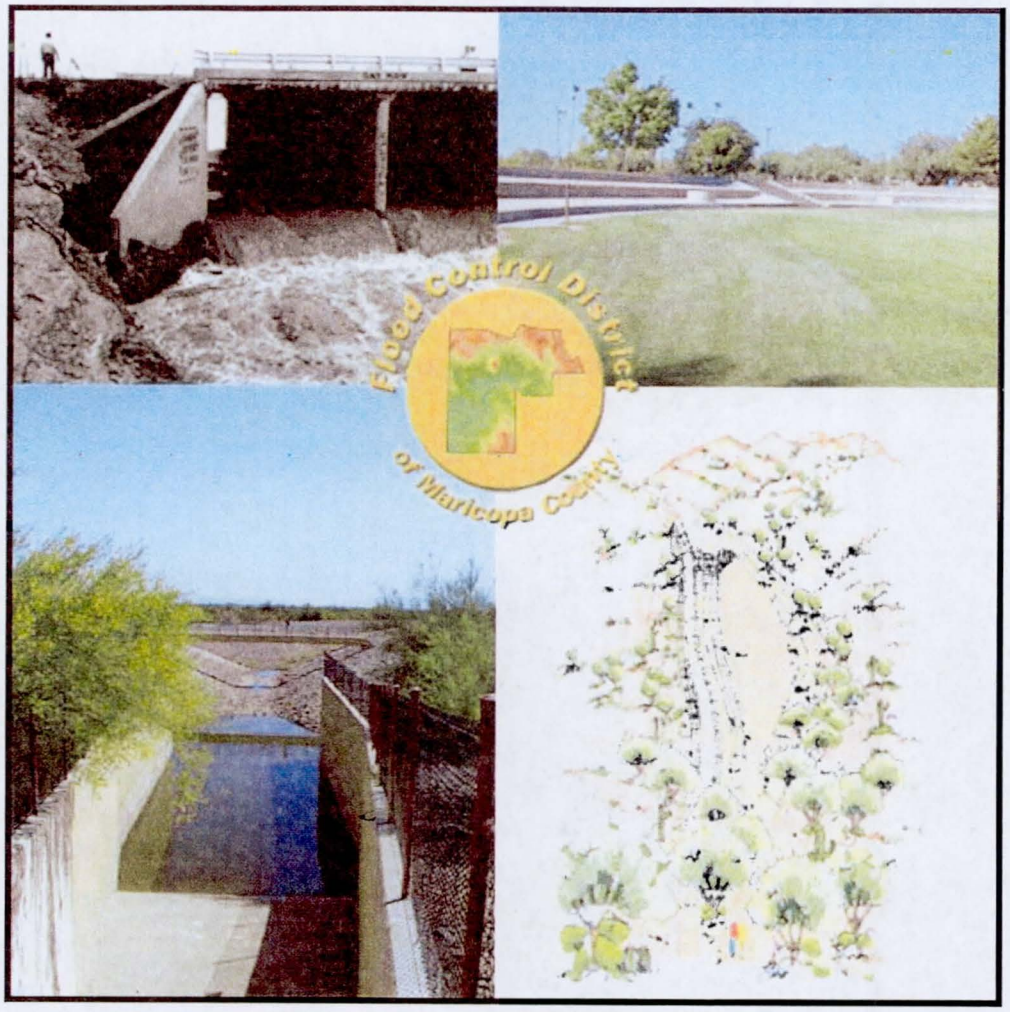
TRL Comments
3/21/02

Flood Control District
of
Maricopa County



Comprehensive Plan 2001

Flood Control Program Report

for
Maricopa County, Arizona

Flood Control District
of
Maricopa County

Comprehensive Plan
2001

Flood Control Program Report

for
Maricopa County, Arizona

Flood Control District
of
Maricopa County

Comprehensive Plan 2001

Flood Control Program Report

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CHAPTER 1. INTRODUCTION

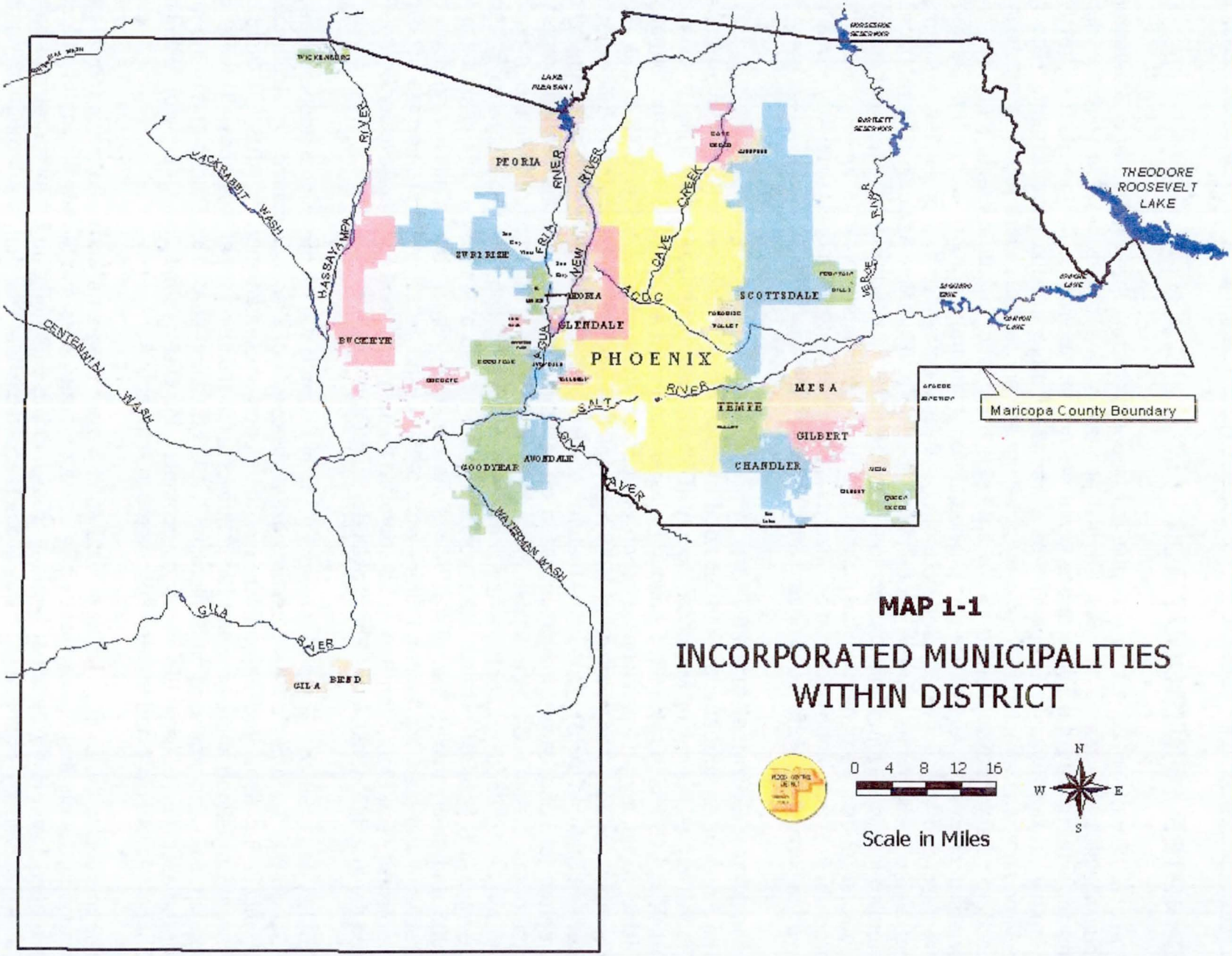
Maricopa County in 2001 had a population of approximately three million and 24 incorporated municipalities (see Map 1-1). But, the first permanent dwellers in the area were the Hohokam Indians who utilized the rivers and a canal system for survival. The formation of the Arizona Territory in 1863 was the beginning of a period of more intense development. The natural environment was affected by this early development and settlers were prone to the hazards of flooding. Farmers who wanted to prevent fields from flooding had to create their own dams or diversion channels. Assistance was provided through federal programs. Some of these structures are described later in this chapter. Without floodplains defined and other studies, residents were not aware their homes were in danger from flooding and erosion hazards. The problems were handled individually and solutions could jeopardize other's remedies if they were not coordinated. Regional efforts were needed for planning and/or coordinating projects to keep residents and property safe from flood and erosion hazards. Development has and will continue, prompting the need to continue regional flood hazard and floodplain management.

Need for a Comprehensive Plan

The State of Arizona saw a need for flood management in response to the above issues. The Flood Control District of Maricopa County (District) was organized under Title 5, Chapter 10, Article 4, §45-2351 to §45-2371 Arizona Revised Statutes in August of 1959. Upon formation of a District, a survey and subsequent report of flood control problems of the District was required. The above statute was repealed in 1985 and replaced by Title 48, Chapter 21, Article 1, Arizona Revised Statutes (ARS). One of the features of ARS §48-3616 is preparation of a comprehensive program for flood hazard mitigation based on recommendations from the required report. The goal of the District's Comprehensive Plans is to continually update this original report describing the remaining flooding problems and the status of existing flood control programs in Maricopa County. ARS §48-3616 states "the report shall be prepared at least every five years beginning in 1985 and shall indicate the past efforts of the district in eliminating or minimizing flood control problems and state the planned future work of the district to eliminate or minimize flood control problems." The Plan (report) must be approved by both the Flood Control Advisory Board (FCAB) and the Flood Control District Board of Directors (BOD).

