale and Peoria). Glendale will provide O&M for the portions of the project in Glendale and the unincorporated County, while Peoria will provide O&M for the portions within its city limits. An IGA with the cities was approved in April 1994. The District has acquired the basin sites at a savings of $3 million from the original 1987 estimate.

Maryvale Flooding Mitigation Project

Flooding along the north bank of the Grand Canal, between 43rd Avenue and 64th Avenue, results in frequent flooding of approximately 150 houses. The project includes construction of two detention basins discharging into existing storm drains and modifications to existing streets and storm drains to divert flows into the basins. The proposed basins will be designed to store runoff from a 10-year storm. A basin located at 51st Avenue and the Grand Canal will be constructed as a mulit-use facility incorporating flood water storage into a Cactus League stadium development by depressing a parking lot and practice fields. The 63rd Avenue basin will require removal of thirty-five existing houses, relocation of existing residents, construction of a detention basin, and modification of existing streets and storm drains. The basins are estimated to cost approximately $4.5 million each.

Colter Channel

The project is located north of Litchfield Park and extends from Litchfield Road to the Agua Fria River along an alignment about one-quarter mile north of Camelback Road. The principal feature is a 14,000 foot long earthen channel that varies from 50 feet to 250 feet wide. The project, which has been constructed, intercepts and conveys to the river the 100-year storm flows from north of the channel, thereby providing protection to the MCDOT improvements on Camelback and Dysart Roads and to Litchfield Park and the surrounding community. The project also eliminates a portion of an "A" Zone floodplain, removing about 20 homes from the floodplain.

Construction is complete and the remaining funds in the 5-Year CIP are for settlement costs associated with rights-of-way acquisitions.

Dysart Drain/Reems Road Connector

The project extends from Reems Road to the Agua Fria River along the north side of Luke Air Force Base (LAFB). Included are improvements to the existing channel and construction of a detention basin northwest of LAFB. The existing Dysart Drain channel no longer functions as designed because of land subsidence in the area, thereby causing the flooding of LAFB from relatively minor flows. The project will intercept and convey to the river the 100-year storm flows from north of LAFB.

The estimated total project cost is $12,500,000, to be shared between the District and LAFB, with the LAFB cost share capped at $6,000,000. Construction is to be completed in three phases. The Phase I basin and Phase II bridges are complete. Phase III channel improvements are underway and will be completed in early 1997. LAFB will provide all operation and maintenance, with the exception of one collector channel feature.

Rid Canal Overchute

This project includes a 100-year capacity (1500 cfs) overchute of the Roosevelt Irrigation District Canal at the Old Litchfield Road alignment which will discharge into an existing channel built by SunCor. Various drainage collector channels will convey flows to the overchute. The project will provide an outfall for 1.6 square miles of existing development in Litchfield Park, Avondale and Goodyear and is a key element of the White Tanks/Agua Fria ADMS and the Litchfield Master Drainage Plan. The overchute will reduce/eliminate floodplain delineations in developed areas of Litchfield Park and Avondale.

Total costs for the project are now estimated at $1.6 million. Alternatives identified during the project design estimate the District cost to be about $1,100,000. SunCor have already invested $220,000 for

work on the related side drainage and outfall channel. RID and SunCor have donated right-of-way and Litchfield Park, Avondale and SunCor will provide for future operations and maintenance for the project.

White Tanks #3 FRS Modifications

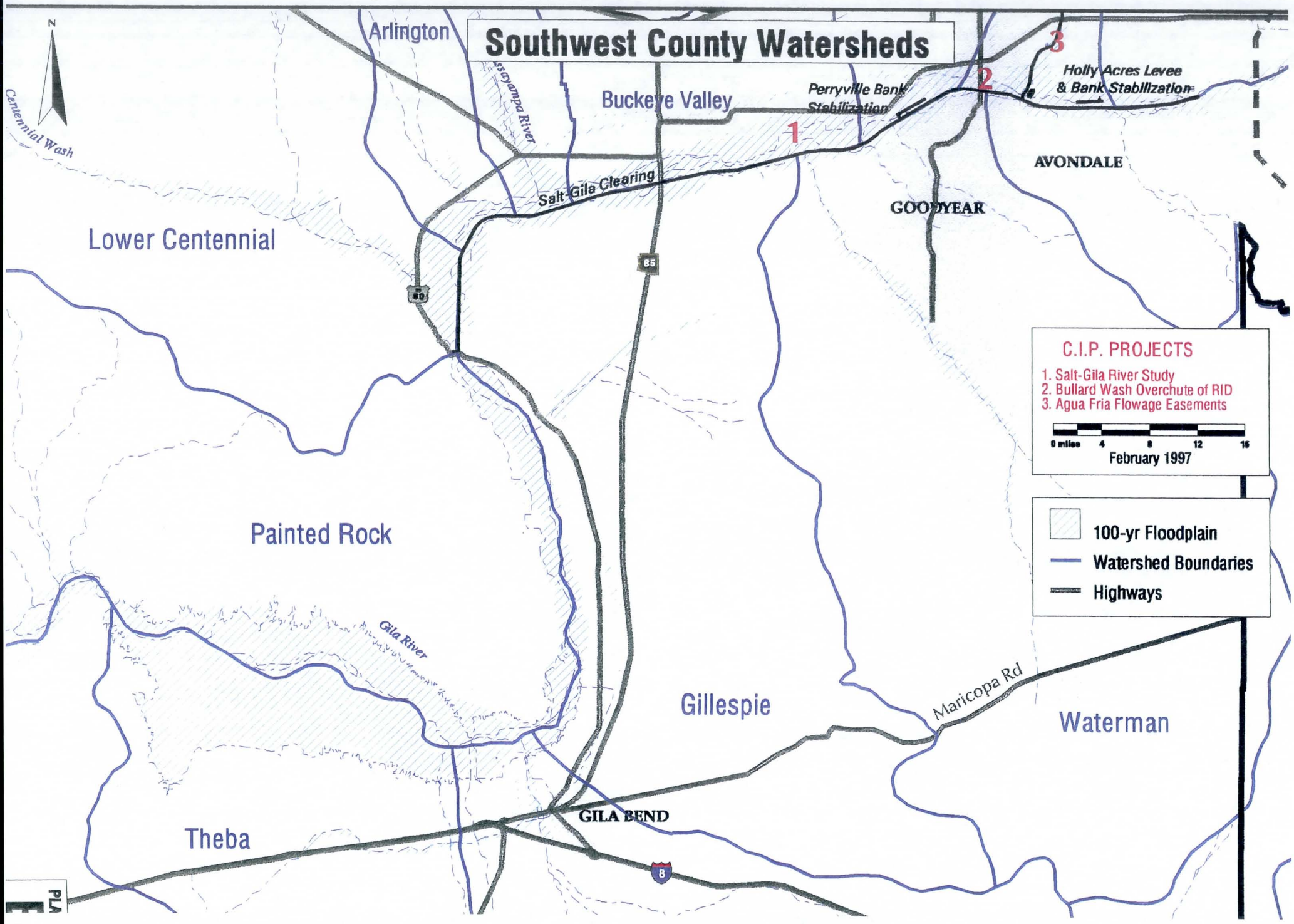
This project involves the rehabilitation of the White Tanks #3 Flood Retarding Structure (FRS) to bring it up to current Arizona Department of Water Resources standards. The Natural Resources Conservation Service (formerly SCS) is the Federal sponsor for the project. They will be responsible for assuming all costs associated with the modification of the FRS.

The improvements, to be performed by the NRCS, include re-establishment of the crest of the dam, construction of an emergency spillway, and improvements to the reservoir behind the FRS.

White Tanks #4 Inlet Improvements

This project includes the construction of a channel along the west right-of-way line of Jackrabbit Road from the White Tanks #4 Flood Retarding Structure (FRS) northward. The Channel will intercept storm water runoff flowing in a southeasterly direction and convey it into the FRS. Construction is proposed to be completed in phases, depending on the availability of CIP funding. Phase I is from the FRS northward to approximately 1,200 feet north of McDowell Road and will be a concrete-lined channel (design is complete) estimated to cost $1.53 million. Phase II will continue the project to approximately 1000 feet north of Thomas Road, and Phase III will extend to the north side of Indian School Road.

The Channel is necessary to intercept flows and divert them into the FRS as intended by the original Soil Conservation Service design. The construction of Interstate 10 and improvements to Jackrabbit Road have disrupted the original drainage paths in the area.


Southwest County Watersheds
N
Arlington
Buckeye Valley
Perryville Bank Stabilization
Holly Acres Levee & Bank Stabilization
Salt-Gila Clearing
Centennial Wash
Sonoyampa River
Lower Centennial
AVONDALE
GOODYEAR
Painted Rock
Gila River
Gillespie
Maricopa Rd
Waterman
Theba
GILA BEND
1
2
3
C.I.P. PROJECTS
1. Salt-Gila River Study
2. Bullard Wash Overchute of RID
3. Agua Fria Flowage Easements
0 miles 4 8 12 16
February 1997
100-yr Floodplain
Watershed Boundaries
Highways

FLOOD CONTROL STRUCTURES IN SOUTHWEST COUNTY

Existing Structures	Programmed Capital Improvement
Holly Acres Levee & Bank Stabilization	1. Salt-Gila Control Works
Perryville Bank Stabilization	2. Bullard Wash Outfall Channel
Salt-Gila Clearing	3. Agua Fria Flowage Easements
	4. South Phoenix Drainage Improvements

EXISTING STRUCTURES :

HOLLY ACRES BANK STABILIZATION

This project was designed to provide protection for Holly Acres Subdivision from the 100-year storm. The capacity of the channel is 115,000 cfs with a freeboard of 3 feet, which is the distance between the water surface and the top of the levee. Gabions, riprap and groins provide bank stabilization which prevent further erosion of the riverbank. The length of the levee is 6,600 feet and it was built in 1984.

PERRYVILLE BANK STABILIZATION

The project is located at the north bank of the Gila River near Buckeye, and approximately one quarter mile south of the intersection of Southern Avenue and Highway 80 (SR 85). The capacity of the channel is 115,000 cfs. Gabions and riprap are used for bank stabilization which prevent further erosion of the riverbank. The length of the levee is 2,300 feet and it was completed in 1984.

CIP PROJECTS :

Salt-Gila River Management Study

This project has been canceled because of the 1993 storm that destroyed the vegetative clearing and pilot channel in the Gila River. To rebuild the corridor, a Corps of Engineers 404 permit would be required. The cost and regulations that would need to be met to attain the permit have made reconstruction unlikely. Funding has been deleted from the five-year CIP.

The land acquisition part of the project will continue after being on hold since the 1989 Appellate Court ruling on stream bed ownership. While on hold, the District has been liable for 10% interest in its condemnation cases until all payments are made to the owners or their legal representatives. Resolution FCD 95-03 authorized the District to finalize all land acquisitions pertaining to the Rivers 1000 foot corridor and eliminate future interest payments. Cost is estimated at $40,000 to complete the acquisition process during FY 96-97.

Bullard Wash Outfall Channel

The project, identified in the White Tanks/Agua Fria ADMS, includes a two-mile outfall channel from Lower Buckeye Road to the Gila River for the 100-year Bullard Wash flows (3,200 cfs). Existing structures and channels in the drainage corridor are inadequate and result in flows that overtop the Southern Pacific RR, MC 85 highway, and the Buckeye Irrigation District Canal. The project will reduce flood hazards for the City of Goodyear's waste water treatment plant, the Phoenix/Goodyear Airport, several hundred acres of agricultural land, the Palo Verde Nuclear Power Plant water supply pipeline, a sanitary sewer pipeline, and three petroleum pipelines.

The project will also provide protection to clean-up facilities for a Superfund ground water contamination site and allow for coordination with MCDOT on two of its projects. A pre-design study has been completed, and total project costs are estimated at $7.6 million. IGAs with the City of Goodyear and MCDOT have been initiated to establish cost sharing and O&M responsibilities.

Agua Fria Flowage Easements

This project includes the acquisition of flowage easements along the Agua Fria River in conjunction with the Agua Fria Channelization project, constructed between Indian School Road and Lower Buckeye Road in 1988. These flowage easements are required by the District's agreement with the Corps of Engineers as a part of the *Phoenix, Arizona and Vicinity (including New River) Flood Control Project.*

All easements have been acquired. The budgeted funds are contract costs to respond to an appeal regarding a parcel acquired by the District through eminent domain near Southern Avenue and Dysart Road.

South Phoenix Drainage Improvements

This project will develop solutions for the 100-year flood event for approximately 100 homes and thousands of acres of farmland located within the City of Phoenix. Several homes within a subdivision located on the southeast corner of 43rd Avenue and Southern Avenue have experienced flooding on a regular basis. The watershed begins in the South Mountain Park and flows northwards to the Salt River. Prior to entering the Salt River, however, the water turns westerly and flows west along the

SALT-GILA CLEARING

The Flod Control District has been maintaining the project after the floods of February 1978 and January 1979. As a result of the 1993 flooding, it was necessary to reestablish the alignment of the riverbed. The following items are major parts of the project: Control re-growth of Salt Cedars, re-excavate pilot channels and re-gain access for maintaining the project.

Segment	1	2	3	4	5	5A	6A,6B,6C
Location	91st Ave - 123rd Ave.	Mumme's Crossing to Gillespie Dam	123rd Ave. - 147th Ave.	Gillespie Dam - Palo Verde Rd.	Palo Verde Rd. - Airport Rd.	323rd Ave. - Airport Rd.	Palo Verde Rd. - Cotton Lane
Work Items	485 acres -Cleared, grubbed & rough grading of 1,000 ft. strip of streamed ---------- 5000 LF - channel excavation & grading from 91st Ave. to 123rd Ave. ---------- 200 LF ditch excavation at 91st. Ave.	161 acres - Cleared, grubbed & rough grading of 300 ft. strip of streambed	348 acres - Cleared, grubbed & rough grading of of streambed ---------- 1,000 LF- reshape & rebuilt existing berm along SRP wasteway ---------- 2,500 LF - Constructed 22 ft. wide roadway parallel to SRP wasteway ---------- 3 - 30" CMP - drainage for constructed roadway --------- 2,100 LF of fence line clearing.	1,007 acres - Cleared, grubbed & rough grading of streambed ---------- 26,000 LF vegetative berm	440 acres -Cleared, grubbed & rough grading of streambed ---------- 31,000 LF - vegetative berm	1,443 acres -Cleared, grubbed & rough grading of streambed. Segment is combination of uncompleted work of Segments 4 & 5.	372 acres -Cleared, grubbed & rough grading of streambed. ---------- 5,000 LF - vegetative berm