On July 11, 1988, the Board of Directors (County Supervisors) for the District adopted Resolution FCD 88-08, *General Policies Concerning the Allocation of Fiscal Resources to Accomplish the District's Functions and Responsibilities*, to support implementation of ARS §48-3616. This Resolution defined and delineated District policies for allocating fiscal resources. This Resolution was updated and amended on September 7, 1993 (FCD 88-08A). This Plan is part of the process for the allocation of fiscal resources to accomplish the District's mission. A copy of ARS Title 48, Chapter 21, Article 1 and the Resolutions are in Appendix A.

The mission of the District's is to provide flood hazard programs within the geographical limits of Maricopa County that prevent loss of life or injury to residents and the elimination or reduction of damages to real and personal property from flooding while enjoying the natural and beneficial values served by floodplains. The District accomplishes this purpose through a number of activities under these programs such as the installation of dams and channels, the implementation of regulatory tools, and multi-use opportunities as part of floodplain management.



MAP 1-1

INCORPORATED MUNICIPALITIES WITHIN DISTRICT

0 4 8 12 16

Scale in Miles

N W E S

The need and demand for these programs has continually been far greater than the District could supply in any given year beginning in the 1960's as population growth accelerated. Due to the enormity of the problem, rate of development, and limited resources the District was forced to stretch program implementation over a number of years and determine which programs and projects were the most critical for implementation at a given point in time. The Plan presented herein gives the overview and guidance needed to prioritize and schedule these projects and programs.

Previous Comprehensive Plans

Comprehensive Flood Control Program Reports have played a major role in the District's operations since 1963 when the first survey of flood control problems and report was published. The report served as a blueprint for District activities for the next 25 years. There were additional draft reports prepared over the years. Only the 1963 and 1991 Comprehensive Flood Control Program Reports received approval from the FCAB and the Flood Control District BOD.

The Comprehensive Flood Control Program, Status Report Interim Update, 1963-1989, was completed in 1989. This report gave an update on the status of all the projects recommended for installation in the 1963 Comprehensive Plan. It also reprioritized all of the 1963 projects that had not yet been built. Also in 1989, a Draft Comprehensive Flood Control Program Report was being developed. This draft added more detail to each of the projects described in the Status Report. It also reported on projects by other agencies and explained the Area Drainage Master Study Program. This draft culminated in the publication of the 1991 Comprehensive Flood Control Program Report.

The 1991 Comprehensive Flood Control Program Report took the data from the 1989 Draft and updated it to 1991 figures. This report also included more comprehensive tables and maps than the 1989 Draft. A Draft Comprehensive Flood Control Report/Plan was developed in 1997. This report updated projects completed since 1991. It also took a more comprehensive look at non-structural program activities such as floodplain and drainage administration.

Comprehensive Flood Control Program

Report of 1963

The 1963 Report was the culmination of several general area studies that identified flooding problems in Maricopa County. The basic purpose of this report was to summarize all pertinent information on Maricopa County flood control problems and to make recommendations for their solutions. The report divided Maricopa County into 35 watersheds that generally conformed to major drainage areas. Flooding problems were defined and potential structural solutions were proposed for each as needed. Table 1-1 shows projects with costs and benefits as they were evaluated in 1963. All of these projects included structural elements such as dams, channels or levees, alone or in combinations. This report was the guiding force behind most of the Flood Control District Programs for a 25-year period.

The present status of these projects is noted in Chapter 4, Table 4-1 along with additional projects added since. Completed projects are described in the watershed write-ups in Appendix B.

Table 1-1 Projects by Group from the 1963 Program Report
Group No. I

Group No. I - Projects Recommended for Immediate Construction

Drainage Area	Location	Job Description	COSTS FCD	Other	Total	Annual Benefits	Annual Costs	Benefit-Cost Ratio	Remarks
1	Gillespie Dam to 107th Ave.	Channel Clearing	250,000	1,000,000	1,250,000	141,600	80,800	1.75 to 1.00	Approved by U.S. Army Corp of Engineers
27	Lower Indian Bend	Floodway Channel	1,770,000	7,250,000	9,020,000	530,000	348,000	1.52 to 1.00	Approved by U.S. Army Corp of Engineers
19-23	Agua Fria, New River, and Skunk Cr.	Channel Clearing	250,000	1,000,000	1,250,000				Deer Valley Group
22	Arizona Canal-Cave Cr. To Skunk Cr.	Divert flood water North of Canal	944,000	7,060,000	8,004,000				Deer Valley Group
25	Dreamy Draw	Earth Dam	150,000	300,000	450,000				Deer Valley Group
22	North Mt.-Arizona Canal, 20th St. to 23rd Avenue	Construct Channel	1,400,000	1,926,000	3,326,000				Deer Valley Group
22	New River NW of Glendale	Earth Dam	2,770,000	2,002,000	4,772,000				Deer Valley Group
22	NW of Adobe	Earth Dam	832,000	2,301,000	3,133,000				Deer Valley Group
22	Lower Cave Cr. Dam Site	Earth Dam	871,000	5,824,000	6,695,000				Deer Valley Group
22	Union Hills Diversion	Lined Channel	500,000	1,500,000	2,000,000				Deer Valley Group
22	64th St. to New River	**Total Deer Valley**	7,717,000	21,913,000	29,630,000	2,232,000	1,296,000	1.72 to 1.00	
22	Maryvale-Glendale Drain	Line Channel	320,000	1,462,000	1,782,000	99,000	68,000	1.46 to 1.00	Moved to Group 1 (1963 Flood)
22	Glendale-Peoria Drain	Lined Channel	426,000	2,552,000	2,978,000	166,000	113,000	1.46 to 1.00	Moved to Group 1
7	Casandro Wash	Earth Dam	60,000	0	60,000	4,500	2,500	1.80 to 1.00	FCD Project
7	Sunset & Sunny Cove Washes	Earth Dams	79,000	0	79,000	6,200	3,500	1.77 to 1.00	FCD Project
32	Buckborn-Mesa	Levees & Channels	3,574,000	3,855,000	7,429,000	500,000	281,000	1.78 to 1.00	Under SCS Study
12	Bender & Sand Tanks Washes, Gila Bend	Levees	152,000	114,000	266,000	12,500	10,700	1.16 to 1.00	Under Study by Corps of Engineers
	TOTAL - GROUP I		14,348,000	38,146,000	52,494,000	3,691,800	2,203,500	1.68 to 1.00	

Table 1-1 Projects by Group from the 1963 Program Report (con't)
Group No. II, III, & IV

Recommended Projects Group II - Subject to Availability of Funds

32	Apache Junction-Gilbert	Levees & Channels	1,209,000	3,803,000	5,012,000	276,700	198,000	1.40 to 1.00	Under SCS Study
32	Mesa-Chandler-Gilbert	Channel	3,000,000	0	3,000,000	259,500	122,400	2.11 to 1.00	Urban Storm Drain
32	Williams-Chandler	Levees & Channels	837,000	3,738,000	4,575,000	326,000	189,000	1.73 to 1.00	Under SCS Study
9	Buckeye-Palo Verde	Levees & Channels	776,000	2,986,000	3,762,000	175,000	128,000	1.40 to 1.00	Under SCS Study
22	W. Phoenix-Maryvale	Channel	337,000	2,205,000	2,542,000	141,000	97,000	1.46 to 1.00	Moved (1963 Rain)
22	North Phx. Mt.-Old Cross-Cut Canal	Channel	966,000	2,360,000	3,326,000	232,000	136,000	1.72 to 1.00	Held Back (Group II)
	TOTAL - GROUP II		7,125,000	15,092,000	22,217,000	1,410,200	870,400	1.62 to 1.00	

Recommended Projects Group III - Subject to Availability of Funds

7	Sols Wash	Channel Alignment & Protection	40,000	0	40,000	2,500	2,000	1.25 to 1.00	FCD Project
7	Powder House Wash	Earth Dam	50,000	82,000	132,000	10,000	5,600	1.79 to 1.00	Studied by Corp of Engineers
7	Cave Creek Town	Earth Levee	3,000	12,000	15,000	1,000	840	1.19 to 1.00	Studied by Corp of Engineers
31	Maxwell Dam (Flood Control)	Earth Dam	650,000	5,050,000	5,700,000	369,000	276,000	1.34 to 1.00	Cost of Flood Control
24	Cave Creek Dam (Old)	Levee	65,000	91,000	156,000	10,200	8,200	1.24 to 1.00	Studied by the Corp of Engineers
33	Queen Creek	Channel	920,000	880,000	1,800,000	90,000	72,000	1.25 to 1.00	FCD Project-Aid expected from U.S. Bureau of Indian Affairs
	TOTAL - GROUP III		4,407,000	36,376,000	40,783,000	2,282,700	1,664,640	1.37 to 1.00	

Group IV - Projects Deferred as not Feasible at this time

7	Flying "E" Wash Wickenburg	Earth Dam	0	183,000	183,000	4,500	7,200	0.62 to 1.00	Financing a question
26	Guadalupe Watershed	Levees & Channels	519,000	660,000	1,179,000	45,450	60,600	0.75 to 1.00	To be referred to SCS
26	South Mountain, 40th St. to 75th Ave.	Levees & Channels	2,652,000	6,251,000	8,903,000	253,000	351,000	0.72 to 1.00	To be studies by Corp of Engineers
28	Indian Bend Wash Above Arizona Canal	Channels	1,217,000	1,701,000	2,918,000	76,000	124,400	0.61 to 1.00	To be studied by Corp of Engineers
33	Santan Watershed	Levees & Channels	895,000	2,678,000	3,573,000	100,000	145,000	0.70 to 1.00	To be studied by SCS
4	Harquahala Valley	Levees & Channels	400,000	3,770,000	4,170,000	70,000	171,000	0.41 to 1.00	To be studied by SCS
6	Box Canyon	Earth Dam	652,000	6,948,000	7,600,000	290,000	325,000	0.90 to 1.00	To be studied by Corp of Enigineers
7	Sols Wash (Matthie Dam)	Earth Dam	500,000	556,000	1,056,000	11,000	43,000	0.26 to 1.00	Studies for recreation
8	Upper New River	Earth Dam & Channel	50,000	450,000	500,000				Studied for recreation