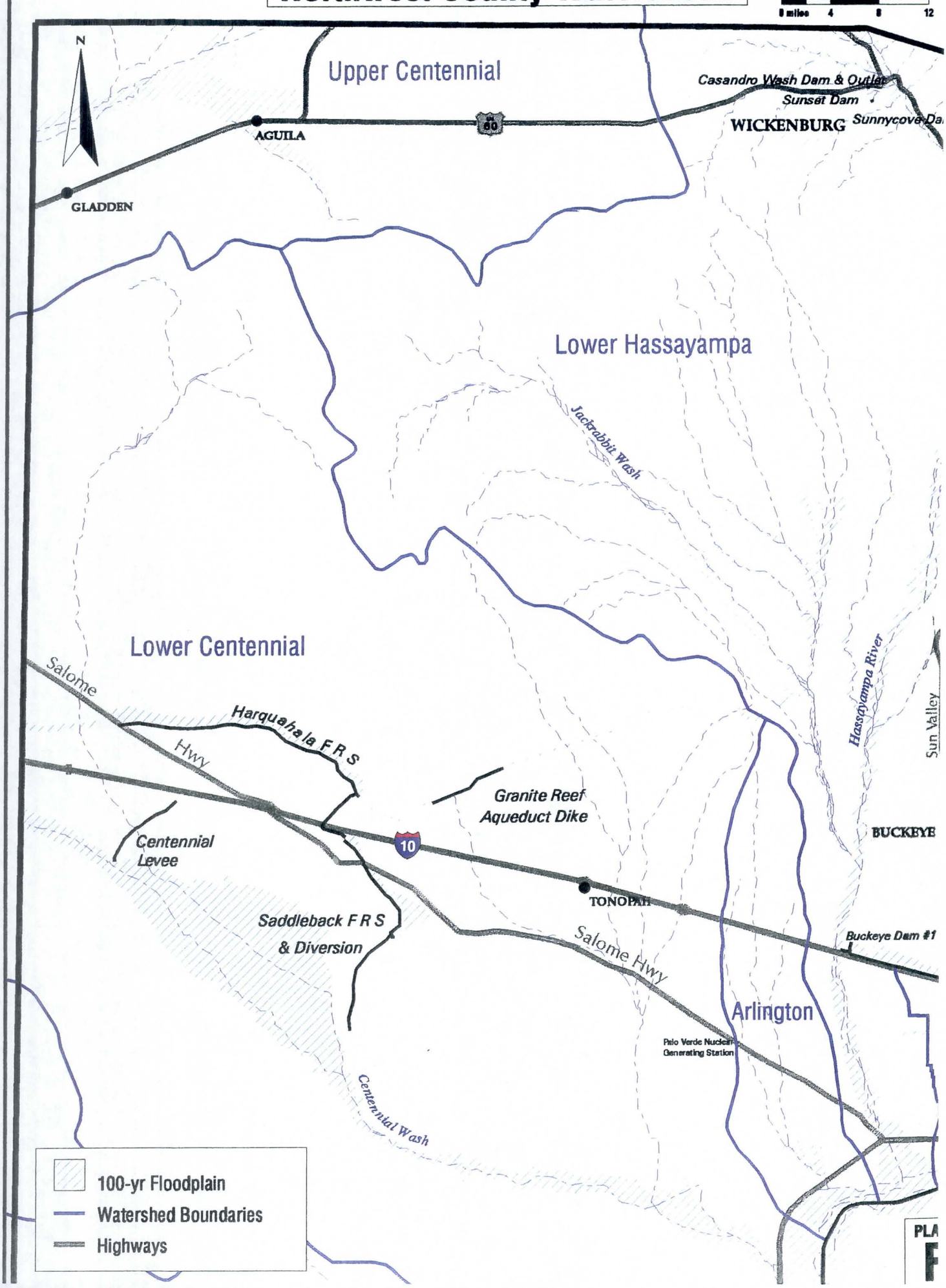
The entire river project clearing will be maintained under a 25 year maintenance program. All areas will be recleared every 2 - 3 years.

Maricopa Drain. During a 100-year flood event the watershed generates 2,200 cubic feet per second of water, and causes two to three feet of flooding throughout the project area.

An additional benefit of the project will be the reduction in the size of bridge planned by ADOT as part of the Southwest Loop. The funding majority will be provided by the District, with maintenance (O&M) being shared with the City of Phoenix.

Northwest County Watersheds

February 1997



FLOOD CONTROL STRUCTURES IN NORTHWEST COUNTY

Existing Structures	Programmed Capital Projects
Harquahala FRS	None programmed
Saddleback FRS & Diversion	
Centennial Levee	
Buckeye FRS #1	
Buckeye FRS #2	
Buckeye FRS #3	
Granite Reef Aqueduct Dike	
Sunset Dam	
Sunnycove Dam	
Cassandro Wash Dam & Outlet	

EXISTING STRUCTURES :

HARQUAHALA FLOOD RETARDING STRUCTURE (FRS) & FLOODWAY

Floodwater runoff is collected from a 102 square mile drainage area and impounded temporarily in the reservoir of the FRS with a storage capacity of 10,911 acre-feet. In 1982 the FRS was built of compacted earthfill. The dimensions of the FRS are 11.5 miles in length with a maximum height of fifty-five feet. Runoff is routed eastward along the dam alignment to a ten foot by four foot Reinforced Concrete Box principal spillway and conveyed into the Saddleback FRS by means of an unlined trapezoidal floodway channel 3.4 miles long. It runs immediately north and parallel to the CAP Aqueduct.

SADDLEBACK FRS & DIVERSION

This structure was built in 1981 to receive storm runoff from a drainage area of thirty (30) square miles and runoff flows from the Harquahala Floodway. It is constructed of compacted earthfill with a maximum height of twenty-two feet and a length of 5.2 miles. The top crest width of the diversion structure is twelve feet wide and the storage capacity of the reservoir is 42.5 acre-feet. The principal spillway outlet is an eight foot by ten foot concrete conduit. Flows are released to a diversion which consists of an earth embankment with an unlined trapezoidal channel running parallel to catch and direct runoff. The outlet is in unimproved rangeland with a drainage way leading to Centennial Wash.

CENTENNIAL LEVEE

Sheetflow from a twenty-one square mile area drains into Reach 1 on a northeast to southwest alignment. The levee begins just south of Interstate-10 and extends to the Centennial Wash floodplain where Reach 2 starts. This levee was constructed in 1985 and is intended to protect the Harquahala Irrigation District Canal which distributes water from the CAP aqueduct. The levee consists of a compacted earth embankment varying in height from 8 feet to ten feet above the floodway invert and has a total length of 4.5 miles. The centerline of the floodway has a bottom width of eighty feet and is 260 feet to the center of the dike.

BUCKEYE FRS #1

This structure is located eight miles northeast of the Town of Buckeye and north of Interstate-10. Storm runoff is collected from a seventy-four square mile drainage area of the western slopes the White Tank Mountains, including discharges from Buckeye FRS #2 and #3. The runoff is temporarily impounded in the reservoir with a storage capacity of 8,195 acre-feet and released to the Hasayampa River through a sixty inch pipe along an unlined channel 870 feet long. The structure was completed in 1975 and is composed of compacted earthfill with a maximum height of 31.5 foot and length of 7.2 miles.

BUCKEYE FRS #2

This structure collects storm runoff from a 5.7 square mile drainage area adjacent to the western slopes the White Tank Mountains and from discharges from Buckeye FRS #3. The water is temporarily impounded in the reservoir with a storage capacity of 1,920 acre-feet and released to the reservoir of Buckeye FRS #1. The structure was completed in 1975 and is composed of compacted earthfill with a maximum height of twenty-six feet and length of 2.3 miles.

BUCKEYE FRS #3

Storm runoff is collected behind this structure from a 9.3 square mile drainage area along the southern slopes of the White Tank Mountains. This FRS is the eastern most of a group of three structures completed in 1975. The water is temporarily impounded in this reservoir with a storage capacity of 2,098 acre-feet, which releases into the reservoir of Buckeye FRS #2 through a thirty inch principal outlet pipe. The structure is compacted earthfill with a maximum height of thirty-four feet and a length of three miles.

SUNSET FRS

Sunset FRS is located in the eastern part of Wickenburg, stretching across Sunset Wash. Runoff from Sunset Wash is temporarily impounded in the reservoir before being conveyed through a thirty inch pipeline through the lower portion of the Wash, which is a tributary of the Hassayampa River. The drainage area is 0.6 square miles and the storage capacity is fifty-five acre-feet. This FRS was constructed in 1976 and is made of compacted earthfill with a maximum height of 30.5 feet and length of 488 linear feet.

SUNNYCOVE FRS

Sunnycove FRS, built in 1976, is located approximately one mile southwest of the center of Wickenburg and sits across Sunnycove Wash which is a tributary to the Hassayampa River. The drainage area is 1.4 square miles and the storage capacity is 218 acre-feet. Storm runoff from Sunnycove Wash is temporarily impounded in the reservoir which is conveyed to the Hassayampa River through a thirty inch pipeline. The Structure is compacted earthfill with a maximum height of 48.5 feet and length of 714 feet.

CASSANDRO WASH DAM & OUTLET

Casandro Wash originates in the Vulture Mountains and runs in a northeast direction through the Town of Wickenburg. The lower portion of the wash utilizes the roadways of a residential neighborhood to carry flows to Sol's Wash. Approximately 99 buildings, including residential homes, commercial and public buildings are located in Casandro Wash's 100-year floodplain.

The dam is located in Casandro Wash north of US Highway 60, approximately 1/4-mile east (upstream) of Mariposa Drive and will remove the majority of the floodplain. Casandro Wash Outlet, which, has been completed, begins, approximately ½-mile downstream of the dam and continues to Sol's Wash. It will recapture and convey flows from the dam through the neighborhood to Sol's Wash. The Town agrees to operate and maintain the outlet and has provided Town-owned rights-of-way to the District at no cost. The total project cost was approximately $3.5 million, including design, rights-of-way, and construction. Construction of the dam is complete and dedication was held August 29, 1996.

The drainage area of the thirty foot high Dam is three (3) square miles with a maximum storage capacity of 150 acre feet. The principal outlet is a 36 inch reinforced concrete pipe 147 feet in length. Peak runoff at Casandro Wash before construction of the dam was 1,800 cfs at Sols Wash.

EXISTING FLOOD CONTROL PROGRAMS

This section of the Comprehensive Report/Plan describes the Districts existing flood control programs and activities. The following ten section are presented:

- Flood Warning and Data Collection Program;
- Floodplain Administration Program;
- Drainage Administration Program;
- Property Management Program;
- Maintenance Program;
- Planning Program;
- Capital Improvement Program;
- Public Involvement Program;
- Environmental Program;
- Open Space Program/Plan.

The purpose of this section is to document the objectives of each program and identify the current program status. In addition, any complementary relationships between the District and Federal, State, local jurisdictions or County Agencies is noted.

FLOOD WARNING AND DATA COLLECTION PROGRAM

Prior to the floods of the late 1970's and early 1980's, the role of the Flood Control District of Maricopa County in reducing flood hazards centered around the construction of more than thirty dams, levees and other structures. During the flooding of the late 1970's and early 1980's it was apparent that local authorities, including the Flood Control District, lacked sufficient hydro-meteorologic data to make decisions concerning evacuations and flood fighting efforts. At that time, information was not available for watershed conditions, status of structures, and the quantity of storm runoff being conveyed to the natural streams and rivers affecting the County. Although the County exceeds 9,000 square miles in area, it is affected by runoff from a drainage area greater than 50,000 square miles. Peak discharges vary from 250,000 cubic feet per second (cfs) on the Salt/Verde system, to 50,000-to-60,000 cfs on the Skunk Creek, New River, Cave Creek, Agua Fria and Hassayampa River. In addition, the catastrophic failure of the Grand Teton Dam and the Big Thompson flood in Colorado brought a heightened awareness of the increased need for hydrologic data.

Realizing the importance of real-time hydro-meteorologic data, the Board of Directors authorized District staff to initiate a flood hazard information/mitigation/data collection system which could provide early warning of flooding or potential dam failures. This warning system would allow time for cities and the County to initiate appropriate responses to save lives and reduce damages within endangered areas. The early warning system was developed according to a National Weather Service protocol called ALERT (Automated Local Evaluation in Real Time).

The current goals and objectives of the program are to design, install, and maintain an accurate, reliable, real-time flood detection and data collection system. This goal is reflected in the District's Mission Statement: "To reduce flood risks for the people of Maricopa County by providing

comprehensive flood and stormwater management services." The operation and maintenance for the system includes:

- The monitoring of structures;
- Flood detection and evacuations;
- Storm monitoring and data collection;
- Technical and project support to the District; and,
- Improved real-time and historical data services.

The program constantly strives to improve the systems' accuracy and reliability by using modern technology, developing secure backup procedures, and updating the system to ensure compliance with current laws and regulations. This will lead to the development of a centralized program for data collection, dissemination, and flood warning. The system is intended to link with a Statewide ALERT data system, with the FCD system serving as a hub for the County. Data collected will be used in developing and refining hydrology and hydraulic methods specific to this area of the State.

Program Accomplishments:

The program has accomplished the initial hardware and software expansion necessary to monitor all of the Flood Control District's dams and most of the other facilities during rainfall events. This system also provides useful rainfall, runoff, and weather data to interested users. The system gauges operated at better than ninety percent (90%) efficiency during the Winter of 1993 and the October 6, 1993 floods in Maricopa County. Because of the extensive coverage of the County and the expertise of staff, the District served as an information hub; receiving data from other agencies; combining it with in-house data; then distributing useful products to emergency managers. This system proved crucial in the timing of the Holly Acres flood fighting effort.

During a typical year, the ALERT system is accessed by users outside the District several hundred times. In addition, numerous formal requests for data and products are completed for customers and many undocumented phone and staff requests are also provided. Dam failure inundation studies/maps have been completed for all District structures and were forwarded to Emergency Management for inclusion in evacuation plans for areas downstream of the dams.

Program Benefits:

All the residents of Maricopa County and some surrounding Counties benefit from the program. A study conducted by the District (Flood Warning Market Survey Study, FCD 89-75) indicated that since 1989, the annual benefits from the comprehensive flood warning system ranged from $500,000 to $2,600,000 per year in reduced flood damages alone.

Several State, County, and municipal agencies have come to rely on the system for information. These types of professionals include: emergency managers, transportation operators, municipal and private planners, design engineers, environmental engineers, hydrologists, climatologists, and meteorologists. Furthermore, attorneys, insurance companies, and public and private construction companies utilize the results.

The following is a list of current remote ALERT users: Arizona Army National Guard, Arizona Department of Water Resources, Bureau of Reclamation-Denver Office, Central Arizona Water Conservation District, City of Phoenix Solid Waste Department, Glendale Emergency Management, Maricopa County Department of Transportation, Maricopa Water District, National Weather Service, Pinal County Flood Control District, Scottsdale Emergency Management, University of Arizona, United States Geological Survey, and the Yavapai County Flood Control District.

Current Program Status:

The system currently is a four-node, PC-BASED network. A voice synthesizer and auto dialer are programmed to call hydrologists during a significant rainfall/runoff event. The auto dialer calls a list of standby staff members until one is reached. These staff notify District management who in turn, send staff to the field for monitoring purposes. If warranted, the Department of Emergency Management is notified, and a County-wide emergency action plan is initiated. The system can be queried by offsite users for the status of structures, precipitation and streamflow assessment.

Geographical Information Systems (GIS) data has been converted for use in the system to be used as base maps. The maps display the United States Geological Survey (USGS) designated watersheds for the Gila River Basin that effect Maricopa County. Going further into the map layers, one is able to call up each specific watershed and query District structures and sites. This procedure enables easy access when analyzing large amounts of data. These watersheds are being studied through a program of Area Drainage Master Studies (ADMS), to determine peak discharges at critical flood hazard points for floodplain delineations and flood evacuation evaluations. A computer flood forecasting program is currently being developed which will utilize real-time precipitation amounts to predict reservoir impoundments and flood magnitudes.

Due to the importance of sharing data, a State Association of ALERT Users was formed. The main intent is to assure continuity of data, avoid conflict of radio frequencies for data transmission, standardize gauge numbering, and share data through a statewide repeater system. All data is currently fed into the National Weather Service's computers.

With real-time communications, the system can be queried by other agencies. For example, the Glendale Emergency Management Department is able to call in to monitor the Arizona Canal Diversion Channel green belt that is also used as a recreational facility. Additionally, a fax connection is being constructed so incoming National Weather Service bulletins can be sent out as they are received.

An agreement has been established with Maricopa County Department Of Transportation (MCDOT) for a road closure program for some low water crossings. Currently, that program is based upon large watershed storm tracks and gauge readings. In the future, this program will become more site specific and may be able to automatically activate beacons.

A County-wide flood drill is held yearly to assure that District staff is familiar with the structures and observation sites. The District receives credit for the exercise towards the Federal Emergency Management Agency's Community Rating System.

FLOODPLAIN ADMINISTRATION PROGRAM

In 1968, the National Flood Control Act was passed and the federal government, through the U.S. Army Corps of Engineers, began a massive nationwide surveying and mapping effort of major watercourses and other selected areas. The 1973 Flood Disaster Protection Act made comprehensive revisions to the 1970 National Flood Insurance Program and required all participating communities to adopt and enforce floodplain regulations. The purpose was to supplement structural flood control projects with cost-effective, non-structural regulation of floodplain uses and development. In 1973, the State of Arizona passed legislation that empowered cities, towns and counties to adopt floodplain regulations and established the Department of Water Resources as the Coordinator of the National Flood Insurance Program in Arizona.

In 1975, Maricopa County adopted its first floodplain regulations, administered and funded through the office of the County Manager until 1982. The District acted as technical support during the years that followed until 1982, when the Board of Supervisors transferred full floodplain management responsibility to the District.

In 1984, the state flood control statutes were revised to require each County to organize a flood control district. The Flood Control District was required to delineate floodplains and adopt and enforce floodplain regulations throughout the County unless municipalities specifically resolved to perform their own floodplain management. Maricopa County moved to adopt these revisions as the costs of floodplain management was transferred from the County to the District.

Phoenix (1) C
Mesa (2) SE
Scottsdale (3) NE
Tempe (4) SE
Glendale (5) NW
Chandler (6) SE
Peoria (7) NW
Fountain Hills (8) NE
Paradise Valley (9) NE
Gilbert (10) SE
Queen Creek (11) SE
Avondale (12) SW
Buckeye (13) NW
Cave Creek (14) NE
Carefree (15) NE
Youngtown (16) NW
El Mirage (17) NW
Guadalupe (18) SE
Goodyear (19) SW
Surprise (20) NW
Tolleson (21) SW
Litchfield Park (22) SW
Wickenburg (23) NW
Gila Bend (24) SW
Apache Junction (25) SE

In 1990, the County volunteered to participate in the National Flood Insurance Program/Community Rating System Program. This is a program in which the County agrees to be rated by the federal government on its effectiveness in performing floodplain management. Citizens, within rated communities, may be eligible for flood insurance premium credit based on the community's rating. Residents in unincorporated Maricopa County currently enjoy a twenty percent (20%) discount rate, which is the second highest in the nation. The City of Tulsa, Oklahoma receives a twenty-five percent (25%) discount. Several local communities receive discount ratings based partly on District activities performed on a regional or inter-jurisdictional basis. The District also performs floodplain management activities within 13 incorporated communities in the county.

The goals and objectives of the Floodplain Administration Program are to:

- Provide service and expert advice to residents and the development community for floodplain identification, drainage and plan review activities.
- Maintain a pro-active program for the identification of flood hazard areas within the County.
- Establish a procedure to identify and acquire property subject to flooding due to discharges from District structures.
- Monitor District and other County programs and procedures to maintain conformance with the Federal Emergency Management Agency National Flood Insurance Program rules and guidelines, and the federal Flood Insurance Administration program; ensure compliance with state statutes and the Floodplain Regulation for Maricopa County.
- Maintain the current twenty percent (20%) flood insurance premium credit through the Community Rating System Program.

The Floodplain Management Program is managed in the Regulatory Division and is divided into administrative functions and technical evaluation tasks. Program functions are made up of the following specific activities:

General Administration:

- Community Rating System Program;
- Map Determination Recordation;
- Pre-development Consultation;
- Activity and other Reports;
- Flood Insurance - Public Information.

Regulation Administration:

- Permitting & Regulation Enforcement;
- Flood Insurance Study Coordination with FEMA;
- Review Federal & State Regulations;
- Coordinate regulatory activities with federal and state agencies.

Technical Review and Evaluation

- Flood Insurance Studies;
- Hydraulic Analysis;
- Hydrologic Analysis;
- Plan Review and support for other departments and agencies.

Services provided by the Floodplain Administration Program include the identification of flood hazard areas and flood prone properties. This activity qualifies the County for insurance premium reduction credits and provides guidance for the development of flood prone properties. Reduction of the risk to life and property is also achieved through compliance inspections in conjunction with approved permits. In addition, floodplain violations are investigated and attempts to gain compliance could result in the filing of criminal complaints through the office of the County Attorney or the State Attorney General.

Special studies are performed in areas where new flood control structures have reduced flood risks and altered previously-identified flood hazard areas. Also, research is conducted in areas of imminent or ongoing development where flooding has occurred but risks have not been determined. This often includes areas where previous studies have become outdated and/or inaccurate from new development, new technical information or changes in federal or state laws, rules or guidelines that require certain areas to be restudied. In addition, many of the Area Drainage Master Studies (ADMS) have delineated floodplains in support of this program.

Community Rating System Program:

The Community Rating System Program (CRS) began in 1990 and is Board sponsored. This program is a means of comparing the District's floodplain management activities with others nationwide. The program provides a valuable benchmark to measure internal progress. This rating program also provides an incentive to the county because flood insurance policy holders receive a reduction on their insurance premiums based on the performance of the county's floodplain management. In 1991, the District rated a five percent (5%) discount. In 1993, this improved to a fifteen percent (15%) discount

rating. In 1994, Maricopa County was rated second highest in the nation. Policy holders in the unincorporated county receive a twenty percent (20%) premium discount. Other local communities participating in the CRS Program receive credit based partly upon certain District activities within their corporate limits. This allows policy holders within those communities to also receive premium discounts.

The Floodplain Management Program is directly related to the EPA's water quality programs (NPDES) and superfund mitigation programs, ADEQ (aquifer protection), the U.S. Army Corps of Engineers 404 (dredge and fill in waters of the U.S.) program, federal flood insurance administration program, and federal natural disaster detection, mitigation and relief programs. It is also related to some agricultural programs where certain activities may be carried out within delineated floodplains, such as milk dairies. This program is also used as a resource for information and evidence by the County Attorney, State Attorney General and the U.S. Justice Department as they pursue violations of various local, state and federal flood and environmental laws.

DRAINAGE ADMINISTRATION PROGRAM

The initial drainage administration effort at the District was not a formal program. It began in the early seventies and consisted of the county planning department and other agencies submitting development plans for review by the District. It was not until the mid-to-late seventies that the Subdivision Regulations for Maricopa County and the county zoning ordinance were revised so that drainage and grading plans were required for development approval.

The Drainage Program began because development was occurring with little or no regard for flooding caused by stormwater. This resulted in developments being subjected to flooding and/or creating greater flood risk and damages to adjacent and downstream properties. Left unregulated, the dwellings would be built without protection from flooding. Floors would be built too low, washes or other drainage paths would be backed up or diverted onto neighbors, and runoff would rise significantly because of an increase of hard surfaces with no provisions for retention of runoff.

The current Drainage Program began to emerge in September of 1983 when, through an Intergovernmental Agreement (IGA) between Maricopa County and the Flood Control District, the District was appointed as the Drainage Administrator. Included in this IGA was a provision that funding for the drainage administration duties would come out of the District funds raised in accordance with the District's enabling legislation, A.R.S. 45-2364 or from fees.

The Drainage Administration Program began functioning as a full-fledged program when the Drainage Regulation for Maricopa County was adopted by the Board of Supervisors on September 26, 1988. Adoption of the Regulation resulted in more efficient administration of the Program since the development drainage requirements came directly out of the Regulation as opposed to referencing the Subdivision Regulations, Zoning Ordinance and State Statutes. The Regulation also included a fee schedule for the processing of drainage permits and plan review. On December 14, 1994, a revision of the Drainage Regulation was adopted which clarified and strengthened the Regulation.

In 1994, a restructuring of the District resulted in the regulatory functions (floodplain management and drainage administration) being combined into the Regulatory Division. This combining of functions

has resulted in improved customer service, increased proficiency in the area of development review and interagency coordination, and improvements in the drainage/floodplain inspection and enforcement efforts. The drainage (as well as the floodplain) fee schedule is currently being assessed in an attempt to reflect actual costs of the permitting/plan review effort. Current fees do not cover the entire cost of the permitting process.

The Drainage Administration Program is one of the regulatory activities that the District provides as a flood and stormwater management service for the benefit of the residents of the County. The Program administers the Drainage Regulation for Maricopa County in order to reduce the potential for future losses resulting from stormwater runoff. Regulating new development and enforcing drainage requirements reduces the cost of both future flood damages and remedial flood control measures.

Program Description:

The services of this program are available within the unincorporated areas of Maricopa County and the Town of Cave Creek. The major activities of the Drainage Administration Program are:

- Public Service - Provide drainage information and respond to drainage inquiries or complaints regarding reports of flooding and possible flood hazards reported by citizens.
- Development Review - Review proposed development for compliance with the Drainage Regulation and to ensure compatibility with other District programs.
- Inspections and Permitting - Inspect development for compliance with drainage plans and the Drainage Regulation. Issue drainage permits to development that are in compliance with the Regulation.
- Regulation Enforcement - Investigate possible drainage violations and work to gain compliance. If necessary, file criminal complaints against property owners to ensure compliance.
- General Administrative - Provide administrative support including archiving, coordination, performance management, training, and budget programming.

Four primary services are provided by this program. They are: development plan review, drainage permitting, drainage inspection, and investigation and correction of drainage violations. The primary service provided by the development plan review is the review of plans to ensure compliance with the Drainage Regulation. The intent is to ensure the drainage is conveyed in a manner the does not adversely impact any property, including property within the development.

The permitting service basically performs the same function as the plan review but at an individual (homeowner) level. The inspection service involves field inspections to ensure that construction is proceeding in accordance with the approved plans. The drainage violation service investigates reported or observed violations of the provisions of the Drainage Regulation. These violations are processed to the extent necessary to correct the violation. Typically, this only requires formal notification to the violator. However, civil court action has been required in some instances. The end result of these services is a safer environment for the citizens of the County and a reduction of losses due to flooding.

The Drainage Administration Program also results in benefits to the District by reducing costs for future flood control facilities, reducing flood damage and maintenance to District facilities, reducing flood and drainage complaint response costs and enabling the District to coordinate development drainage with Area Drainage Master Plans (ADMP) on a regional basis.

Program Issues:

An issue that challenges the Program concerns exemptions to the Drainage Regulation. The Drainage Regulation was established under Title II of the Arizona Revised Statutes, which exempts agricultural uses. This results in situations where unregulated drainage conditions on agricultural properties are modified and adversely impacting other properties.

Another challenge continues to be the coordination of drainage provisions with communities adjacent to development in the unincorporated area. Staff has developed an unofficial association with the other drainage jurisdictions in Maricopa County to address this drainage coordination effort.

PROPERTY MANAGEMENT PROGRAM

The Property Management Program was initiated when the District was formed in 1959. Funding for this Program is accomplished through a combination of property rental/leasing, property sale and the District tax levy receipts. The historic function of this Program has remained essentially unchanged since the beginning of the District. Currently, the Program is administered through the Lands Division, which is responsible for leasing, selling and managing District real property to generate income on an interim basis. The program is also charged with maintaining the value of this property until all or a portion of the property is needed for a project. Finally, the program is responsible for maintaining remnant property where size and/or physical boundaries preclude the sale of the property due to zoning restrictions.

The Goals and Objectives of the Property Management Program are to aggressively manage all District property to the maximum extent possible. This is accomplished through the disposal of excess property through lease, sale, easement or exchange for appraised value. In addition, District staff maintains an effective and efficient license and easement program by documenting procedures, creating standardized documents, and establishing fair market values for property. Management of District rental property is conducted to optimize interim return and maintain value. This is accomplished by leasing at appraised value, regular inspections, suitability for use determinations, advertising and background investigations for tenants.

The Property Management Program is responsible for the development of policies and procedures affecting the following: property management, marketing of properties, collection of rent & easement payments, and maintenance of property including, but not limited to, health and safety. Contracts are also administered and monitored under the Program. Typical contracts include service contracts, appraisal fees and title reports and escrow documents provided by title companies.

The Property Management Program has also established a G.I.S. database to create an automated, centralized parcel-based land system to efficiently manage the property owned by the District.

Program Description and Activities:

The Flood Control District owns approximately 22,000 acres in fee simple and holds perpetual easements on an additional 38,000 acres. The acquisition of this real estate was legislatively authorized by several statutes including A.R.S. §48.3603.C.1, §48-3603.C.2 and others as described in the department's overview. All acquisitions were undertaken as a result of Board of Directors resolutions to acquire land as part of projects being done by the District. Other Board resolutions have authorized the District to lease properties, declare land excess to District needs and to sell at public auction, at fair market value, lands declared excess (FCD 81-05, 86-21, 87-12, 88-5, 90-01, 92-07 et. al.).

The Property Management Branch serves a wide variety of both internal and external customers including other Flood Control District divisions; County agencies such as Maricopa County Department of Transportation, Parks and Recreation, Library District, School Districts, Stadium District, Assessor's Office, Solid Waste Management; Municipalities, including, but not limited to, the Cities of Phoenix, Tempe, Mesa, Avondale, Peoria, and Glendale; State Agencies such as Arizona Department of Transportation, the Arizona State Land Department, Arizona Department of Water Resources, Arizona Department of Emergency Services; Federal Agencies, such as Bureau of Land Management, Bureau of Reclamation, and the Corps of Engineers; private citizens, nonprofit organizations and private corporations by making land available for parks, recreation, farming, utility easements, commercial and residential development, golf courses and other multiple land uses.

Many utility companies rely on the District for licenses and easements for new lines crossing FCD property. The District works with many cities to legitimize the sewer, water and other city utility corridors and right-of-way documents needed for their projects. Large tracts of land are available, through Intergovernmental Agreements (IGAs) and leases, for recreational opportunities. Many properties have already been utilized by the recreation departments of the County, the Cities of Phoenix and Tempe, and other local jurisdictions.

Program Issues:

There has been a shift in emphasis of the program from residential rentals on the Arizona Canal Diversion Channel in the last ten years to agricultural rentals, commercial rentals and land sales. Increased buyer sophistication has required the property manager to obtain environmental clearances, and to zone property before selling it in order to achieve the highest possible values. One of the major challenges in this program continues to be the perception from private developers and other governmental entities that the District is allowed to give land rights away for no cost. The law clearly precludes the District from disposing of excess lands at less than fair market value. Additional opportunities include this program's ability to help defray original acquisition costs, to put land back on the property tax rolls, and to generate significant income to be used in ongoing or future flood control projects.

MAINTENANCE PROGRAM

The maintenance program can trace its roots to the formation of the District in 1959. Since that time, the District has added new structures to its inventory as each Capital Improvement Project is completed. As a direct result, the maintenance program has expanded to provide maintenance for these new structures. The District now maintains twenty-four (24) dams and over fifty (50) miles of underground conduits and improved channels to acceptable functional design and aesthetic standards. This program is funded by the flood control tax levy.

The goal of the maintenance function is to maintain the dams and other structures of the FCD in accordance with federally stipulated standards and at levels necessary to comply with State dam safety inspections. This program directly enables the Flood Control District to meet its mission statement: "To reduce flood risks for the people of Maricopa County by providing comprehensive flood and stormwater management services." Without proper maintenance of District structures, they would ultimately not function as needed in the time of an emergency.

Program Description:

The Maintenance Program is managed within seven of the eight branches of the Construction and Maintenance Division. These branches are: Administration, Ecology, North, West, and East Maintenance Areas, Shop/Warehouse, and Work Control Center. The Administration, Shop/Warehouse and Work Control Center are basically support functions. The remaining branches provide direct field support. The maintenance function can be divided into two groups:

1) Structures: Dams, levees, dikes, and channels.

2) Rights-of-way: Roads, fencing, gates, landscaping, mitigation areas, rental property and signage. The right-of-way items fall under several categories:

   a) Roads, fencing, gates and signage. These are maintained so that the structure is accessible for required maintenance or operation during an emergency.

   b) Landscaping.

   c) Mitigation areas. Built and maintained as a condition of obtaining a permit to perform other work.

The major maintenance services provided include the following:

1) Maintenance of structures such as dams, levees and dikes. This work includes erosion and vegetation control, maintenance of the outflow devices, and rodent control.