How about a wider right margin? Equal to left margin

Comprehensive Flood Control Program

Report of 1991

The 1991 Comprehensive Report summarized what had been accomplished and what was still needed based on more current information. Approximately 15 of the 40 projects identified in 1963 were in construction or had been completed at the time of the 1991 Report. Five of these 40 projects were incorporated into other projects or eliminated. This report also looked at projects that were being installed in cooperation with the Arizona Department of Transportation (ADOT), various municipalities, and the Soil Conservation Service, an agency in the United States Department of Agriculture. By 1991, the District was operating and maintaining 29 flood control facilities. The 1991 Report documented the District's non-structural flood control programs such as Floodplain Management, Drainage Administration and Flood Warning. This report pointed out the need for additional planning in many areas of the County and explained the Area Drainage Master Study Program.

Past Floods

Flooding in the desert? Isn't the problem not enough water? Not always, in fact some portion of Maricopa County generally experiences a flooding situation at least once, and on many occasions, more often during a calendar year. What are the conditions that cause flooding in the desert? Major clues are found in the following quote from Jim Patton's work.[1] "The first settlers to Maricopa County found a natural system of washes, streams and rivers that adequately carried off natural drainage water. As population growth continued the increased growth of agriculture and urban development disrupted this system. Streets, roads, farms and subdivisions in many cases were developed with little regard to the natural drainage system. As urban development takes place buildings, homes and pavements do not absorb water as did the natural ground and vegetation they replaced."

Floods that create major damage in a desert setting are a function of four factors: a large population base, location in a major drainage basin, the chance for large storms with greater than normal precipitation, and inadequate drainage conveyance. The remainder of this section will discuss how these factors come into play in Maricopa County. Population growth and projections will be looked at in detail in Chapter 2 of this report.

The Phoenix Metropolitan Area is located within the valleys of four major rivers (Map 1-1). The Salt River flows through the southern third of the Metropolitan Area moving in an east to west direction. The Verde River is located to the east of the Metropolitan Area and flows to the Salt River just north of the City of Mesa. The Agua Fria River is to the west and flows to the Gila River which runs through the southern end of the City of Avondale. The Gila River, running in a southwesterly direction, bisects the north and south portions of the Metropolitan Area. The Gila River is the final depository for all the water originating in and passing through Maricopa County.

A fifth river that affects Maricopa County is located outside the present Phoenix Metropolitan Area. The Hassayampa River passes the towns of Wickenburg and Buckeye before entering the Gila River north of Gillespie Dam. In addition, the New River and a series of major washes contribute to the potential flooding and erosion hazards in the County.

Flooding in Maricopa County normally occurs from one of two types of storm conditions. The condition that generally offers the potential to cause the most damage is the tropical storm. These storms, originating in the Pacific Ocean, are normally the cause of winter flooding and cover a large area. The excess rain produced by these storms, coupled with the potential for saturated soil, rising freezing levels and melting snow, can cause stream levels and canals to exceed bank capacities. These storms are generally more regional in nature and can affect one or more of the large river systems during the same period of time.

The other type of storm, with potential to cause flooding, is the thunderstorm. These storms generally originate during the higher humidity portions of summer (monsoon season). They are normally much more localized, covering a smaller area than the tropical storms, and usually are of shorter duration. The flooding that results is also more localized and of a shorter duration. However, the damages resulting from a flood of this nature can be just as devastating to the area where they occur. Table 1-2 lists some of the more significant flooding events that Maricopa County has experienced in recent years.[2]

A couple of conclusions can be drawn from the information in Table 1-2. First, it appears the dollar value of damages has increased, sometimes very significantly, the more recent the flood has taken place. Some of this increase could be attributed to larger flood flows or to inflation of the dollar. However, a percentage of increase is due to the ever-growing number of people who are living in Maricopa County. The increasing population growth creates the likelihood of improved property being located in the floodplain and therefore susceptible to flood damage. In addition, these people have increased the amount and value of the possessions they have contributing to the higher dollar amount of damage found in the more recent floods.

A second conclusion is that the most damaging floods are normally in the November through March time frame. These winter storms are more regional in nature, usually affect a larger area of Maricopa County and take longer to move out of the area than thunderstorms. All of these factors combined tend to make for greater flood damage.

Major Flood Control Structures

The frequency and extent of flooding in Maricopa County has, over time, brought about the installation of a number of flood control structures. Some of these structures are primarily for flood control. Others were built for different purposes but have indirectly contributed to some measure of flood control. Map 1-2 shows these major structures and their locations within Maricopa County.

Salt River Project Dams

The Salt River Project provides power and water supply, both domestic and irrigation, to a major portion of Maricopa County. Power and water supply comes from a total of six dams and reservoirs. Four of which are located on the Salt River and two on the Verde River. Theodore Roosevelt Dam and Reservoir is approximately 80 miles east of the Phoenix Metro Area on the Salt River. This dam was completed in 1911 and held 1,382,000 acre-feet of water to be used for power generation and water supply.[3] Only the dam itself is within Maricopa County boundaries. Roosevelt Dam was modified beginning in 1989 with completion in 1996. This modification increased the total water holding capacity of the reservoir to approximately 2,209,000 acre-feet with 557,000 acre-feet of this total being dedicated to floodwater storage.[4]

Table 1-2 Major Floods and Past Flooding Damage 1891 to Present

Date	Remarks
Feb 18 - 26, 1891	First record of major flood in Phoenix area. Salt River estimated to have a peak flow of 300,000 cubic feet per second.
Aug. 21, 1921	Approximately 4,000 acres flooded including the state capital. Damages estimated at $240,000.
Aug., 1963	Damages for Phoenix (Maryvale) and Glendale equal $2,900,000.
Dec. 22 - Jan. 2, 1966	First large flow through Phoenix since reservoirs were built on the Verde River (1939). Damages equal $10,000,000.
Sept. 5 - 7, 1970	Eight lives lost. Damages equal $5,800,000.
June, 1972	Damages for Phoenix Metro area equals $10,588,000.
March, 1978	Salt River has a peak flow of 122,000 cubic feet per second. Damages estimated at $33,138,000.
Dec., 1978	Salt River has a peak flow of 140,000 cubic feet per second. Damages estimated at $51,800,000.
Feb., 1980	Salt River has a peak flow of 170,000 cubic feet per second. Damages estimated at $63,700,000.
Sept. 27 - Oct. 3, 1983	Flooding is attributed to Tropical storm Octave off the coast of Baja California. Although Maricopa County was not one of the eight counties in Arizona to be declared a major disaster. Damage was done to residences, agricultural areas and roads.
Jan. 7 - 8, 1993	Salt River has a peak flow of 124,000 cubic feet per second. Two lives were lost and over 200 families throughout the County were evacuated from their homes because of flooding.
Sept. 25 - 26, 1997	Flooding from Hurricane Nora results in the breaching of Narrows Dam. The calculated 24-hour, 100-year rainfall amount in NW Maricopa County was exceeded at six ALERT measuring sites.
Oct. 21, 2000	Rain described as heavy and destructive fell in western Maricopa County. Centennial Wash was hit especially hard.

1983 Source: Expedited Reconnaissance Study: Section 905b (WRDA 86) Analysis: Tres Rios, Arizona.1997 and Floods of October 1983 in Southeastern Arizona, United States Departments of the Interior, Geological Survey Water-Resources Investigations Report 85-4225-C

1993 Source: Maricopa County Emergency Management Reports 1990-1995

1997 Source: FCDMC Annual Hydrologic Data Report Volume II Surface Water Data: Water Year 1997

2001 Source: Storm report: Summer/Autumn Storms of 2000. FCDMC. Waters, Preferment & Gardner.2/1/01

Horse Mesa Dam and Apache Lake Reservoir are located approximately 15 miles below Theodore Roosevelt Dam on the main stem of the Salt River. The dam is about 65 miles east of the Phoenix Metro Area. Apache Lake holds about 245,000 acre-feet of water when filled to its maximum capacity.

Mormon Flat Dam and Canyon Lake Reservoir are third in line as one moves downstream on the Salt River. Mormon Flat Dam is about 51 miles east of the Phoenix Metro Area. Canyon Lake holds approximately 58,000 acre-feet at capacity. The fourth and final dam storing water on the Salt River is Stewart Mountain Dam. This dam is approximately 41 miles east of the Phoenix Metro Area and creates Saguaro Lake Reservoir. This reservoir has a capacity of about 70,000 acre-feet. Granite Reef Dam is located below the confluence of the Salt and Verde Rivers. It does not store water, but diverts the flow into the two main irrigation canals serving the Valley of the Sun. It has no potential flood water storage capacity.

Horseshoe Dam and Reservoir is located on the Verde River about 58 miles north of the Phoenix Metro Area. The dam and about 40 percent of the reservoir are located in Maricopa County with the remainder in Yavapai County. The reservoir has a capacity of nearly 143,000 acre-feet.