2) Maintenance of channels such as rivers, floodways, basins, drains and washes. This work includes vegetation maintenance, erosion control, low flow channel maintenance, and the maintenance of outflow devices.

3) Maintenance of rights-of-way such as roads, fencing, gates, landscaping, mitigation areas, rental property and signage. At times, natural habitat is destroyed when a project is built. The District replaces these areas with other habitat that are called mitigation areas. The District must maintain these areas once they are created.

4) Emergency Response: During flood situations, the maintenance staff provides both emergency response and storm monitoring services. When an emergency exists, staff is dispatched to monitor the functions of the structures and in some cases, operate the outflow devices to control the release of water. Maintenance personnel also operate heavy equipment which is used to protect public and private property during emergencies. They also provide manpower and supplies (sandbags, etc.) to protect both public and private property when structures are damaged or flows exceed the design capacity of the structures.

A large portion of the maintenance budget is expended on contracts with non-FCD organizations providing service and equipment. This includes outside labor, equipment rental, mowing and pesticide services, and materials purchases.

The District has worked with the Arizona Department of Corrections to secure the labor of inmates convicted of DUI offenses. This program is called Aspen. Each day, 20 to 30 inmates are detailed to the District to provide labor used in landscape maintenance, trash pick up, and general maintenance. The Aspen program is a major dollar savings program for the District.

The maintenance of structures is mandated. A.R.S. §45-1212 requires the State to inspect dams in order to ensure proper maintenance. If the District fails to maintain the structures in accordance with State guidelines, the State is mandated to direct corrective action and require the District to reimburse the State for expenses if the State performs or causes the performance of the corrective action. A.R.S. §45-1423 requires the District to operate in accordance with Federal guidance that is normally issued in the form of structure Operating and Maintenance Manuals. The Federal manuals direct the District to operate and maintain the structure in accordance with the standards in that manual. The Federal manuals and other State maintenance mandates are referenced below:

1) 33CFR Title 33, Title 2, Chapter II-Corps of Engineers, Department of the Army, Part 208, Flood Control Maintenance & Operations of Flood Control Works. This document governs the maintenance level and requires District compliance on Corps constructed structures.

2) State of Arizona Executive Order 77-6, dated September 27, 1977 directs each state agency to ". . . provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities . . ."

3) A.R.S. §48-3616 requires the preparation and approval, by the Flood Control Advisory Board and the Board of Directors, of a comprehensive plan to ". . . eliminate or minimize flood control problems."

All structures are inspected annually by the State Department of Water Resources, Dam Safety Section. In addition, all of the structures are inspected by the sponsoring agency on a periodic basis. If the structure is not maintained in accordance with the Operations and Maintenance Handbook provided by the sponsor when the structure was turned over to the District, corrective action is directed by the State, and the District must reimburse the State for the corrective action.

Program Issues:

Vandalism: The District currently spends a large amount of time and money because of damage to District property. Graffiti is painted by vandals at every possible location. Hundreds of plants are stolen from District property every year. Methods of reducing this problem need to be addressed.

Efficient use of employee time: With a service area the size covered by the District, time lost by employees travel from job site to site is great. Methods to reduce this loss have been investigated. One solution was the placement of the East Mesa and North Phoenix Maintenance Yards. These facilities opened as the result of a Total Quality Management study and have resulted in increased productivity. The increase is due to the fact that travel from the facilities to northern and eastern county structures is significantly reduced. This increases available work time and decreases vehicle use rates.

PLANNING PROGRAM

In the mid-1980's, the District began to recognize the need for an independent planning program due to the rapid growth of the Phoenix metropolitan area and the impending completion of several large-scale federal projects that had directed the District's actions for many years. The first step towards an independent planning function began when the Area Drainage Master Study (ADMS) Program was conceived in 1983. This program, which is now included in the District's Planning Program, was approved by the Board of Directors in 1985 as Resolution FCD 85-3. In 1989, planning was first identified as a separate and distinct District program

Since its inception, the Planning Program has been responsible for preparing the *Comprehensive Plan for Flood Hazard Mitigation*. According to statute, the District is to conduct a survey and prepare a report at least every five years describing the remaining flooding problems and the existing flood control facilities in Maricopa County. In conducting the survey, the District solicits comments from and consults with the County's incorporated communities and other County, State, and Federal agencies. Following the preparation and approval of the survey report, a *Comprehensive Plan for Flood Hazard Mitigation* is to be prepared. The plan includes a tentative priority, time schedule, and estimated cost for implementation of the various projects or project elements required to mitigate the County's flooding problems.

In 1993, the Planning Program also began managing the *Procedure for Identifying and Prioritizing Potential Five-Year CIP Projects*. This procedure serves as the primary means of coordinating the District's planning and CIP activities with the incorporated communities and drainage-related agencies of Maricopa County.

Initial and current funding for the Planning Program has been provided by the District. Occasionally, planning studies leading to CIP projects are completed by other cities or agencies and are reviewed and approved by the District.

The mission of the Flood Control District is, "To provide flood and stormwater management services for the benefit of the people of Maricopa County." These services are provided through regulatory activities, master planning, technical assistance, and structural projects such as dams, channels, and storm drains. The primary stakeholders in the success of the Program are the citizens, municipalities, and other governmental agencies throughout Maricopa County.

In support of the District's mission, the primary goal of the Planning Program is to reduce flood risks for the people of Maricopa County. The objective of this goal is to plan and implement flood control projects in the shortest time possible and at the lowest total cost, while balancing both social and environmental considerations.

A second important goal of the Planning Program is to identify potential flood control and stormwater management problems prior to the onset of new development. The objective of this goal, through sound planning, is to avoid or minimize the future need for publicly-funded structural flood control projects.

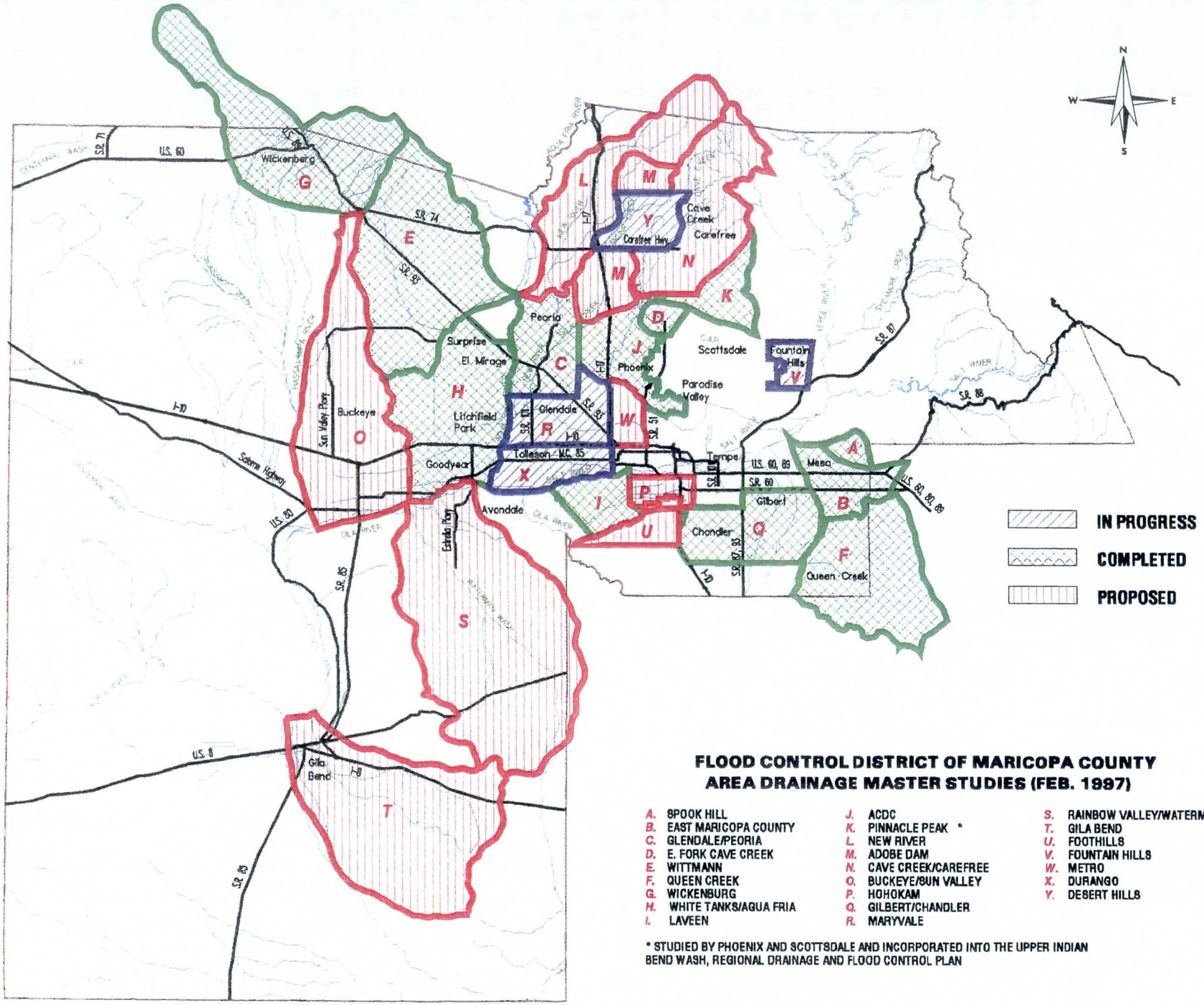
Services Provided:

1) ***Area Drainage Master Study (ADMS) Program:***

In 1985, the Board of Directors approved the concept of pursuing ADMSs as a planning program. The ADMS program is also included as an element of the District's *Comprehensive Flood Control Program Report* (1991). To date, twenty-five ADMS areas have been ranging in size from 15 to 280 square miles. Twelve of the studies have been completed and three are currently underway. Area Drainage Master Plans (ADMPs) are derived for each of the ADMS areas. These plans identify the results of the studies and recommend solutions for flooding problems. Many of the solutions identified in an ADMS/ADMP serve as the basis for specific project proposals submitted by the incorporated communities through the *Procedure for Identifying and Prioritizing Potential 5-Year CIP Projects*, which will be summarized below.

The purpose of the ADMS program is to analyze watersheds to identify flooding and drainage problems. From such studies, potential solutions are developed to reduce or eliminate the flood hazard. Public involvement efforts are utilized to obtain public input on existing flooding problems and to identify possible solutions.

The ADMS program was conceived in order for the District to provide a proactive, leadership role in developing uniform, comprehensive inventories and models of the natural and man-made features that influence rainfall-runoff in identified study areas. In addition to providing a comprehensive overview of existing watershed conditions, the ADMS program also provides a hydrologic model that can be used to measure the cumulative impacts of future changes in the identified watershed.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
AREA DRAINAGE MASTER STUDIES (FEB. 1997)

A. SPOOK HILL
B. EAST MARICOPA COUNTY
C. GLENDALE/PEORIA
D. E. FORK CAVE CREEK
E. WITTMANN
F. QUEEN CREEK
G. WICKENBURG
H. WHITE TANKS/AGUA FRIA
I. LAVEEN
J. ACDC
K. PINNACLE PEAK *
L. NEW RIVER
M. ADOBE DAM
N. CAVE CREEK/CAREFREE
O. BUCKEYE/SUN VALLEY
P. HOHOKAM
Q. GILBERT/CHANDLER
R. MARYVALE
S. RAINBOW VALLEY/WATERMAN WASH
T. GILA BEND
U. FOOTHILLS
V. FOUNTAIN HILLS
W. METRO
X. DURANGO
Y. DESERT HILLS

* STUDIED BY PHOENIX AND SCOTTSDALE AND INCORPORATED INTO THE UPPER INDIAN BEND WASH, REGIONAL DRAINAGE AND FLOOD CONTROL PLAN

PLATE G

In most instances, the watersheds being modeled are complex in nature and cross two or more jurisdictional boundaries. Due to the multi-jurisdictional nature of most watersheds, individual communities have not indicated an interest in performing ADMS-type studies.

The District actively strives to include the public in its decision-making processes, especially those relating to Area Drainage Master Studies (ADMS), floodplain delineations and project planning and design.

Public involvement also is an important component of the District's floodplain delineation program. This program identifies the limits of 100-year floodplains along rivers, streams, washes and ponding areas in Maricopa County. The District typically performs six to ten such studies a year and has delineated an average of 65 linear miles of floodplain per year since 1986. It is important that potentially affected property owners are made aware of the study, offered an opportunity to provide input, and informed of the final study results.

Construction projects designed with little or no public notice or input can invite opposition and may be stopped, changed or delayed as a result. Public meetings, planning workshops, site visits, and open houses all are used to encourage public participation.. A project aesthetic and landscaping policy adopted by the District calls for the formation of an Aesthetics Committee with membership to include neighborhood representatives. In addition, Citizen Advisory Committees are sometimes used to identify preferred design alternatives.

In recent years, the public provided input or participated in the planning of numerous projects and studies, including; 10th Street Wash Basin Design, Upper New River Flood Mitigation Project, Town of Guadalupe Drainage Study, Bullard Wash Outfall Study, Indian Bend Wash Floodplain Delineation Study, Skunk Creek Channel Improvement Project; Tatum and Cholla Interim Drainage Improvement Project, and the Skunk Creek Improvement Project

2) ***Comprehensive Report/Plan:*** As noted above, ARS §48-3616 directs the District to "prepare a comprehensive program of flood hazard mitigation" that is based on the District's survey of flood control problems within Maricopa County. These efforts are required to be completed every five years. In the conduct of the survey, the District solicits comments from and consults with the County's incorporated communities and other County, State and federal agencies. Following the preparation and approval of the survey report, the *Comprehensive Plan for Flood Hazard Mitigation* is prepared. The plan includes a tentative priority, time schedule, and estimated cost for implementation of the various projects or project elements required to mitigate the County's flooding problems.

3) ***Watercourse Master Plans:*** ARS §48-3609.01 defines a "watercourse master plan" as a "hydraulic plan for a watercourse that examines the cumulative impacts of existing development and future encroachment in the floodplain and future development in the watershed on potential damages, and establishes technical criteria for subsequent development so as to minimize potential flood damages for all flood events up to the one hundred-year flood." By statute, the adoption of uniform rules to guide management of a watercourse's 100-year floodplain across jurisdictional boundaries can only occur if the watercourse master plan is completed by a flood control district.

4) *Pre-design Studies:* When the Board of Directors adopted Resolution FCD 88-8A (September 1993) amending the *General Policies Concerning the Allocation of Fiscal Resources to Accomplish the District's Functions and Responsibilities*, staff was directed to begin using the *Procedure for Identifying and Prioritizing Potential 5-Year CIP Projects*. In the first step of this procedure, all proposed CIP projects are evaluated for inclusion in a District-funded and prioritized pre-design study program.

5) ***Interagency Cooperative Projects:*** According to ARS §48-3603, the Flood Control District may, "Contract and join with this state, the United States or any other flood control district or floodplain board, municipality, political subdivision, governmental agency, irrigation or agricultural improvement district, association, corporation or individual in acquiring constructing, maintaining and operating flood control works, and regulating floodplains."

These agreements allow the District to redirect resources to provide a higher level of services than would be possible if only District tax revenues were used. By working cooperatively with other agencies, it is also possible to plan for infrastructure solutions that incorporate multipurpose objectives, often at a savings to both County and municipal taxpayers. As is evidenced in the CIP Program section of this report, a majority of District CIP projects include cooperative assistance from incorporated communities or other agencies.

6) ***Coordination with County Planning Activities:*** In 1993, the Board of Supervisors adopted the *County-Wide Comprehensive Plan Goals, Policies and Standards*. As stated in this document, "The goals and policies are intended to initiate public and private actions to guide orderly development and planned growth in the County; promote high-quality residential, commercial and industrial development; and to improve and expand transportation and public facilities throughout the County." Specific goals and policies that reflect the close relationship between the Flood Control District's programs and Maricopa County's stated planning initiatives include:

1) Goal: Encourage developments which are compatible with natural features and minimize adverse environmental impacts.