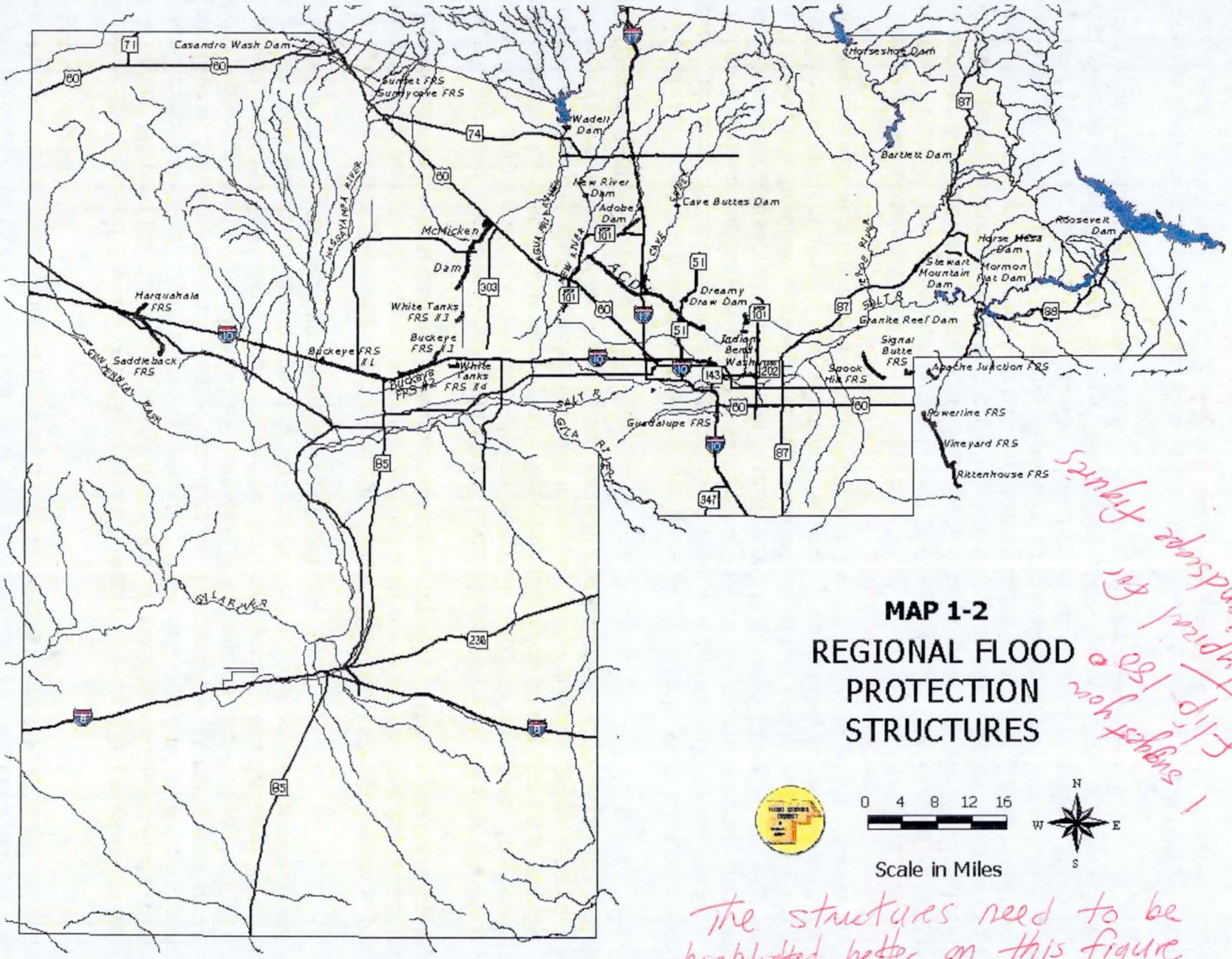
Bartlett Dam and Reservoir are on the Verde River about 46 miles north of the Phoenix Metro Area. The dam creates a reservoir of approximately 180,000 acre-feet. The four dams and reservoirs on the Salt River were originally designed to provide power and water supply. The two dams and reservoirs on the Verde River are to provide water supply. All six reservoirs are used for boating, fishing and other water based recreational activities. Only Modified Roosevelt Dam has flood storage as an identified purpose. OK

However, all six of the reservoirs can be and have been used to store excess runoff over the years. How much can be stored at any given time is a function of several factors, such as: amount of excess capacity in the reservoir at the time of the storm, warning time before peak runoff reaches the reservoir, allowing some draw down in advance of high flows and the timing of peak flows from the various river systems. An example of this timing would be if the Verde and Salt River systems peaked at the same time leaving no opportunity to store one of the system's flows ~~thereby~~ reduc~~ing~~e the impact of high flows from the other system on the Phoenix Metro Area. The effect of coincident peaks is that available storage in one system cannot be used to

Bureau of Reclamation Dams

The New Waddell Dam[5] was built by the United States Bureau of Reclamation (USBR) in 1992 to replace the smaller Waddell Dam on the Agua Fria River. The purposes of the New Waddell Dam and Lake Pleasant Reservoir are water supply, regulatory storage of the Central Arizona Project (CAP) water, and recreation. The reservoir has a maximum capacity of 1,101,000 acre-feet with 811,800 acre-feet dedicated to water supply. There is no dedicated flood control storage within the reservoir. However, just as with the Salt River Project dams and reservoirs, there is incidental flood storage available. How much is dependent upon the operation of the CAP system, the runoff from the basin upstream of the dam, and the operation of the dam itself.

Coolidge Dam, located on the Gila River about 100 miles southeast of the Phoenix Metropolitan Area, was built by the ~~U.S. Bureau of Reclamation~~ USBR in 1928 (See Map 1-3).



MAP 1-2

REGIONAL FLOOD PROTECTION STRUCTURES

0 4 8 12 16

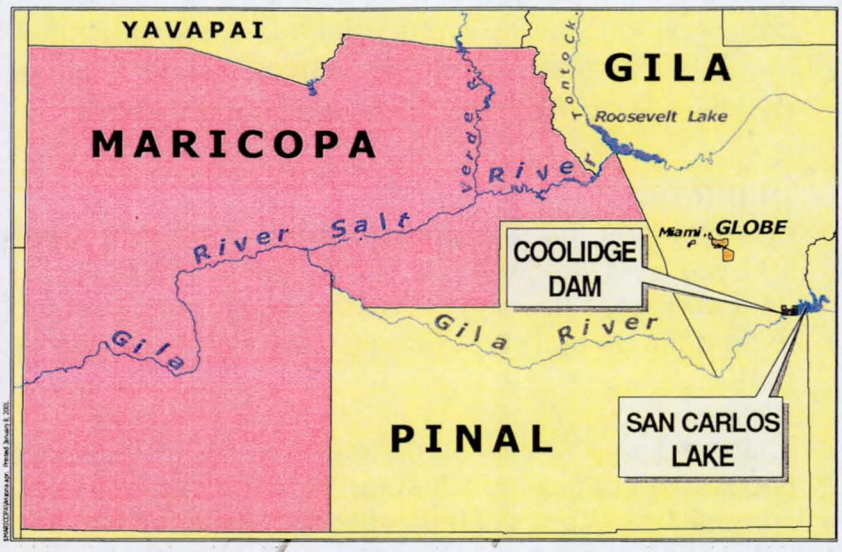
Scale in Miles

N W E S

Suggest you flip 180° to upright for landscape figures

The structures need to be highlighted better on this figure.

The reservoir (San Carlos Reservoir) originally had a storage capacity of 1,206,000 acre-feet[6] to be used for irrigation and power production. This storage capacity has been reduced over the years due to sediment buildup and now has a capacity of approximately 850,000 acre-feet.[7] The San Carlos Reservoir has had excess capacity for the majority of its useful life and has been available to store flood flows from the Gila River. This storage has benefited Maricopa County in the past by essentially eliminating floodwater contributions from the Upper Gila River that would otherwise reach a portion of the Phoenix Metro Area. Coolidge Dam originally had flood control gates on the emergency spillway, soon after construction they became inoperable. Reclamation prepared designs for new gates which have not been installed. Gate installations at the Coolidge Dam with proper operation could have a potential to gain significant added flood protection on the Salt and Gila Rivers, even past the Tres Rios to El Rio.



Map 1-3 Coolidge Dam in relation to Maricopa County

US Army Corps of Engineers Dams

There are 22 dams and floodwater retarding structures owned and operated by the Flood Control District of Maricopa County dedicated to flood control. The U.S. Army Corps of Engineers has constructed McMicken, New River, Adobe, Cave Butte and Dreamy Draw dams as well as the Arizona Canal Drainage Channel and the Indian Bend Wash flood conveyance channel.

Soil Conservation Service Floodwater Retarding Structures

The Soil Conservation Service (now Natural Resources Conservation Service - NRCS) an agency in the United States Deparetment of agriculture has constructed 16 flood control dams known as floodwater retarding structures (FRS). In addition, the Soil Conservation Service has built a number of floodways or flood conveyance systems that work in conjunction with the floodwater retarding structures.

Flood Control District of Maricopa County

Dams

The Flood Control District of Maricopa County has installed the Casandro Wash Dam, a small flood control dam located in the Wickenburg area.