Policy A-2: Encourage land uses and development designs that are compatible with environmentally sensitive areas such as parks, designated open space preservation areas, floodplains, hillsides, wildlife habitat, scenic areas, and unstable geologic and soil conditions.

2) Goal: Protect and preserve water resources and minimize damage from flooding.

Policy B-1: Encourage cooperation with the Flood Control District to minimize land development conflicts with the storage and movement of water and achieve compatibility with the development and implementation of Area Drainage Master studies and other relevant investigations.

Policy B-5: Encourage Federal, State, and Flood Control District policies and regulations which support the County-wide Comprehensive Plan.

3) Goal: Provide for a functional, efficient and cost-effective system of utilities, facilities, and public services.

Policy G-3: Support preservation of natural drainage ways as linear open space corridors.

Coordination between the District and Infrastructure Planning also occurs in the development of Area Land Use Plans. One such example is the *Estrella Land Use Plan* (1990). Under the hydrology element of the plan, the following direction is provided:

4) Goal: Protect and preserve existing water resources and minimize flood hazards.

Policy B-1: Encourage cooperation with the Flood Control District to minimize land development conflicts and achieve compatibility with the development and implementation of Area Drainage Master studies and other relevant investigations.

Policy B-5: Support Flood Control District's policies, drainage regulations, and floodplain regulations for all development within the County.

Policy B-6: Discourage the location of structures which would alter current stormwater drainage patterns and which would increase water ponding and sheetflow in areas currently susceptible to sheetflow.

The regional, comprehensive, and advanced planning performed by the District not only provides information and solutions to existing flooding and drainage problems but also identifies potential future problems. Through prudent planning and regulation, these future problems can be avoided or minimized to allow for the cost-effective and safe development of the County.

Development of the various Flood Control Planning Program elements requires significant coordination with the public and local jurisdictions, and with other County, State, and federal agencies. The Program requires the efforts of many different professional and support staff disciplines from within the District and from the private consulting community.

6a) Coordination with the County-wide Comprehensive Plan: During 1997, the Maricopa County Department of Transportation (MCDOT) and the Department of Planning and Infrastructure Development (PID) will be completing an intensive comprehensive planning effort. This undertaking will culminate with publication of a County-wide Comprehensive Plan affecting the unincorporated portion of Maricopa County.

Among the topics addressed in the Plan are issues pertaining to:

- Growth management,
- Infrastructure development,
- Management of infrastructure systems,
- Infrastructure investment within cities and towns, and
- Inter-jurisdictional cooperation.

In the past, decisions regarding infrastructure expenditures and service delivery have not been optimally coordinated. Implementation of the County-wide Comprehensive Plan will allow a more efficient and systematic approach maximizing benefits enabled by expenditures.

The Flood Control District has closely coordinated with the MCDOT and PID planning team during the development of the County-wide Comprehensive Plan. Several areas of concern have been identified by the District for inclusion into the County-wide Plan. Most of these items lie within areas of responsibility outside of direct District authority. By inclusion within the County-wide Comprehensive Plan, however, implementation mechanisms can be developed. The following topics will be addressed in the County-wide Comprehensive Plan:

- Encourage (require) developers to preserve delineated flood plains as "open space."
- Maintain natural drainage corridors in Development Master Plans (DMP's).
- Require Best Management Practices (BMP's) for maintaining / improving water quality for storm drainage infrastructure in all developments.
- Encourage the use of "soft" drainage infrastructure to enhance infiltration and ground water recharge.
- Require developers to quantify impacts of their developments on the regional drainage systems (natural & man made).

7) ***Prioritization Procedure***: The District also works closely with the Maricopa County Department of Transportation (MCDOT) to ensure that effective drainage solutions can be combined with roadway improvements whenever feasible. To further this relationship, District staff participates on MCDOT's Comprehensive Plan, CIP, and Regional Transportation Plan committees, and MCDOT is included in the District's annual notification process for the *Procedure for Identifying and Prioritizing Potential 5-Year CIP Projects.*

Flood protection services are delivered, as directed by ARS §48-3602 ,through the Flood Control District. The District has been organized to provide flood and stormwater management services to the 9,226 square miles that are under Maricopa County's jurisdiction. The services listed above are regionally-coordinated planning functions which identify drainage problems on a watershed basis and develop technically sound, cost-effective solutions for consideration in the District's 5-Year Capital Improvement Program (CIP). Since the CIP Program serves as the outcome of the Planning Program, the following "regional" criteria have been developed to further clarify how and where planning services are delivered:

a) The watershed contributing to the project is located in or the downstream impacts affect more than one municipality, at least one municipality and the unincorporated county, or only the unincorporated county or counties.

b) The proposed project receives funding from or is part of a multipurpose project involving a federal, state, or county agency, or more than one municipality (e.g., drainage structures associated with highway construction).

c) The project is a primary element of a drainage master plan that affects more than one municipality, at least one municipality and the unincorporated county, or only the unincorporated county or counties.

d) The project is required as mitigation for, protects the integrity or improves the performance of an existing District flood control or stormwater management project, or enhances the resale value of property owned by the District.

e) The project, regardless of its location, is a primary element of a drainage master plan that manages stormwater from a watershed at least ten square miles in area or provides benefits to or impacts an area of at least ten square miles.

f) The project provides the District operating facilities or facilities associated with the District's flood warning program or the National Pollutant Discharge Elimination System.

The primary internal mechanism used by the Planning Program to determine how and where services are provided is the *Procedure for Identifying and Prioritizing Potential 5-Year CIP Projects*. The following summary of the "Prioritization Procedure" is provided:

"When developing the District's first Strategic Plan in 1991-1992, staff identified a concern that the existing project development process, which includes identifying, planning, prioritizing, funding, and constructing capital improvements projects, was too time consuming and complex. About this same time, in early 1992, a preliminary audit report of the District was completed by Arthur Andersen & Co. The preliminary report confirmed District staff's concerns that the project development process was inefficient in its use of the District's financial and staff resources. The auditors recommended, "The District should analyze the project process on a more detailed basis to shorten the time required to complete a project by eliminating duplication and unnecessary items and bottlenecks. In addition, further analyze the flow to have effective up-front planning."

Due to the existing institutional knowledge of the project development process, District management determined that the problem could be addressed by staff through a Total Quality Management (TQM) approach rather than through a detailed audit. The primary recommendation from the TQM team was to implement the *Procedure for Identifying and Prioritizing Potential 5-Year CIP Projects* (Prioritization Procedure).

After review by the County's cities and drainage-related agencies, the Prioritization Procedure was approved by the Flood Control Advisory Board and the Board of Directors in 1993 by means of amendment to the *General Policies Concerning the Allocation of Fiscal Resources to Accomplish the District's Functions and Responsibilities*. To date, the primary benefits of the procedure are:

1) Reduction in uncertainty by applying Board-approved and community-reviewed criteria during the project review process.

2) Improvements in fiscal efficiency by requiring concurrent review of all project proposals and timing this review with the District's budget cycle.

3) Elimination of duplication and improves community commitment by focusing planning efforts on projects approved for pre-design/feasibility analysis.

4) Provision for reconstructing or reprioritizing the District's budget and 5-Year CIP with a minimum of disruption to ongoing activities by developing a rank ordering system.

There are two steps in the prioritization procedure. First, all newly proposed projects are evaluated according to established, weighted criteria by a committee comprised of District staff members. The selected projects are included in a District-funded and prioritized pre-design study program.

The second step includes the evaluation and prioritization of projects for inclusion in the District's Five-Year CIP program. For projects requiring an Intergovernmental Agreement, the information developed in the pre-design study serves as the basis for negotiations. As ADMPs are completed, it is envisioned that a significant number of future pre-design studies and CIP project requests will originate through the ADMP program. Annual input regarding the priorities for projects contained within these plans, as well as other potential projects, continue to be sought through the cities, towns and other agencies, and prioritized on a country-wide basis.

During the development of the Prioritization Procedure, the District invited its client communities to help define the appropriate criteria for project review and assign an appropriate weighting. The ten subject criteria was reviewed and approved by the Flood Control Advisory Board and Board of Directors.

In the first five years (1992-1997) of the Prioritization Procedure, a total of one-hundred and seven (107) projects have been submitted for District review. Of this total, twenty-four (24) projects are complete while thirty-two (32) requests have been eliminated from consideration. The remaining fifty-one (51) requested projects are in various stages of more detailed review and/or implementation. These fifty-one (51) projects, which meet Board-approved criteria for consideration, total over $182 million in District project costs that are not funded in the current Five-year CIP.

The District's ability to meet the County's goals is enhanced by two key characteristics that are unique to the District when compared to the municipal jurisdictions where the majority of the County's residents reside. First, flood and stormwater follow physical rather than jurisdictional boundaries. The District's ability to reduce flood risks for the people of Maricopa County through regionally-coordinated watershed management allows for a more comprehensive assessment of the cumulative effects of flood control and stormwater management projects. Often, the negative effects of such projects occur outside the jurisdiction of the municipality responsible for implementing the project. Therefore, a regionally-coordinated approach improves service delivery by reducing the need for public expenditures to fix the problems created by uncoordinated,

municipally-oriented flood control and stormwater management projects. In addition, this approach provides for a more equitable distribution of costs between municipalities.

Complementing the concept noted above, the District's second unique characteristic is financial stability, which is provided through our statutorily-created funding source. By focusing on a country-wide perspective for funding, the Legislature has provided the District with the ability to instill public confidence and benefit the regional economy by allowing the reduction of flood risks to be based on watershed characteristics rather than political boundaries. This allows public investments in flood risk reduction to be prioritized based primarily on need. The District has formalized this process by following the Board-approved *Procedure for Identifying and Prioritizing Potential 5-Year CIP Projects*, which specifically outlines the project criteria that are considered by the Flood Control District and its Board of Directors to be important to the people of Maricopa County. The District's financial stability has also allowed the County to reap substantial benefits through the leveraging of outside funding sources such as the Corps of Engineers, the Natural Resource Conservation Service (formerly the Soil Conservation Service), the State of Arizona, and local communities.

Throughout its history, the District's ability to serve as the local sponsor for federally-funded projects has brought substantial revenues into Maricopa County. Since 1967, the District has leveraged an estimated (in 1995$) $484. million in federal funds and $59.5 million in state funds. While federal funding levels have been scaled back in recent years, the District continues to work with the federal agencies to maximize Maricopa County's accessibility to these funds.

CAPITAL IMPROVEMENT PROGRAM

The Capital Improvement Program (CIP) is a primary reason for the existence of the Flood Control District. The CIP or the Planning Program, which is the foundation for the CIP, ıs initiated in August 1959 with the action of the Board of Supervisors to form the Flood Control District of Maricopa County as "a political taxing subdivision of the state" with the authority to acquire "rights-of-way for and construct, operate and maintain flood control works and storm drainage facilities within or without the district for the benefit of the district."

One of the first activities of the new district was to prepared the "Comprehensive Flood Control Report of 1963" which became the basis for the Planning Program and the CIP for the next twenty to twenty-five years. During this period, the District functioned primarily as the "local sponsor" for federally funded flood control projects planned, designed, and implemented by either the Soil Conservation Service (SCS) or the U.S. Army Corps of Engineers (Corps). As "local sponsor," the District's role was to fund and take the necessary actions to acquire the rights-of-way required for a project as identified by the federal agency, to relocate the people affected by the acquisition of rights-of-way, to relocate utilities affected by the project, and to assume operations and maintenance responsibility for the completed flood control project.

The District was and is funded through a special secondary tax levied on real property throughout the County. The tax rate is set by the Board of Supervisors based upon the recommendation and "certification" by the Board of Directors of the needs of the District for its programs.

The primary goal of the CIP is to implement structural and non-structural flood control measures (*provide flood and stormwater management services*) to reduce or eliminate the risk of loss of life and property as a result of flooding (*for the benefit of the people of Maricopa County*).

The specific program goals and objectives of the CIP are to:

1) Receive public input for engineering design concepts or reports from pre-design concept reports, and prepared scopes of work and management of consultant engineering design contracts for the preparation of construction plans and specifications for flood control projects.

2) Negotiate, coordinate, and administer intergovernmental agreements (IGAs) concerning the design, cost sharing, and long term maintenance of flood control projects.

3) Prepare realistic project cost estimates for the design, rights-of-way, utility relocations, and construction, and manage project budgets.

4) Ensure that design of flood control improvements incorporate the "best available demonstrated control technology" to protect or enhance the quality of stormwater and the environment, and that aesthetic considerations are a part of the design. Obtain the required environmental permits for projects through preparation of environmental assessments and complete exploration of project alternatives that minimize or avoid adverse impacts.

The CIP is approved by the Board of Directors during the budget process, and published on an annual basis. The CIP consists of two elements: the current or budget year program, which allocates funds to specific projects, and the Five-year CIP, which is essentially a planning document that indicates the continuity of funding required to complete projects under construction and forecasts funding allocations for proposed projects during the next four-year period.

If a CIP project has been through the complete planning process, the pre-design study and analysis of alternatives will have been accomplished. In this situation, the project manager will prepare the scope of work necessary to accomplish the engineering design based on the concept approved and accepted during the planning process. If the pre-design has not been accomplished, the scope of work prepared by the project manager will require the identification of project alternatives, support for public meetings to receive input regarding the project, and other activities which would normally be provided during the planning process.

Environmental Compliance Programs support many CIP Projects. These programs are either mandated by federal, state, or local environmental regulations or are aimed at reducing liability and risk of environmental hazards. Environmental Site Assessments (ESA) for real property acquisition is conducted before the purchase or sale of any property. Environmental site assessments are undertaken to identify the presence of any environmental hazards connected with the property. This program is mandated under the Superfund Amendments and Reauthorization Act (SARA) which establishes liability for clean-up of environmental hazards when property ownership is transferred.

Environmental permitting is required whenever a Flood Control District project impacts a "water of the United States." Review and permitting under section 404 of the Federal Clean Water Act is required in this instance. This federal permitting process dictates an environmental review of potential

impacts of the projects. This review includes a survey of biological resources that may be adversely effected by the project and coordination with the U.S. Fish and Wildlife Service to determine if threatened or endangered species are present. Archaeological and historical resources are also evaluated. Results of cultural resources investigations are submitted to the State Historic Preservation Officer for review and concurrence. Expenses associated with this program are predominately staff time, with the exception of contracted archaeological and site assessment services. Capital expenditures for mitigation are budgeted as a project cost.

The environmental functions provided in support of the CIP are not strictly limited to environmental permitting, which can include deterring permits, air quality permits, and aquifer protection permits. Environmental compliance issues for the CIP, are addressed by environmental support functions.

Environmental Objectives in the CIP/Planning Program were established to meet environmental regulatory requirements mandating that environmental consequences of projects be evaluated, avoided where possible, and mitigated if necessary.

The level of service for archaeological review has been established by state and federal agencies. The service levels for environmental assessment of real property has been set by American Society for the Testing of Materials (ASTM) Standard E 1527 - 93. The level of service for permit applications is determined by the permitting agency.

Design for engineering detail, and preparation of construction plans and specifications for all major CIP projects are accomplished by consulting engineering firms contracted by the District. The scope of work for each contract is prepared by the project manager, and is specific to that project. The scope is tailored from a generic framework to accomplish the specific needs of a given project. Project managers are responsible for;

- managing the project budget;
- administering contracts related to the project;
- coordinating the review of the consultant's work projects by the in-house engineering staff; coordinating the activities to research and identify utility conflicts and relocations;
- identifying the rights-of-way required to build the project, coordinating the acquisition of the rights-of-way with in-house land management staff;
- coordinating with the requesting customer;
- developing and managing the public involvement activities;
- coordinating with the contracts administration staff;
- coordinating with the construction inspection staff; and
- reviewing and assembling the construction plans and specifications.