Ownership and Responsibilities for Dams and FRS's

The District owns, operates, and maintains all of the Corps of Engineers and Soil Conservation Service installed structures. A portion of the Powerline Floodway and four FRSs are located in Pinal County, but protect portions of Maricopa County. The District is also responsible for the

safety of the Dams and FRSs as currently performed under elements of the District's Dam Safety Program. Collectively these structures provide a large measure of floodwater protection to the people and property of Maricopa County. Individually, each of these structures provides important protection to localized areas. Each of these structures benefit one or more watershed areas and are listed in their respective watersheds in Chapter 4, Flood Control Program Report (see Appendix B – Watershed Write-ups for more detail).

Summary

Flooding, and the problems it causes, has been a part of Maricopa County history for well over 100 years. The ~~Flood Control District of Maricopa County~~ District was organized over 40 years ago to deal with these flooding problems. Much progress has been made. However, much work remains to be done as Maricopa County continues to be one of the fastest growing counties in the United States.

The remainder of this Comprehensive Plan will explore the characteristics that cause and affect flooding in the County (Chapter 2). This Plan will also explain the programs the ~~Flood Control~~ District currently uses to mitigate ~~the~~ flooding (Chapter 3). It will describe by region and watershed areas where flooding continues to be a concern, where significant problems still remain, and what will be done about them over the next five years (Chapter 4 & 5). Finally, the Plan will look at what is on the horizon in terms of additional programs, needed policy changes, funding sources, and partnering (Chapter 6).

DRAFT

FCDMC has not been defined previously. 'District' not appropriate here, so spell out.

Endnotes

[1] Jim Patton, Sun Valley, Nov 2, 1966. "County Flood Control Plan Based on Historic Deluge of '91.

[2] Information from this Table has been Taken from the following: various Corp of Engineer, Los Angeles Branch, flood damage reports made for the Phoenix Metro Area after Damaging floods; the United States department of the Interior Expedited Reconnaissance Study, 1983; the Maricopa County Emergency Management Reports, 1993; FCDMC Annual Hydrologic Data Report Volume II Surface Water Data, 1997; FCDMC, Storm Report, 2001.

[3] This information on the original Theodore Roosevelt Dam and the other five Salt River Project Dams and Reservoirs comes from a Bureau of Reclamation Publication entitled "Salt River Project, 1962".

[4] Information for this paragraph was taken from Section 7 Study for Modified Roosevelt Dam, Arizona, U.S. Army Corps of Engineers, Los Angeles District, March 1996.

[5] Information for New Waddell Dam is taken from the Agua Fria River Study New Waddell Dam to Gila River Confluence, Arizona, U.S. Army Corps of Engineers, Los Angeles District, July,1995

[6] U.S. Geological Survey Water- Supply Paper 1850-C, Floods of November 1965 to January 1966 in the Gila River Basin, Arizona and New Mexico, and Adjacent Basins in Arizona, pp.75.

[7] This figure from a telephone conversation with San Carlos Project Office, Bureau of Indian Affairs, U.S. Department of Interior.

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CHAPTER 2. CHARACTERISTICS

Overview

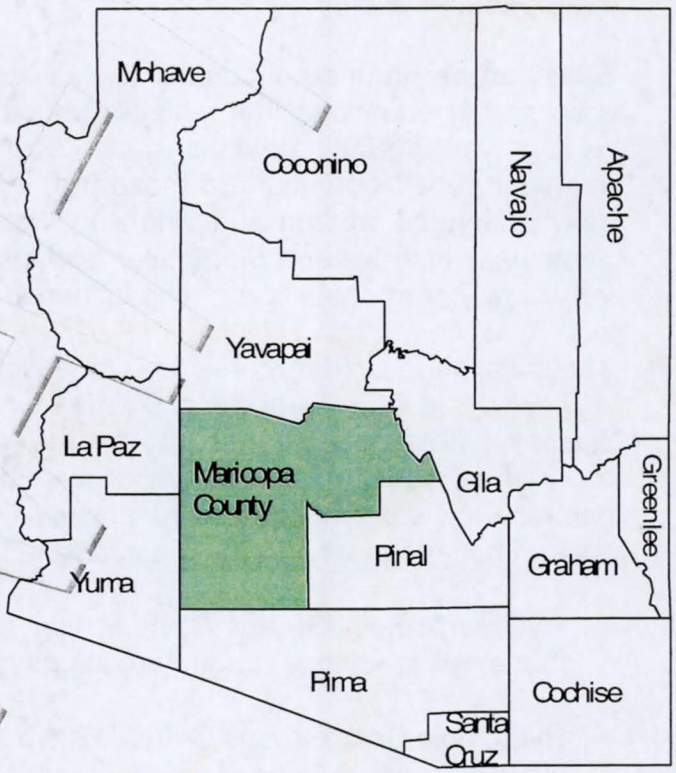
To adequately understand the problems and opportunities of a region one must understand the characteristics of that area. This chapter separates these characteristics for Maricopa County into two broad categories entitled physical and socioeconomic. Physical characteristics are defined as those having minimal human interference. Examples of physical characteristics would include topography, climate and geomorphology. Socioeconomic factors are those that have been heavily influenced by the human element. Examples in this category include population numbers, land ownership and development trends. Each of these two broad categories will be discussed in more detail in the following sections of this chapter.

Physical Characteristics

Size and Topography

Maricopa County is located in south central Arizona within the upper Sonoran Desert (See Map 2-1). The county is approximately 103 miles long (north to south) and 130 miles wide (east to west) at its most extreme locations. It has a land area of 9,226 square miles of which 1,441 square miles (15.6 percent) are incorporated and 7,785 square miles (84.4 percent) are unincorporated. Maricopa County is larger in area than seven states and the District of Columbia and rates as the 14th largest county in land area in the United States.[1]

The county is bisected by the Salt River, which flows from northeast to southwest. It joins the Gila River near the center of the county, continuing in a southwesterly direction to the county line. (See Map 1-1) This extensive river system provides life-sustaining water to the desert. This water was, and continues to be the basis for the large population growth in Maricopa County.



Map 2-1 Location Map of Maricopa County

Elevations range from a high of 7,657 feet on Brown's Peak in the northeastern portion of the county, to a low of 436 feet above sea level near the southwestern border. This variance in elevation allows for several different plant communities. At the lower elevations, desert scrub, punctuated with saguaro cactus, is the predominate species. The higher elevations contain woodlands and forests. Riparian communities flourish along the rivers, streams and washes.[2]

Soils

Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support habitation. There are two aspects of the definition; dynamic soil quality and inherent soil quality.

> **Dynamic soil quality** - that aspect of soil quality relating to the change of soil physical properties ~~change~~ as a result of soil use and management
>
> **Inherent soil quality** - that aspect of soil quality relating to the ~~a soils~~ natural composition and properties of soils

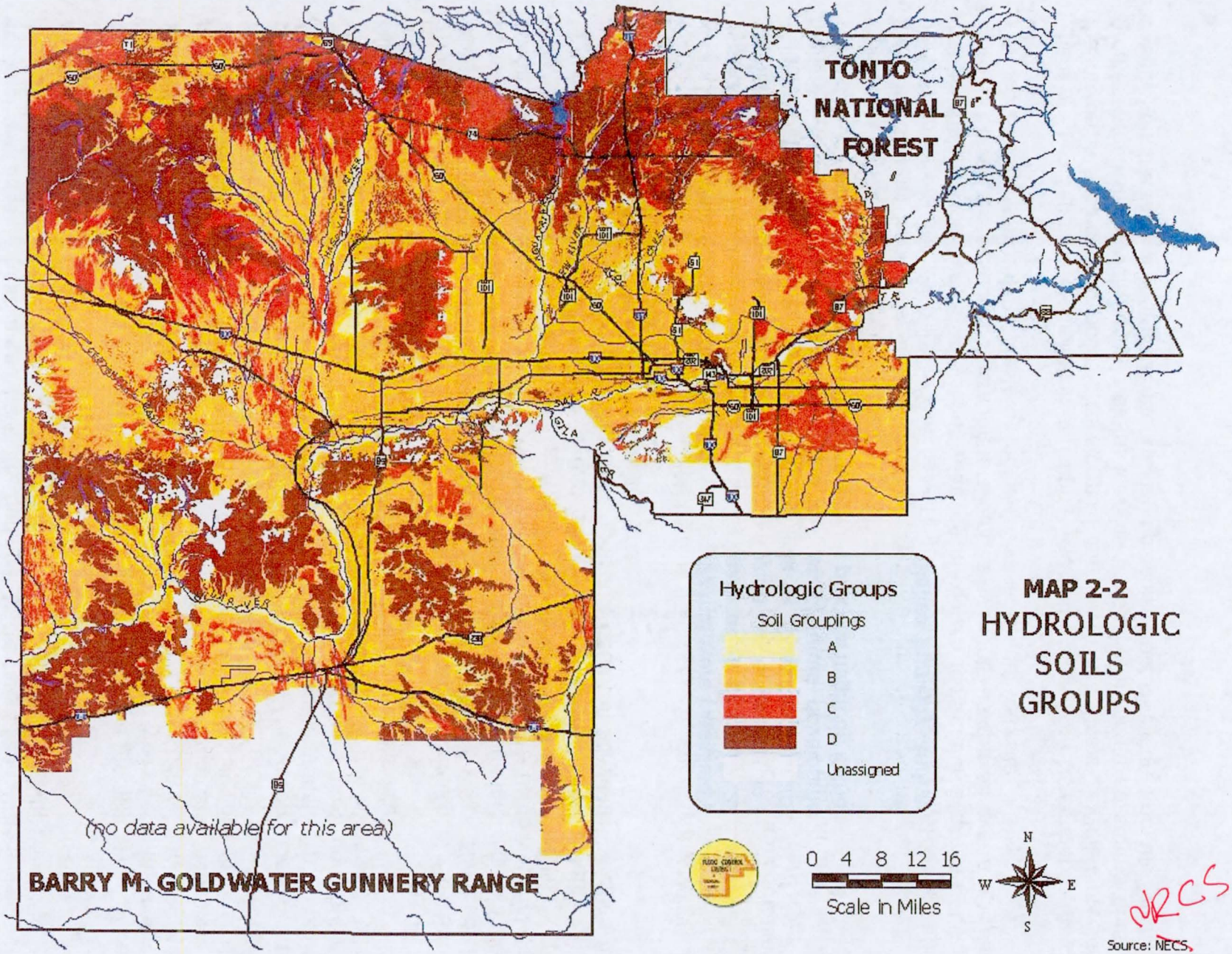
Maricopa County has nearly 60 different soil types that have been surveyed and mapped to show the geographic distribution of dynamic and inherent soil qualities, some of which contribute to erosion and sedimentation problems. These potential hazards are of particular significance to the ~~Flood Control~~ District.