During the construction phase, a project manager is responsible for coordinating with the construction inspection staff to ensure that the project is implemented in accordance within the intent of the engineering design.

Most flood control and stormwater management problems in a large metropolitan area are regional/inter-jurisdictional in nature. The District is in a better position to address such projects in a comprehensive manner and to coordinate the solutions across jurisdictional boundaries than individual communities. Solutions implemented on a jurisdictional basis are potentially more cost

effective and more likely to provide a high level of protection. Frequently, the District is able to facilitate a solution and encourage the jurisdictions to cost share in the solution by bringing expertise and funding into the negotiations.

The District (County) wide property tax focuses solutions on the most urgent problems, as identified in the prioritization process. Additionally, the District has been able to leverage funds from other agencies to assist in implementing flood control measures. The Arizona Department of Transportation (ADOT) has been a cost sharing partner on several flood control projects and has allowed the District to use its facilities as a discharge outlet on other projects. The District has also been able to work with the U.S. Air Force as a cost sharing partner in flood control measures to protect Luke Air Force Base and a portion of the unincorporated County.

Revenues are also produced from the sale of lands acquired for a CIP project that are excess to the flood control needs of the District upon completion of the project. These revenues are reported under the Property Management Program.

The goal is that 95 percent of the program's budget will be expended by the end of any given year. Because of the nature of the engineering design and construction business, achievement of this goal may not always be possible. Unforeseen soil conditions, delays due to weather or material shortages, etc. may all impact the ability to achieve the estimated cash flow schedule in any given year.

PROGRAM ISSUES:

1) The District's CIP is by far the largest of the District's defined programs and more than two-thirds of the annual budget is utilized to support it. If the Planning Program budget is added to the CIP budget, three-quarters of the total District budget is spent on planning and implementing capital improvements. The two most significant issues concerning the CIP and the Planning Program are the size of the annual funding to be dedicated to the programs and the continuity of funding.

2) The other significant issue affecting the CIP, which is critical to the vision of the County's Business Plan, is the stability of funding and the level of public confidence in continued funding. Planning and implementing capital projects are dependent on many variables: sufficiency of available data; complexity and magnitude of the problem; location of problem versus solution; jurisdictional limitations; environmental issues and impacts; long-term maintenance requirements and cost sharing. Even the most rudimentary projects require three-to-five years to plan, design, coordinate, and construct. Most regional, multi-jurisdictional projects require more than five years; therefore, the availability and continuity of funding in the future for implementation is tantamount to the success of a project. Most of the District's projects fall into this latter category.

3) During the last six successive years, the reduction in the District's funding rates were to be temporary, one-year impacts that would be restored in future years. This did not happen. The Five-year CIP approved by the Board of Directors in September 1996 was based on a flat revenue scenario and the CIP, planning program, and staffing levels were adjusted accordingly. Annual fluctuations in the CIP not only affect the District, but also impact the plans and construction schedules of other jurisdictions and agencies with whom the District plans,

coordinates, and partners projects. Large reductions in available CIP funding can result in the phasing of a project into many smaller parts or can completely delay a project. Both of these options typically increase construction costs while lowering the level of service dedicated to remedy existing flood control problems.

4) The District maintains and publishes an annual Five-year CIP. The CIP document contains the most recent forecast of projects the District will be funding and the schedule of the projects, their estimated costs, and project cost-sharing partners. The first two years of the CIP contain projects that are under construction or will soon be constructed and those projects for which design contracts, rights-of-way acquisition, permitting, and intergovernmental agreements are being finalized. For these reasons, it is difficult to abruptly change the CIP funding without incurring significant contractual costs, possible legal repercussions, or affecting the planning activities of other agencies. The later three years of the CIP offer more flexibility to change without the negative impacts stated above.

5) The District's regional role in providing planning and capital improvements for flood protection and comprehensive drainage services within Maricopa County is recognized by various private and public entities. The community has come to rely upon the District and expects quality technical guidance as well as regulatory and infrastructure improvements that directly contribute to the lessening of public safety problems and the enhancement of quality of life. To provide these services and to meet these expectations, a sufficient and continuous level of CIP funding is necessary.

6) In Maricopa County, most of the major flooding and drainage problems that impact people and developed property are in the Phoenix metropolitan area. Many of these problems are inter-jurisdictional among cities but a few also involve unincorporated areas of the County. Because many of the cities in the metropolitan area have common boundaries, what one city does within its boundaries often has an impact on another city. In these circumstances, the District is better able than any one city to identify, negotiate, and resolve the flooding problems in an efficient and effective manner. Stormwater does not recognize political boundaries.

7) Most of the projects undertaken by the District involve cost sharing with a city, town, or other agency. Even those projects that may be wholly within one city may have another city as a cost sharing partner because the project is an element of a regional plan identified in an Area Drainage Master Plan (ADMP).

8) Area Drainage Master Studies (ADMSs) and the resulting ADMPs are developed on a watershed or sub-basin basis. Elements ~~of the~~ plans interconnect drainage systems and may be constructed as individual projects within the framework of the master plan. These elements may be wholly within one jurisdiction or be multi-jurisdictional.

9) The District is uniquely suited to assist and coordinate Water Course Master Plans or ADMPs, and to implement elements of regional plans with different levels of government involved with water resources planning and management. The expertise of the District's staff is recognized and respected in the local and national engineering community.

10) Most of the District's revenues are generated from the incorporated areas. The tax levy on real property concentrates the revenue source as developed property which is generally within an incorporated area. In the long run, each municipality expects the District to return the tax revenues generated within their city in the form of flood control assistance and/or projects. The District's staff is dedicated to balancing that expectation and at the same time negotiate cost sharing agreements to leverage the District's funding and provide more flood control for the citizens. In most cases, the smaller cities are at a disadvantage in generating revenue and their ability to cost share in projects. The west side cities of Glendale and Peoria are in a period of economic and real growth and need the District's help to maintain the growth within their boundaries without sacrificing the quality of life of their citizens. It would be unfair to curtail the capital improvement program at a time when the smaller cities are starting to enjoy its benefits.

11) The District's staff, in recognition of the need to balance the flood control needs of a community with its contribution to the District's revenues through the tax levy, developed the process for prioritizing CIP projects that was approved by the Board of Directors in 1993. The prioritization process is discussed in detail in the Planning Program section. The prioritization process allows cities to submit requests for any number of projects, but requires that each project stand on its own in terms of the flood control benefits, how it ranks among the city's requests, and whether the city is willing to become a cost sharing partner or assume the long term maintenance for the completed project.

12) Frequently, the District's projects provide opportunities for recreational and environmental enhancements. This is especially true in areas that are already fully developed. These amenities are provided at no increased cost to the District's flood control efforts, but have a great impact on the quality of life important to our customers. The District's "Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects" approved by the Board in December 1992, is helpful in this area because it provides planning guidance for staff in negotiating IGA's and also provides an upper limit for District expenditures on non-flood control amenities.

13) Although federal flood control programs are becoming more limited by the funding cut backs and the high discount rate used in computing whether there is a federal interest in a project, District staff is continuing to provide data, expertise and analyses to federal agencies to assist communities in pursuit of non-flood control assistance. Specific examples include:

- The federal investigation of the alluvial fan are in north Scottsdale by the U.S. Corps;
- Alluvial fan floodplain delineation methodology by the National Science Foundation; and
- A reconnaissance level study conducted by the Corp of the "Rio Salado Concept" through the cities of Tempe and Phoenix.

14) Several projects have encountered difficulty during implementation. For example, the Watercourse Master Planning effort for the Salt and Gila Rivers from Granite Reef Diversion Dam to Gillespie Dam attempted to bring together all the communities, private organizations, and state and federal agencies interested in the development and the resources of the rivers. After identifying the cost of accomplishing a master planning effort, the District has relinquished the leadership role in this effort to the cities and the Maricopa Association of

Governments (MAG). The master plan is a worthwhile and needed effort, but it is better accomplished by the communities with jurisdiction and control over land use.

15) The District's flood control efforts on the lower Salt River and the Gila River west of 91st Avenue is another area of difficulty. The 1,000 foot wide clearing and pilot channel project provides some level of flood protection, but the floods of January 1993 that destroyed 80 percent of the facility caused staff to refine the scope of this project and undertake a non-traditional engineering and geomorphic analysis of the rivers as a system.

Issues Analysis:

1. Goals and Objectives of the District. The goals and adjectives for the District CIP are the same as the program goals and objectives. The program is meeting the goals and objectives of:

   a) Soliciting and gathering public input for project formulation and providing public information to obtain consent and support for proposed projects. The public involvement process is an area of continuing improvement for the District staff.

   b) Negotiating, coordinating, and administering IGAs for proposed projects. The process of prioritizing projects, project planning, and accomplishing pre-design concepts prior to negotiating the IGA is providing staff with better tools. Stability and continuity of funding levels available for the CIP is a detriment to negotiations.

   c) Preparing realistic estimates for the needs the specific projects. The limited amount of funding available for the CIP has caused staff to work harder at preparing project estimates and managing the allocation of funds. In the past, funds were frequently carried over from one fiscal year to the next; with the limited funds available, and the planning process that is better defining the project design, funds are being shifted to projects where they are needed for implementation and maintenance of a schedule.

   d) Ensuring that the engineering designs incorporate the "best available demonstrated control technology" (BADCT) to protect or enhance the quality of stormwater and the environment. Currently, this goal is being accomplished through the environmental permitting process which requires identification and analysis of project alternatives and the selection of alternatives that contribute to the "least damage" to the environment, and then to mitigate the damages that cannot be avoided. Staff is currently undertaking efforts to analyze existing flood control facilities for the purpose of identifying whether retrofit efforts are feasible and necessary ~~for the~~ improvement of stormwater quality. The identification of BADCT and best management practices for enhancing the quality of stormwater is a part of this effort that will be used in planning and implementing future flood control measures.

   e) Responsible fiscal management. District staff is very conscious of its fiduciary responsibilities in the use of public funds and strives for efficiency and effectiveness without endangering the public health, safety and welfare. An example is the non-traditional analysis being undertaken for the Salt-Gila River Clearing and Pilot Channel Project. Accepting and spending millions of dollars of federal flood control assistance to

construct less than optimal projects would be easier than conducting an analysis to determine an effective and durable flood control measure.

PUBLIC INVOLVEMENT PROGRAM

The Public Involvement Program and related activities were initiated as a separate function in 1985. Until this time, the District had no specific policy or program for receiving or soliciting public comment concerning flood control projects or activities. In November of that year, the Flood Control Advisory Board approved the hiring of a Public Involvement Coordinator (PIC) to coordinate public involvement and information activities and to oversee the work of three public relations firms hired to conduct public involvement programs for several key projects.

Until this time, most projects involved federal agencies such as the Soil Conservation Service (SCS) and Corps of Engineers which took care of the public involvement components of the projects. Beginning in the mid-80's, the mainstay of the District's efforts began to involve local projects with cities and towns. In many instances, public involvement became the responsibility of the district as the lead agency involved in the project. Unequipped for the task, the District had sought expertise in the private sector at considerable expense. By funding a new staff position, the District could perform the function "in-house" at considerable savings.

Prior to the development of a Public Involvement Program, public involvement responsibilities were often performed by technical staff (Project Managers and Engineers) not always trained or equipped to respond to the demands of public relations associated with some of the more controversial CIP projects or studies. Transferring these tasks and responsibilities to someone trained in the Public Relations field would improve consistency of implementation and the effectiveness of public involvement programs. This also permitted the Project Managers to focus their efforts on the important tasks of overseeing the work of contractors and consultants and keeping the project on schedule and on budget.

Public involvement activities were very different than "public information" activities. This is because the required specific knowledge about projects is only obtained through close daily coordination with the project managers. Having the public relations expertise in-house has resulted in considerable savings because funds have not been expended on expensive PR firms such as those hired in 1985 and 1987 (although such expenditures may still be warranted in some instances where specialized services or expertise is required).

For many years, the District was able to perform its mission in the public's best interest and the public rarely questioned the need for a particular flood control project, policy or study. This no longer holds true. Because of shifts in social values, heightened neighborhood activism and awareness, and increased expectations of tax-supported services, the District often finds itself questioned, challenged and sometimes criticized. By striving to improve the level of involvement by the public in the decision-making process (through a pro-active public involvement program) the District has improved its credibility. These positive results have greatly increased the District's chances for accomplishing its mission of flood protection.

The goals of the District's Public Involvement Program include:

1.) To demonstrate the necessity of a project. Through open communication with the public, the District is able to establish the need for a project. Not only is concern displayed for the community, but, so to is the responsibility to protect that community from flooding.

2.) To identify project alternatives. Through public involvement, the District is able to increase two-way communication to better understand mutual concerns and needs. This leads to finding alternatives that are more likely to be acceptable to the community.

3.) To build consensus. A consensus must be formed on each issue as it develops. There is rarely just one right action. Public involvement provides a process where divergent viewpoints can be molded into a single consensus that will be accepted by the majority.

4.) To improve agency credibility. Asking the public for input exhibits the Districts concern for the community. The desire to be a "good neighbor" is prominently displayed which often increases credibility and name recognition with the general public.

Another important goal of the Public Involvement Program is to reduce the possibility of litigation. This goal is less overt and explicit than the others and may simply be a fortuitous by-product of effective public involvement. Identifying problems before they erupt or reducing combative emotions during a conflict greatly reduces the likelihood of a law suit. This results in more time spent serving the public and building a consensus concerning specific projects.

PROGRAM ISSUES:

The need for the Public Information Program has been described above. The consequences of not having a program would likely result in increased project costs. There would be delays caused by concerned citizen's demands for an opportunity to provide input. By programming such opportunities into the project from the outset, in the form of a public involvement plan, there is some control over the schedule. Fewer projects, however, would be constructed as a result of public objections which were not identified or addressed early-on in the planning stages. Public Involvement is crucial to obtaining "informed consent" from those who otherwise might be able to stop the project by claiming no effort was made to solicit their input.

ENVIRONMENTAL PROGRAM

Maricopa County receives storm water runoff from over 9000 square miles of watersheds within central Arizona. The water that the FCD receives in its structures from diverse watersheds throughout Maricopa County has varying levels of water quality characteristics. Consequently, conveyance and discharge of this storm water runoff from FCD structures has resulted in potential environmental impacts. The goals of the Flood Control District's Environmental Program are to ensure that the operation, maintenance and construction of flood control structures complies with federal and State regulatory environmental requirements.

The FCD's Environmental Program is directed at achieving several important and interrelated objectives. They are:

- Ensure that existing structures and Capital Improvement Projects comply with federal and State water quality programs in order to satisfy environmental requirements. These programs include permit requirements of the Clean Water Act relating to the discharge of dredge or fill material within waterways, control of the discharge of pollutants in waterways, and protection of wetlands.
- Reduce potential environmental hazards associated with hazardous materials that may exist on FCD property.
- Develop a program to design and implement structural and nonstructural controls to improve storm water quality.
- Implement a regional storm water management program to assist Maricopa County municipalities in complying with National Pollutant Discharge Elimination System (NPDES) storm water permitting requirements.
- Establish and implement a County policy regarding the use of FCD property by municipalities and private organizations to recharge groundwater and conserve water resources.

Compliance with regulatory environmental permit programs requires coordination with numerous federal and State agencies, and the regulatory programs that they administer. These agencies and programs that relate to FCD environmental functions include:

AGENCY	REGULATORY PROGRAM
-Environmental Protection Agency	-Clean Water Act (water quality standards)
Arizona Department of Environmental Quality	-Clean Water Act (water quality standards)
-U.S. Fish and Wildlife Service	-Endangered Species Act
-U.S. Army Corps of Engineers	-Clean Water Act (protection of navigable waters and wetlands)
-State Historic Preservation Office	-National Historic Preservation Act (protection of significant archaeological and historic resources)
-Arizona Department of Game and Fish	-Endangered Species Act
-Arizona Department of Water Resources	-Protection of groundwater resources

The following sections describe in more detail the elements of the Environmental Program.