Soils can be grouped according to their water runoff potential in Hydrologic Soil Groupings ~~and~~ that are used in equations that estimate runoff from rainfall. A Hydrologic Soil Group is a group of soils having similar runoff potential under similar storm and vegetative cover conditions. Soil physical properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are the following: depth to a seasonally high water table, intake rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The influence of ground cover is treated independently.

The soils in the United States are placed into four groups, A, B, C, and D, ~~and~~ and an unclassified group. three dual classes, A/D, B/D, and C/D, as defined by the NRCS. Dual classes were not recognized in Maricopa County. In the definition of the classes, infiltration rate is the rate ~~of which~~ that water enters the soil at the surface and is controlled by the surface conditions. Transmission rate is the rate at which water moves in the soil and is controlled by soil physical properties. The unclassified grouping consists primarily of rock out cropping and soils with inadequate information available to be classified in one of the other four groups.[3]

- Hydrologic Soil Groups A and B have low and moderate runoff potential respectively. Soils in these two groupings range from sands and/or gravels to sandy loams and clay loams.
- Hydrologic Soil Groups C and D have a high runoff potential. These soils are primarily ~~in the~~ silts and clays or have an impervious layer, such as bedrock that impedes the downward movement of water.

Approximately 35 percent of the total acreage in Maricopa County, excluding the Tonto National Forest and the Barry M. Goldwater Gunnery Range, fall into Hydrologic Group C or D (See Map 2-2). Most of the soils found in Groups C or D are in the mountains and low hills of the County. Most of these areas are sparsely populated and the threat of direct flood damages is relatively minor. However, runoff from these areas can impact lower lying more densely populated tracts depending upon rainfall patterns.



MAP 2-2
HYDROLOGIC SOILS GROUPS

Source: NECS. NRCS

date

There are areas in the County that fall into Groups A or B that have been or could be developed for intensive uses. These areas have the potential for increased runoff especially in the time frame after clearing but before development takes place. Without cover this land becomes very susceptible to erosion and sediment damages.

Erosion is a two-step process. The first of these is detachment, the breaking away of particles at the surface of the soil. The rate of detachment depends upon the type of soil, the steepness and length of slope, amount and type of land cover, and external forces such as duration and amount of runoff. Detachment, by itself, can be a major source of property damage, especially in areas where drainage patterns have previously been established. High velocity flows in these drainages can eat away at channel banks. Structures within these erosion areas may be damaged or destroyed unless some type of bank stabilization is installed. The second step in the erosion process is transportation, which results in the actual loss of soil material. The product of this transportation is called sediment. Sediment has been classified as a major contributor to water quality problems nation wide. Sediment, deposited by floodwaters within homes and businesses, will normally contribute as much to total damages as from the high water itself.

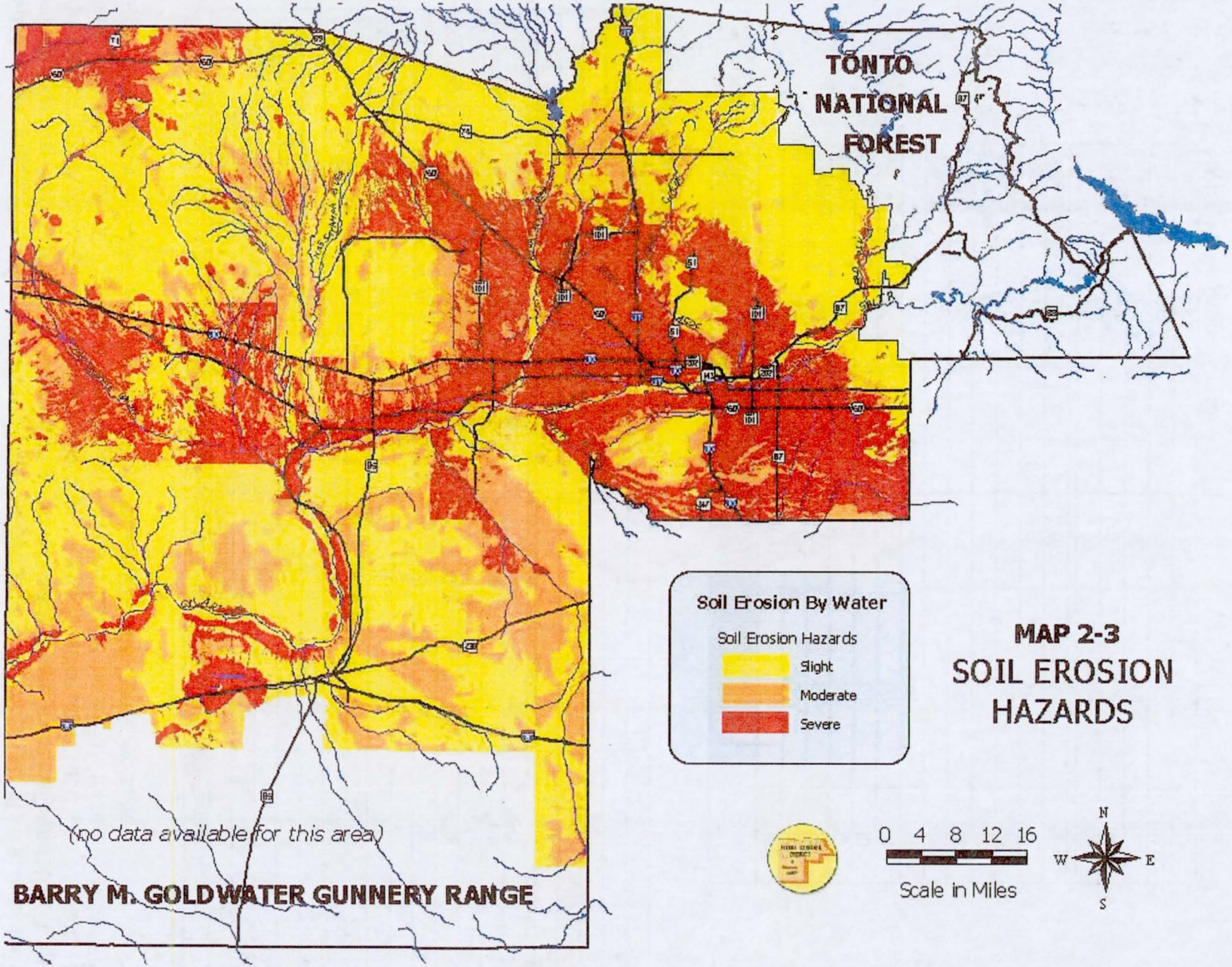
The Natural Resources Conservation Service (NRCS), through their Digital Soil Survey, has developed a Soil Erosion by Water Map for Maricopa County (See Map 2-3). The map shows the general relationship of soil detachment and movement by water, divided into slight, moderate and severe erosion hazard classes for the County with the exception of the Tonto National Forest, the Barry M. Goldwater Gunnery Range, and the Tohono O'Odham Indian Nation. This is a generalized map suitable for making broad assumptions concerning the severity of potential erosion and sedimentation problems in the County. It does not eliminate the need for onsite sampling, testing and detailed study of specific sites.

Of the approximate 6,766 square miles in the County that were classified by the NRCS, a severe erosion hazard has been identified on 1,803 square miles or nearly 27 percent of the total. Another 29 percent or nearly 2,000 square miles has a moderate erosion hazard. Thus, over 55 percent of the soils in the County are susceptible to detachment and/or transportation of soil particles under the right conditions. The location of future development can have a major influence on how severe damages from the erosion process might be in the future.

Climate

Maricopa County has a desert-type climate. Relative humidity and annual rainfall are low. Temperatures are normally high in summer. Records kept at Phoenix Sky Harbor Airport show that on the average over 80 days per year the maximum temperatures exceed 100 degrees. Table 2-1 gives a breakdown of temperature ranges by month as studied over a 50-year period. This table was taken from the Western Regional Climate Center web site.

There are two separate precipitation seasons. The first occurs from November to March, when the region is subjected to occasional storms from the Pacific Ocean. Winter precipitation is greatest when the middle latitude storm track is unusually far south so storms enter Arizona directly from the west or southwest after picking up considerable moisture from the Pacific Ocean.



MAP 2-3
SOIL EROSION HAZARDS

The second rainfall season occurs in July, August and most of September when the area experiences widespread thunderstorm activity associated with moist air moving into Maricopa County from the south and southeast. These thunderstorms are extremely variable in intensity and location, and some of the heaviest amounts of precipitation in a short period occur during these months. Table 2-2 gives a breakdown of precipitation by month for the greater Phoenix Area. This table was also taken from the Western Regional Climate Center web site.