Regional Storm Water Management

NPDES storm water permit regulations under the Clean Water Act require that municipalities with populations over 100,000 implement programs to control pollutants in storm water. The FCD is assisting Maricopa County municipalities to comply with the requirements of their NPDES storm water permit regulations. Since 1991, the FCD has provided the municipalities of Phoenix, Mesa, and Tempe with assistance in collecting samples and characterizing storm water quality for their respective NPDES permits (the City of Scottsdale was recently notified by the EPA to begin preparing an NPDES storm water permit application). A primary objective of this program has been to establish a regional storm water monitoring network. To this end, the FCD Board of Directors authorized a Joint Funding Agreement with the U.S. Geological Survey and Intergovernmental Agreements with the municipalities to establish sampling stations for characterization of storm water quality. A total of

16 land use-based monitoring stations and eight in-stream stations are in place. The FCD provides the municipalities with an annual report on storm water monitoring efforts and pollutant loads. The monitoring program also provides storm water quality information to assist the FCD with complying with storm water discharge requirements if and when the County is notified by the EPA to begin preparing NPDES permit applications. In addition, the program provides the FCD a means to investigate and eliminate illicit discharges into its structures.

As a secondary objective to the Regional Storm Water Management Program, the FCD is developing with other Arizona municipalities a cohesive strategy for complying with EPA's storm water quality regulations. A major component of this strategy is a research study to assess potential environmental impacts of storm water discharge to waterways. Information developed will be used to negotiate NPDES permit conditions and water quality standards with the EPA.

Legislative and Regulatory Review

In order to assess potential federal and State regulatory impacts to FCD structures, the FCD regularly reviews pending legislation that effect NPDES regulations and water quality standards. The FCD has recently completed review and comment of the State water quality standards, including review of proposed techniques for testing toxicity levels in storm water.

Storm Water Quality Control

Currently, the FCD is evaluating feasible Best Management Practices (BMP's) for controlling the discharge of pollutants in storm water. The BMP's are being evaluated for Capitol Improvement Projects and existing structures that receive and convey storm water. The goal of this objective is to identify BMP's that provide cost effective storm water quality improvements. BMP's under evaluation range from submerged-flow constructed wetlands and sediment basins to siltation fences. The FCD is currently modeling the performance of a constructed wetland designed to remove oil and grease from storm water runoff at a County vehicle maintenance yard.

Public Outreach

The FCD has also developed and presented guidance material for use by the public, contractors, developers and municipalities that describes both structural and non-structural ways to reduce storm water pollution. These services include preparation of guidance documents for use by small businesses in implementing BMP's, preparation of technical information regarding the selection of water quality enhancement projects, educational materials, updates to the FCD's Erosion Control Manual, and production of a video regarding storm water pollution.

Environmental Site Assessments for Real Property Acquisition

Prior to purchase or sale of any real property, the District conducts an environmental site assessment to establish the presence of any environmental hazards connected with the property. This program is mandated by EPA under the Superfund Amendments and Reauthorization Act (SARA) under which the liability for clean up of environmental hazards is transferred with property ownership. Also addressed under this program is the remediation of District owned properties that would constitute an environmental hazard under the Comprehensive Environmental Resource and Recovery Act of 1980

(CERCLA) and State Statutes regulating environmental hazards. This includes removal of asbestos containing materials from structures acquired during right-of-way acquisition that will be demolished during project construction. During the 1995/1996 fiscal year a total of twenty (20) preliminary Environmental Sites Assessments have been conducted, three underground storage tanks have been removed from project right-of-ways, one site has been remediated for residual pesticides, and sixteen (16) structures have been abated for asbestos.

Environmental Permitting

Clean Water Act - Section 404

The Clean Water Act, Section 404, requires that all discharge of dredged and/or fill material into "waters of the United States" including "adjacent wetlands" must be permitted by the United States Army Corps of Engineers (ACOE). Whenever a FCD construction or maintenance project impacts a "water of the United States," an area with a broad definition that includes most if not all dry desert washes and river channels, review and permitting under Section 404 of the Clean Water Act is required. This Section of the Act is administered by the ACOE with the United States Environmental Protection Agency providing oversight authority. Because this is a Federal permitting process, compliance with the National Environmental Policy Act is required. The primary conditions of this permit require that environmental impacts are to be avoided and/or minimized and where unavoidable, mitigation measures are to be designed and implemented. Wetlands impacts are considered in the Section 404 permit review process; the District develops all practicable alternatives to avoid potential impacts to the use of wetlands as a result of improvements or maintenance to structures. The District routinely consults with the ACOE and other resource agencies regarding mitigation measures to reduce impacts to wetlands and sensitive wildlife/aquatic habitats located within "waters of the U.S." Currently, the District is developing a policy for streamlining the processing of Section 404 permit applications with the ACOE and other State and federal resource agencies in central Arizona.

Clean Water Act - Water Quality Certification

Another condition required for issuance of a Section 404 permit is certification by the Arizona Department of Environmental Quality (ADEQ) that project construction or maintenance activities comply with Section 401 of the Clean Water Act. Section 401 certification requires project review by ADEQ. This review requires that BMP's and pollutant control features are incorporated into the project to insure that there will be no degradation of water quality below State standards.

Endangered Species Act

This act requires an assessment of potential environmental and biological impacts of District projects. Prior to construction of improvements, the District conducts a survey of biological resources that may be adversely affected by the project; survey results are coordinated with federal and state wildlife agencies to determine if threatened or endangered species are present. If threatened or endangered species or habitat for such species may be adversely affected, consultation is required with the United States Fish and Wildlife Service to identify mitigation measures to reduce impacts. The District is now developing a plan for managing and protecting riparian habitat to be used future mitigation sites.

National Historic Preservation Act, Archaeological Resources Protection Act, Arizona Historic Preservation Act, Arizona Antiquities Act

Archaeological and historical resources are also required to be evaluated to determine if any resources will be disturbed that are potentially eligible for inclusion on the National Register of Historic Places. The District conducts archival research is as well as site surveys; the results of these investigations are submitted to the State Historic Preservation Officer (SHPO) for review. If significant historic or archaeological resources may be disturbed, mitigation measures are developed in consultation with the SHPO. The District has conducted over thirty (30) archaeological and historic resources surveys.

Groundwater Recharge

The District is supportive of innovative techniques for managing storm water and conserving water resources. To this end, a policy regarding the use of District structures for groundwater recharge has been developed.

Several local jurisdictions and private organizations are interested in artificial groundwater recharge because of the many benefits a successful program can produce. Some of the more outstanding benefits include the restoration of continually decreasing local groundwater levels and the commensurate slowing of land subsidence, assurance of a future water supply for the community which in turn allows for increased residential development, and the cost savings realized over that of construction and operation of conventional surface water treatment plants.

To address this new issue, a Groundwater Recharge Policy was prepared. Comments regarding the policy were solicited from both public and non-public entities, and several meetings with local jurisdictions and interested parties were held. The FCD's primary mission is to provide flood protection and, to that end, often uses engineered structures such as earthen levees, dams and basins. Consequently, the FCD's primary concern is to maintain the integrity of those structures. With this in mind, the newly approved policy develops a procedure to allow the lease of FCD property for groundwater recharge while protecting FCD's structures and mission. The policy addresses technical issues, liability and indemnification, the lease application process, notification and monitoring, and fee structures.

Several municipalities have expressed a desire to use FCD property for the purposes of conducting groundwater recharge, replenishment or underground storage. Potential locations for siting basins include the impoundment areas of McMicken and Cave Buttes Dams, the channel at the confluence of Skunk Creek and the Arizona Canal Diversion Channel, the east bank of the Agua Fria River at McDowell Road and most recently, adjacent to the East Maricopa Floodway. Potential sources of recharge water can include potable water from municipal supplies, wastewater treatment plant effluent, storm water runoff, and un-treated surface waters such as the CAP, Verde River, or SRP canal water.

During Summer and fall of 1996, the City of Surprise operated the only groundwater recharge facility on FCD property. The city began operation of a one acre pilot project in April, 1996, within the impoundment area of McMicken Dam. In the first three months of operation, the recharge pond has performed well and the overall project has had good results. While only one groundwater recharge facility is currently operating on FCD land, several jurisdictions have expressed interest in siting facilities on FCD properties and have initiated preliminary discussions.

OPEN SPACE PROGRAM/PLAN

While not an actual District program, the concept for preservation of open space is compatible with several District activities. The District encourages other agencies and communities to utilize and develop District property and facilities for recreational or multiple-use amenities. Through active participation during a projects planning and design phase, multiple-use objectives can be facilitated without adversely impacting flood control objectives. The District cannot, however, allow its funds to be spent on non flood control projects or permit the primary flood control purposes of any property or facilities to be compromised.

Floodplain management also can facilitate open space access and acquisition. The floodplains of the major rivers and washes throughout the County provide valuable habitat in rural areas. These floodplains also offer the potential for rehabilitation or reestablishment of natural areas and wildlife habitats within urbanized areas. The Flood Control District cost-shared with the Maricopa County Department of Transportation and the Maricopa Association of Government (MAG) for the Development of the Open Space Plan, now named the Desert Spaces Plan for Maricopa County.

The Desert Spaces Plan is a regional open space plan designed to guide jurisdictions within Maricopa County to establish and protect suitable open space areas. The Plan is intended to be utilized by Federal, State, County, and local jurisdictions as a framework for decision-making and coordination. The overall goal of the Open Space Plan is to identify a regional system of integrated open space along with a mechanism to establish and manage the system. The Flood Control District supports the Open Space Plan concept without accepting any responsibility or obligation by the District for implementation. The Resolution protects the District and the County from expending funds for extraneous purposes, while supporting intergovernmental cooperation in the development of a regional open space system.

The Plan concept is to conserve and enhance environmentally sensitive areas such as floodplains and mountainsides throughout the County. The Plan identifies rivers and washes as important components in the provision of a regional trail system. Many goals and policies within the Plan support the Drainage Regulations presently enforced by the District. One of the Plan's major points is the potential for recreational opportunities adjacent to flood plains or flood control structures. Currently, several local jurisdictions are actively pursuing a multiple-use concept associated with development of proposed flood control facilities. The following policies, identified in the Plan, support and/or complement several Districts activities:

1. Discourage new development within the 100-year floodplain.

2. Flood control improvements should be designed to minimize loss of valuable wildlife habitat and loss of native vegetation.

3. Manage the resources associated with the regionally significant rivers and washes to accomplish one or more of the following objectives:

   - Protect valuable limited and endangered natural riparian habitats;
   - Provide an ecologically sound transition between riparian habitat communities and urbanized areas;

- Promote the economic benefit to the region by providing the aesthetic, recreation and wildlife value of rivers and washes;
- Develop trails that link to an interconnected regional system from the Salt River to the primary arms of the system such as the Verde and Agua Fria rivers;
- Promote natural erosion control; and
- Promote continuity of xeroriparian or native plant habitats.

4. Manage locally important washes to enhance wildlife and appropriate recreation values.

5. Rehabilitate the open space system by revegetating the banks of the Salt River.

6. Provide access for recreation, non-motorized transportation and maintenance vehicles along the edge of the corridor as defined by the limits of the 100-year floodplain.

7. Where appropriate, develop other "linear" improvements such as roads and utility corridors to run parallel to, but not in, regionally significant rivers and washes.

8. Design all road crossings to accommodate trails and to minimize disturbance of the natural environment.

9. Choose and foster flood control methods that retain and maintain some level of natural flooding and riparian vegetation while minimizing damage to private property. These methods include designation of flood prone areas as open space, management of lands by acquisition of flood easements, development of levees that allow a wide floodway to maintain the natural meander of streams and encourage the formation of riparian plant communities.

Any cost incurred with implementation of the Open Space Plan would be identified and addressed on an individual project basis. District staff supports the concept of cooperating with interested parties and considering the Desert Spaces Regional Open Space Plan goals and policies when evaluating flood control projects or activities. This support is conditioned on the provision that primary flood control purposes are not compromised nor subject to increased costs.

CONCLUSIONS AND RECOMMENDATIONS

This portion of the Comprehensive Report/Plan identifies and describes conclusions and recommendations drawn from the preceding section concerning the existing Flood Control District programs.

Flood Warning and Data Collection Program:

Data collected by this effort serves to calibrate the District's models for rainfall and flooding. Since all engineering designs are based on the need to contain certain size floods, having accurate information about those floods is key to efficient engineering. This program insures that District structures are not under designed (which doesn't solve the flooding problem), but yet are not over designed, which would be a waste of tax payers' money.

- District staff will continue to research and collect rainfall/runoff data in order to sustain this vital link in the calibration and continued refinement of hydrologic models which are the basis for engineering designs.

Floodplain Administration Program:

The identification of floodplains and an administrative effort to minimize development in those areas is essential to a pro-active stance towards preventing flood damages to property, rather than trying to retrofit expensive, structural engineering measures, after the fact. A FEMA (Federal Emergency Management Agency) floodplain ensures that flooding problems are addressed during the development of the property.

- District staff will continue to develop, support, and enforce an aggressive floodplain management program which has resulted in a 20% discount of flood insurance premiums, the second highest discount in the country.

Drainage Administration Program:

Many flooding problems associated with older residences are a result of the homes being constructed at grade or level with the surrounding ground. This allows flooding from very shallow sheet flows which can inundate houses causing significant damage. The drainage regulations currently in place preclude that from occurring with new construction. The existing regulatory program prevents flooding problems by insuring that adequate safeguards are in place prior to construction. This method is significantly less expensive to address the problem rather than allowing unregulated construction and then rectifying the problem afterwards.

- District staff will continue to develop, support, and enforce pre-emptive regulatory programs which are a less expensive way to deal with potential flooding problems. This is borne out by the fact that the District rarely has to "fix" flooding problems resulting from new construction.

Maintenance Program:

Increased public awareness of environmental issues and recreational opportunities has led to the inclusion of multi-purpose objectives in the development of some flood control structures. Generally, this involves a different type of landscaping and maintenance program. In those cases where the recreational activities are active (e.g., planned uses), much of the maintenance component is taken over by the other agency cost sharing the project, for whom recreation is the primary objective. This trend could reduce the overall need for the District to perform 100% of the maintenance on all of its structures. This program may also decrease District maintenance by having the "active users" of the structure be responsible for the non-structural maintenance

- District staff will encourage and support the multiple-use of District structures/property provided that the primary flood control purposes are not compromised nor additional costs to the District incurred.

Planning Program:

As a result of reviewing land use and demographic projections for the next twenty years, the ADMS schedule has been changed to reflect anticipated high growth areas of the County. A primary purpose of the ADMS' is to "get out ahead" of development by characterizing flooding potential. This is desirable so that development can take appropriate steps to preclude flooding problems through improved design and construction.

- District staff will review current population projections for growth in the County and change the development schedule for Area Drainage Master Plans so that storm water planning is targeted towards and encompasses potential high growth areas.

Capital Improvement Program:

After the fourth round of Capital projects prioritization, there is a need to update and adjust the criteria and the weighting scheme, so that "local" projects are properly characterized and rank ordered accordingly. Previously, the District's CIP has focuses almost totally on solving regional drainage and flood control problems.

- District staff will review and appropriately revise the qualifying criteria for the Prioritization Procedures and will modify the existing standards to reflect differences between local projects and those regional in nature. A separate program within the CIP will be proposed to address local problems.

Environmental Program:

Increased federal and state requirements for environmental mitigation have put a premium on the need to incorporate those requirements early-on into the design of a project. Environmental permitting is often a time consuming process. Environmental permits, such as 401 and 404 permits, issued by the Corps of Engineers may require six to eight months for processing. District staff has increased their awareness of changing rules for permits. Staff strives to establish realistic project time lines to acquire required permits and/or clearances allowing construction to move forward without delay.

- District staff will comply with environmental regulatory programs to obtain required permits, including implementation of mitigation features, necessary to construct flood control projects, and will consider environmental enhancements where practicable without compromising the primary flood control purposes or increasing the costs.

Property Management Program:

Several cities have approached the District about the right to use District property for groundwater recharge. In response, the District has developed a policy for that use. Other entities have become interested in the potential for recharge on District lands. This interest has resulted in a new policy for land utilization which could provide a new potential source of revenue for the District.

- District staff will review and support requests from municipalities for the potential water recharge of District property.

While the following two programs, Public Involvement and Open Space, are not budgeted programs they are included because they embody important activities or objectives supported by the District.

Public Involvement Program:

The public demands to be increasingly involved in District projects. In the past, public involvement has been perceived as lost time on a project. Efforts to include the public in the planning process have, however, proven to be much more efficient and the District gains public credibility. District staff has developed an increased awareness of the need for public involvement. Time and materials are built in to every project so that public input can be accommodated. Multi-use of flood control projects increases the value and utility of projects from the public's perspective. In the long run, public involvement is more efficient, and the District gains credibility when the public becomes part of the planning process.

- District staff will increasingly involve the public in the planning and implementation of District projects.

Open Space Program:

The concept for preservation of open space is compatible with several District activities. The District encourages other agencies and communities to utilize and develop District property and facilities for recreational or multiple-use amenities. Through active participation during a projects planning and design phase, multiple-use objectives can be facilitated without adversely impacting flood control objectives.

- District staff will continue to consider and cooperate with interested parties to achieve the goals included in the Desert Spaces Regional Open Space Plan where practicable and without compromising the primary flood Control purposes or increased costs of planned facilities.

APPENDIX

Glossary of Terms

100-Year Flood A flood stage or height that, statistically, has one percent chance of being equaled or exceeded in any given year. The one hundred year flood is often referred to as the base flood.

Acre Foot A volume of water, sand or coal, etc. equal to an area of one acre with a depth of one foot (43,560 cubic feet.)

ADMP Area Drainage Master Plan

ADMS Area Drainage Master Study

ADOT Arizona Department of Transportation

Alluvial Fan A body of stream deposits whose surface approximates a segment of a cone that radiates down slope from a point where the stream leaves a mountainous area. Alluvial fans have greatly diverse sizes, slopes, types of deposits and source area characteristics.

ARS Arizona Revised Statutes

CAD Computer Aided Drafting

CIP Capital Improvement Program

CFS (Cubic feet per second) Used to describe the amount of flow passing a given point in a stream channel. One cubic foot per second is equivalent to approximately 7.5 gallons per second.

Channel Reach A segment of stream length that is arbitrarily bounded for purposes of study.

Crest of Dam The crown of an overflow section of a dam. In the United States, the term "crest of dam" is often used when top of dam is meant. To avoid confusion, the terms "crest of dam" and "top of dam" may be used to refer to the overflow section and the dam proper, respectively.

Culvert A drain or waterway built transversely under a road, railway, or embankment, consisting of a pipe or covered channel of box section.

Dam	An earthen, metal, masonry, or wooden wall or barrier across a flow of water, which is used to restrict or prevent the water from flowing.
Diversion Channel	A waterway used to divert water from its natural course.
Discharge	The volume rate of flow in a stream, river, or pipeline in cfs.
Design Discharge	Maximum flow a structure or channel is expected to accommodate without contradicting the adopted design constraints.
Design Frequency	The nth-year storm for which it is expected that the structure or facility designed for that storm would experience an actual hydrological event of a given magnitude, once, on average, in n years. For example, a 50-year storm has a 2 percent chance of occurring in any given year. Also called the return period, excedence interval, or recurrence interval.
Detention Basin	A relatively small reservoir constructed to slow down or temporarily detain surface runoff from a storm.
Drainage Area	An area that drains naturally to a particular point in a river or to an outlet.
Drop Structure	A constructed structure such as: a conduit, canal, or open channel for the purpose of gradient (bottom slopes) control.
EIS	Environmental Impact Statement
Embankment	A man-made earth fill structure constructed for the purpose of impounding water.
Emergency Spillway	An outflow spillway from a stormwater detention/retention facility that provides for the safe overflow of floodwaters for storm events in excess of the design capacity of the Primary Outlet Structure, or when a malfunction or debris blockage of the Primary Outlet Structure.
EPA	(Environmental Protection Agency) The federal agency concerned with the protection of our resources of land, water and air.
FCDMC	Flood Control District of Maricopa County
FEMA	(Federal Emergency Management Agency) The federal agency that administers the National Flood Insurance Program (NFIP) as well as programs for disaster planning and recovery.

FIRM	(Flood Insurance Rate Map) An official map on which on which the Federal Insurance Administration has delineated both special flood hazard areas and the risk premium zones applicable to a community
Floodplain	A flood-prone area identified on FEMA flood insurance rate maps generally containing a floodway fringe district and floodway district or areas of land adjoining or near the channel of a watercourse which have been, or may be, covered by floodwaters. A floodplain functions as a temporary channel or reservoir for overbank flows.
Floodplain Management	The operation of a program intended to lessen the damaging effects of floods, maintain and enhance natural values, and make effective use of related water and land resources within the floodplain. It is an attempt to balance values obtainable from use of floodplains with potential losses arising from each use.
Floodplain Variance	A grant of relief from the requirements of the Floodplain Regulation which permits construction or other uses of property in a manner that would otherwise be prohibited or restricted by this Regulation.
Flowage Easement	Not an easement by agreement, but the common law servitude of land of a lower grade level to allow water from land of higher level to flow across it.
Freeboard	The vertical distance above a design water surface elevation that is provided as a contingency or allowance for waves, surges, water-borne debris or other factors.
FRS	Flood Retarding Structure
FY	Fiscal Year
Gabion or Wire-enclosed Basket	A basket or compartment rectangular container made of steel wire mesh. When filled with cobbles or rock of suitable size, the gabion becomes a flexible and permeable block with which flow-control structures can be built.
GIS	Geographic Information System
Groundwater	Underground water that occupies the pore spaces in soil or fissures in rock.
Groundwater Recharge or	Refers to the movement of water via man-made systems from the surface of the earth to underground water-bearing strata where it may be stored for future use.

Artificial Recharge	Recharging reclaimed water, usually sewage and wastewater and recharging natural water in lakes and ponds are the two major categories of artificial recharge. Direct artificial recharge methods include spreading basins, playa lakes, recharge pits, and shafts, ditches, and recharge wells. Indirect methods include induced infiltration (enhanced streamed infiltration) and conjunctive wells. Some Cities in Maricopa County have proposed to use existing flood control structures maintained by the District for ground water recharge. Guidelines for utilizing the structures for groundwater recharge has been drafted.
IGA	Intergovernmental Agreement
Invert	The lowest point in the channel cross section or at flow control devices such as drop structures, dams, or outlet structures.
Jurisdiction or Jurisdictional Agency	Maricopa County, the Flood Control District of Maricopa County, and the Incorporated Municipalities within Maricopa County
Levee or **Dike**	A long low embankment. The height is usually less than 4 to 5 meters (13 ft. to 16 ft.) and the length more than 10 to 15 times the maximum height. Usually applied to embankment or structures built to protect land from flooding. Also used to describe embankments that block areas on reservoir rims that are lower than the top of the main dam and that are quite long.
Low Flow Channel	A channel within a larger channel which typically carries low and/or normal flows.
MAG	Maricopa Association of Governments
Master Planning	A "systems" approach to the planning of facilities, programs and management organizations for comprehensive control and use of stormwater within defined geographical area or drainage basin.
NRCS	Natural Resources Conservation Service, formerly Soil Conservation Service (SCS).
NFIP	National Flood Insurance Program

Non-point Source Pollution	A scattered, unconfined discharge of water from the land to a receiving body of water from the land to a receiving body of water. When this water contains materials that potentially can damage the receiving stream, the runoff is considered to be a source of pollutants. Runoff from city streets, parking lots, home lawns, agricultural land, individual septic systems, and construction sites that finds its way into lakes and streams and is a source of water pollutants.
NPDES	National Pollutant Discharge Elimination System
Outlet Structure	A hydraulic structure placed at the outlet of a conduit, open channel, spillway, etc., for the purpose of dissipating energy and providing a transition to the channel or conduit downstream. Outlet structures may consist of culverts, weirs, orifices (gated or un-gated), dry wells, or any combination thereof.
Peak Flow	The maximum instantaneous discharge that occurs during a flood. It is coincident with the peak of a flood hydrograph.
Point Source Pollution	A pipe or channel from which pollutants are discharged into a body or water.
Probable Maximum Flood	(PMF) The flood runoff that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.
Project Life	The design life of a flood control project based on the useful life expectancy of the materials used in construction of the project. For economic analysis purposes, the project life is normally assumed to be equal to the level of protection provided.
Positive Outfall	The point of discharge from a natural or man-made channel, conduit, or wash of sufficient hydraulic capacity to handle the discharge without creating a backwater or damages.
Regional Drain	A natural or man-made channel, conduit, river, or wash serving a watershed area greater than 10 square miles.
Retention Basin	A basin or reservoir wherein water is stored for regulating a flood, however, it does not have gravity flow outlets for outflows during floods as detention basins do. Stored water must be disposed by another means such as soil infiltration, evaporation, injection (or dry wells) or pumping system.

Right-of-way A strip of land which is used as a roadbed , either for a street or railway. The land is set aside as an easement or in fee, either by agreement or condemnation. May also be used to pass over the land of another.

Riprap A layer of large uncoursed stones, broken rock, or precast blocks placed in random fashion on the upstream slope of an embankment dam, on a reservoir shore or on the sides of a channel to hinder the flow of water, preventing erosion.

Runoff The portion of precipitation on land that ultimately reaches streams; especially water from rain or melted snow that flows over the ground surface.

Scour Erosion due to flowing water, usually considered as being localized as opposed to general bed degradation.

Sediment (Or Fluvial sediment) Fragmented material transported, suspended, or deposited by water.

Sediment Basin A depression, either excavated or formed by a dam, that holds water and debris and facilitates sedimentation of particles. Normally used for drainage areas equal to and greater than 5.0 acres.

Sheetflow Runoff that has not yet reached a well-defined stream channel or drainage ditch.

Soil Erosion The wearing away of the land surface due to water, wind, ice or other geological agents.

Spillway A structure through which flood flows are discharged. If the flow is controlled by gates, it is a controlled spillway; if the elevation of the spillway crest is the only control, it is an uncontrolled spillway.

Principal Spillway (Primary Spillway) The principal or first used spillway during flood flows.

Emergency Spillway (Auxiliary Spillway) A secondary spillway designed to operate only during exceptionally large floods.

Stilling Basin A basin constructed to dissipate the energy of fast-flowing water, e.g. from a spillway of bottom outlet, and to protect the channel or river bed from erosion.

Storm Sewer	A sewer carrying off rain water. May also carry off industrial waste, such as chemicals, although many areas now prohibit this.
Stormwater Management	The planned control of surface runoff in natural and urban systems to prevent flooding and pollution.
Unincorporated Area	An area of a county which has not formed a municipal corporation (become a town or city).
Watershed	An area confined by drainage divides, often having only one outlet for drainage to discharge.
Weir	A notch of regular form through which water flows. A weir may be a depression or notch in the side of an outlet structure or a depression or specific shape in the embankment of a stormwater storage facility. Classified in accordance with the shape of the notch which can be rectangular, V-notched, trapezoidal or parabolic.
Wetlands	A land area that is covered or saturated with water for a large portion of the year, such as a marsh or bog. Wetlands can improve water quality naturally through sedimentation, adsorption, filtration, chemical precipitation and uptake by vegetation. The two classes of wetlands are *natural wetlands* and *constructed wetlands*. Natural wetlands were created by non-human geophysical factors such as erosion, subsidence, limestone and earthquakes. It depends mainly upon the quantity and flow rate of water through the system and the systems's capability to retain water. *Constructed wetlands* are man-made systems designed to simulate natural wetlands. The simplest type of a constructed wetland consist of a forebay and wetland vegetation.

Contributions For Completed Projects

The following list outlines costs and contributions for projects constructed by the Flood Control District.

Flood Control Projects	District Contribution (1995 Dollars)	Federal Contribution (1995Dollars)	Total (1995 Dollars)
48 St. Drain (1981)	$123,994	$3,185,395 *(1)	$3,309,389
Adobe Dam (1982)	$22,458,279	$12,549,340	$35,007,619
Agua Fria Drain (1974)	$340,262	$0	$340,262
Agua Fria River (1989)	$42,471,289	$4,086,033	$46,557,321
Apache Junction FRS & Floodway, Bulldog Floodway & Pass Mountain Diversion (1985 to 1988)	$12,796,367	$10,448,172	$23,244,538
Arizona Canal Diversion Channel (1985 to 1992)	$144,228,982	$108,614,847	$252,843,829
Buckeye FRS #1 (1974), FRS 2 & 3 (1975)	$256,639	$8,861,241	$9,117,880
Cave Buttes Dam (1980)	$5,267,339	$14,248,730	$19,516,069
Centennial Levee (1985)	$792,023	$3,570,833	$4,362,857
Dreamy Draw Dam (1974)	$71,128	$1,784,936	$1,856,064
East Fork of Cave Creek (1996)	$5,401,000	$0	$5,401,000
East Maricopa Floodway (Formerly RWCD Floodway) (1981 to 1989)	$12,031,257	$6,768,723	$18,799,980
Guadalupe Dam (1975)	$373,904	$1,161,122	$1,535,026
Harquahala FRS & Floodway (1981)	$790,101	$11,666,965	$12,457,066
Indian Bend Wash Outlet (1977) Inlet (1980) Greenbelt (Scottsdale responsibility) Interceptor & Side Channel	$21,812,360	$5,567,232	$27,379,592
McMicken Dam (1966)	$13,277,925	$7,706,848	$20,984,773
McMicken Dam Outlet Channel (1966 & 1984)	$45,000	$0	$45,000
New River Dam (1985)	$8,210,513	$11,949,556	$20,160,069
Old Cross Cut Canal (12/75)	$3,845,735	$0 *(2)	$3,845,735
Powerline Dam (1967)	$2,884	$1,409,109	$1,411,993
Powerline Floodway (1968)	$229,725	$3,142,141	$3,371,866
Rittenhouse FRS (1969)	$105,731	$1,360,089	$1,465,820
Saddleback Diversion (1982)	$764,149	$0 *(2)	$764,149
Saddleback FRS (1982)	$668,991	$2,328,971	$2,997,962
Salt Gila Clearing (1985)	$828,549	$0	$828,549
Salt Gila Control Works (1984 & 1985)	$3,168,093	$0	$3,168,093
Signal Butte FRS & Floodway (1984 to 1987)	$2,328,971	$9,611,933	$11,940,905
Skunk Creek at I-17 (1983)	$0	$4,386,886	$4,386,886
Sossaman Channel & Basin (1994)	$937,000	$0	$937,000
Sossaman Drain (1981)	$3,156,559	$0	$3,156,559
Spookhill FRS & Outlet (1980)	$2,812,452	$8,488,298	$11,300,750
Sunnycove FRS & Sunset FRS (1976)	$45,000	$1,710,924	$1,755,924
Vineyard Rd. FRS (1968)	$99,000	$1,793,587	$1,892,587
White Tanks #3 & 4 (1954)	$4,537,794	$953,504	$5,491,298
Wickenburg Watershed	$187,433	$0	$187,433
TOTAL	$314,466,428	$247,355,415	$561,821,842

*(1) Other, local contributors.
*(2) City of Phoenix, major contributor.
*(3) Expenditures grouped with other projects.

Enclosures:
Map 1 "County Structures Map"
Map 2 "Five Year Capital Improvement Map"

Rear Pocket