Table 2-1: Period of Record General Climate Summary for Phoenix from 1948 to 1998 - Temperature (°F)

	Monthly Averages			Monthly Extremes			
	Maximum	Minimum	Mean	Highest Mean	Year	Lowest Mean	Year
January	66.6	42.8	54.7	62.2	86	44.7	49
February	71.1	46.0	58.5	65.6	91	51.9	55
March	76.0	50.2	63.1	70.1	89	55.8	52
April	84.8	57.4	71.1	79.6	89	63.3	67
May	93.3	65.4	79.4	86.3	97	71.8	53
June	102.9	74.1	88.5	93.6	94	80.8	65
July	105.2	80.5	92.9	96.1	80	87.5	55
August	103.6	79.3	91.4	96.1	94	87.4	55
September	99.3	73.3	86.3	90.9	79	81.9	50
October	89.3	62.2	75.8	81.6	88	70.0	49
November	76.1	49.6	62.8	69.0	95	56.6	57
December	67.7	43.1	55.4	62.5	80	49.7	67
Annual	86.3	60.3	73.3	76.3	81	70.2	64
Winter	68.4	44.0	56.2	61.8	81	49.8	49
Spring	84.7	57.7	71.2	77.5	89	66.6	65
Summer	103.9	78.0	90.9	94.8	94	86.5	55
Fall	88.2	61.7	75.0	77.9	77	70.4	57

Source: Western Regional Climate Center

Table 2-2: Period of Record General Climate Summary for Phoenix from 1948 to 1998 - Precipitation (in.)

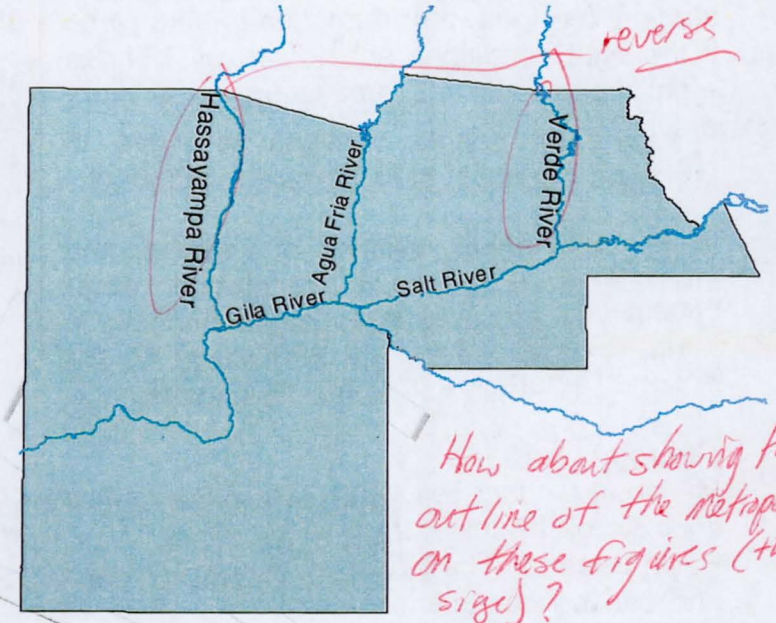
	Mean	High	Year	Low	Year
January	0.9	4.3	93	0.0	67
February	0.8	3.1	98	0.0	60
March	1.0	3.1	83	0.0	55
April	0.3	2.3	52	0.0	50
May	0.1	0.9	76	0.0	50
June	0.1	1.2	65	0.0	51
July	0.8	4.9	84	0.0	63
August	1.1	5.3	51	0.0	75
September	0.7	2.9	66	0.0	48
October	0.7	4.3	72	0.0	50
November	0.6	3.1	93	0.0	48
December	0.9	4.1	67	0.0	56
Annual	8.0	15.1	93	2.9	53
Winter	2.6	9.7	93	0.2	64
Spring	1.4	4.1	52	0.0	56
Summer	2.0	8.0	55	0.1	75
Fall	2.0	5.5	93	0.0	53

Source: Western Regional Climate Center

Hydrology

The five major river systems flowing through Maricopa County drain an area of approximately 57,000 square miles including areas of New Mexico and Mexico. This drainage area is approximately six times as large as Maricopa County. Thus storms as far away as Mexico can influence the probability of floodwaters causing damage somewhere within the county. Many of the most damaging floods have occurred when winter storms have extended well outside of the Maricopa County area.

Intense summer storms on a localized basis have the potential to cause flooding in Maricopa County on a much more frequent basis than the winter storms. How often flood damages result from these localized storms depends on the size of storm, where measurable damages would start, and whether the effects of the storm occurs in developed areas of the county. The point where measurable damages begin varies depending upon the type, location, and elevation of the property in question. However, experience with evaluating flood damages has shown that measurable damages can be determined for at least the ten-percent chance storm in most instances.[4]



How about showing the outline of the metropolitan on these figures (this size)?

Map 2-4 Major River Systems

Rainfall records have been kept for the Phoenix area on a consistent basis for over 100 years. These records have been analyzed and the data used to make predictions concerning return periods for short duration precipitation. These predictions were used in developing the following forecasts concerning rainfall in Maricopa County. For Sky Harbor Airport, the 24-hour duration rainfall that would occur in a 100-year event[5] would be 4.04 inches. A 50-year event would generate 3.57 inches and a 10-year event 2.53 inches over a 24-hour period.[6] These values vary throughout Maricopa County and by the size of the area impacted by the storm.

show actual for Maricopa

and ?

The ~~Flood Control~~ District currently has 260 precipitation measuring gages located in Maricopa County, ~~and surrounding counties~~. The first of these gages was installed in 1981. This system is still growing ~~as new flood hazards are discovered~~ as increased definition is needed. Data from each of these gages is available from the ~~Flood Control~~ District web site located at http://www.fcd.maricopa.gov/.

Summary data from these gages has been studied to determine how frequently rainfall, with the potential to cause measurable damages, has occurred in Maricopa County. The water years of 1992 through 1997 were used as being a fairly typical representation of historical rainfall patterns for the county. Rainfall events of 10-year frequency or greater were tabulated for each of the precipitation gages for this six year period. Table 2-3 gives the number of storms for the 10 percent or greater frequency in tabular form.

We use 10-year and 10 percent chance interchangeably. Should we define 10, 50 & 100-year recurrence interval up front in terms of % chance in any given year, and then be consistent with terms?

either use 10 percent chance or 10-year frequency

Thus, in a six year period, the ten percent chance rainfall was equaled or exceeded somewhere in Maricopa County 114 times. This does not mean that damageable floods occurred 114 times during this period. It does mean that the potential existed these 114 times, or an average of 19 times per year studied, for floodwater damages to take place if the right conditions should prevail. These "right conditions" become more and more prevalent as people continue to move to Maricopa County in ever increasing numbers.

Table 2-3 Number of Rainfall Events of Greater than the Ten Percent Frequency, by year for Maricopa County

Do you mean 2% and 1%?

Year	10% or >	50% or >	100% or >
1992	21	1	0
1993	19	2	3
1994	13	0	0
1995	11	3	2
1996	2	0	0
1997	20	10	7
Totals	86[1]	16	12

[1]Ten of these readings approached the 50-year frequency rainfall.

this para seems to come out of the blue. Needs more lead-in.

Water table depth, location of aquifers, and subsidence issues due to ground water mining can affect or help cause flooding in some areas. These issues are addressed by the Arizona Department of Water Resources.

Geology

Maricopa County lies within the Basin and Range province of the Southwest which in Arizona consists of the lower third of the state. This province includes the Sonoran, Mojave and Great Basin Deserts. The Maricopa County portion of the province is located within the Sonoran Desert and can be characterized by wide valleys and mountain ranges trending northwest to southeast. The mountain systems surrounding the valleys are generally comprised of metamorphic and igneous rocks. However, in the northern and western portions, volcanics are more predominant, while in the west basalts are more common.[7]

The majority of the populated areas of Maricopa County are located along the Quaternary alluvial deposits of the river basins. The Salt and Gila Rivers consist of recent alluvium (Holocene to late Pleistocene), while the Hassayampa River consists of older sedimentary materials (middle Pleistocene to late Pliocene). This fine-grained alluvial material produces the wide, flat open spaces that typify the desert.[8]

The people reading this will not know, typically, what Holocene, Pleistocene and Pliocene mean. Define? Maybe use footnotes.

Geomorphology

Geomorphology can be defined as the study of landforms and the processes that shape them. In the desert, both natural and artificial processes can shape landforms, as well as create relatively sudden (in geologic time) changes. Whether unexpected or predictable, these geologic changes can affect the drainage patterns of an area. Because the majority of the urbanized population live in the valleys where the results of processes such as sedimentation and erosion culminate, they are more likely to become susceptible to flooding. As the county continues to grow, pressure to develop hillsides is potentially leading to more complicated flooding problems.

The numerous dry riverbeds, combined with the relatively infrequent rainfall events in the county contribute to the general attitude of complacency towards flooding events. Often, years or decades may pass before a particular area experiences flooding problems. This length of time

plus the transience of the population leads people to believe they are not at risk. As development continues to expand, the effects of flooding will become more evident.

Desert landforms are an exemplary display of erosion forces and depositional processes that are characteristic of the desert. In the Sonoran Desert water plays a large role in these erosion processes. Two specific types of landforms occurring in Maricopa County, that can both influence and be influenced by floodwaters, are arroyos and alluvial fans.

Arroyo (wash) is a term applied in the arid and semi-arid southwestern United States to a small flat-floored channel or gully usually with steep or vertical banks that form under certain conditions. As arroyos develop, upstream sediment gets deposited downstream, ultimately reducing flood storage capacity of the channel. Urban development along arroyos has resulted in straightening of the channel which increases flood velocities. Other land uses, such as agricultural activity and mining, can also have deleterious effects on arroyos further complicating erosion and flooding problems.[9]

Alluvial fans occur at the base of mountain ranges where the sediment has eroded from the mountainside to form a gently sloping fan-shaped deposit.[10] These fans are formed when floodwaters transport sediment from upper watersheds via stream channels onto the valley floors below. As the floodwaters near the valleys, the velocity decreases, and the sediment begins to be deposited. Alluvial fans can contribute to flooding problems because of their unpredictable nature. It is common for alluvium to backfill a channel causing the channel to shift its course (avulsion). In addition, alluvial fan flows frequently shift their position horizontally, a phenomenon known as lateral migration. The nature of this type of shift on an alluvial fan is very unpredictable and, as such, it is very difficult to forecast the course of flooding along an alluvial fan.

In a report entitled "Alluvial Fan Hazards in the United States" The Federal Emergency Management Agency (FEMA, 1989) lists the following as hazards that may occur on alluvial fans: high velocity flows; erosion/scour; deposition of sediment and debris; debris flows/impact forces; mudflows; inundation; and flash flooding.

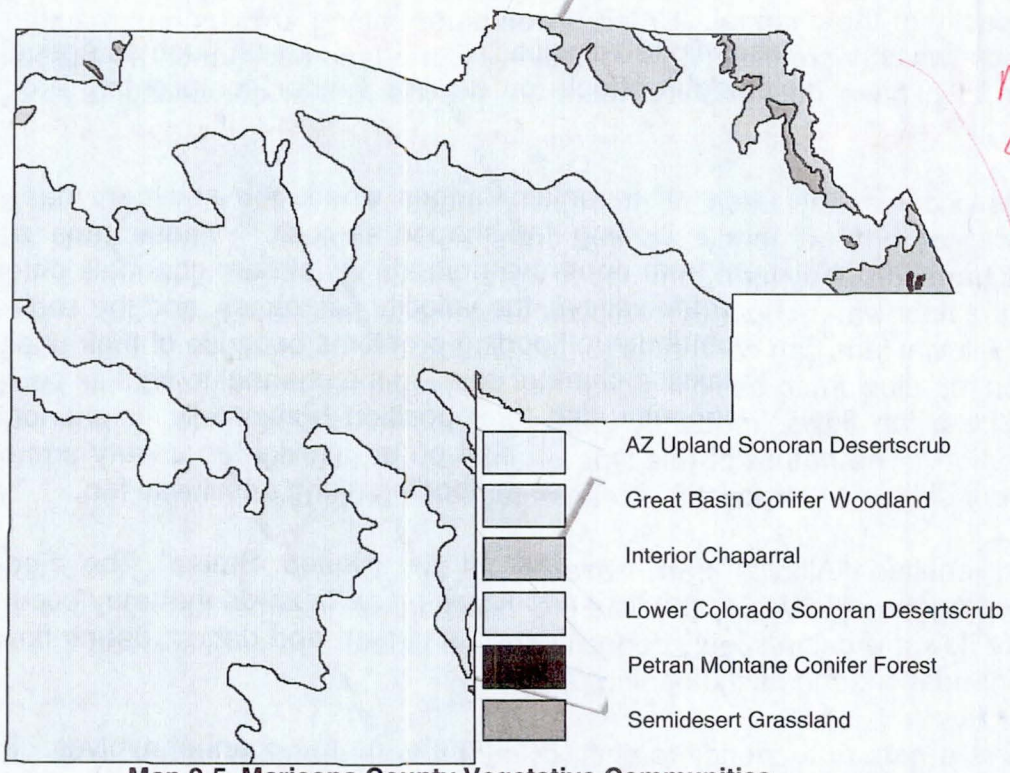
Streams have a natural tendency to shift, or migrate, as the channel evolves. In the Southwest, this migration may occur either vertically or horizontally. Horizontal channel movement, otherwise known as lateral migration, occurs when the main channel shifts its course, either for natural or human induced reasons. Vertical channel migration is usually associated with either stream bank erosion or deposition, both of which affect the stability of the stream. Alterations in the channel, whether horizontal or vertical, can cause severe changes in the capacity of the channel to carry floodwaters and can affect peak flows and velocities.

Vegetation

The vegetative communities of Maricopa County can be divided into six major units. These units are Arizona Upland Sonoran Desertscrub, Lower Colorado Valley Sonoran Desertscrub, Interior Chaparral, Semidesert Grasslands, Great Basin Conifer Woodland, and Petran Montane Conifer Forest (See Map 2-5). Although not included in Map 2-5, riparian vegetation is another important habitat, and as such will be discussed later in this chapter.

The majority of the county falls within the Lower Colorado Valley Sonoran Desertscrub community (57%) or the Arizona Upland Sonoran Desertscrub community (38%). The remaining units comprise less than 5% of the total habitat. For the purposes of this discussion, only the two dominant communities will be described.

Upland Sonoran Desertscrub occurs primarily on the slopes and hills of the mountain ranges in the County. Due to the bimodal pattern of rainfall and subtropical climate, the Upland Desertscrub community houses the most diverse desert vegetation.[11] This community is often very architecturally complex and may consist of a tall layer of trees such as Yellow (or Foothill) Palo Verde, Mesquite and Ironwood, a layer of shrubs and mid-height cacti such as Cholla and Jojoba, and a layer of near-ground vegetation such as Barrel Cacti.[12]



Not enough contrast here.

Map 2-5 Maricopa County Vegetative Communities

In contrast, the Lower Colorado Valley Desertscrub community, which occurs primarily on the flat desert valleys, is much less varied. This is in part due to the substantially lower amount of rainfall it receives during the year. Plants commonly found in this community are Creosote Bush, White Bur Sage, Yellow Palo Verde, Ocotillo, and Brittlebrush.

Riparian Habitat

Riparian areas are ecotones, or transition zones, between watercourses and the surrounding lands. Riparian habitat is associated with such a transition zone. In Maricopa County the majority of the watercourses are ephemeral, yet due to the presence of groundwater, riparian vegetation exists along many of the rivers. Riparian vegetation varies depending upon both groundwater and surface water levels. Perennial streams created by dams, especially along the Salt and Gila Rivers often exhibit the cottonwood and willow association that was once typical along these

rivers. Mesquite bosques are also found in these areas. Small pockets of cottonwood-willow association also occur in other areas that have a perennial or intermittent water source.

Xeroriparian habitats are the more common type of riparian vegetation found in the County. This type of vegetation is commonly found along ephemeral streams, where there is seldom any surface water. Plants in this habitat may include Ironwood, Palo Verde and Mesquite.

Riparian habitat serves several natural flood control functions. Vegetation along watercourses acts as natural erosion control. Tree roots and vegetation help to stabilize soil and decrease erosion impacts near streams. This tends to decrease the probability that a stream will erode or that the channel will widen. Vegetation can also trap and stabilize sediment from floodwaters, and can store and slowly release floodwaters. Vegetation in the floodplain can also slow downstream flood velocities.[13]

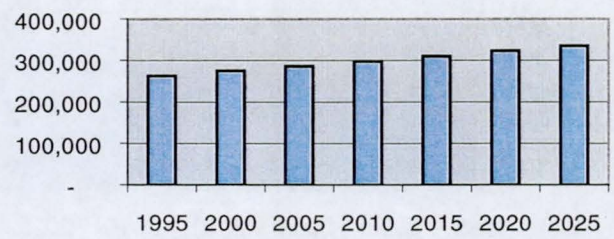
In the past, riparian habitat has been considered a problem and the solution has been to eradicate it. Water loving plants, termed phreatophytes, were thought to consume water necessary for human purposes. They were also considered a flood threat because plants in the floodplain can divert water flows. Research, however, has shown that riparian vegetation is necessary because it maintains the normal functions of the floodplain. Riparian vegetation is also effective at trapping and storing floodwaters, ultimately increasing groundwater depths.

Socioeconomic Characteristics

Population

The population of the United States in 1995 stood at 262,754,000 and continues to grow. This total is expected to increase to 335,048,000 by the year 2025.[14] This is an increase of about 27.5 percent over the 30-year period or nearly one percent per year (see Figure 2-1).[15]

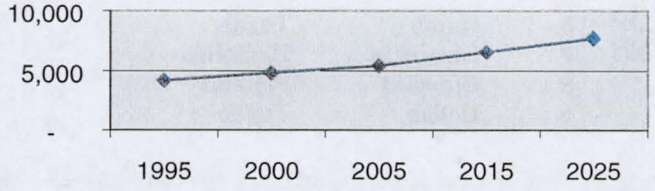
Figure 2-1 Population Growth in the United States 1995 - 2025
[Thousands. Resident population]



Source: U.S. Bureau of the Census, Population Division, PPL-47

Arizona had a population of 4,218,000 people in 1995 (see Figure 2-2).[16] The State ranked as the 23rd most populous when compared to all 50 states and the District of Columbia. However, Arizona is projected to be the 13th most populous state by 2025, with approximately 7,729,000. This is a gain of 3,511,000 people over the 30-year period. This gain is just over 83 percent or approximately 2.77 percent per year. Arizona has been one of the fastest growing states ranking sixth in net gain between 1995 and 2000.

Figure 2-2 Population Growth in Arizona 1995 - 2025
[Thousands, Resident Population]



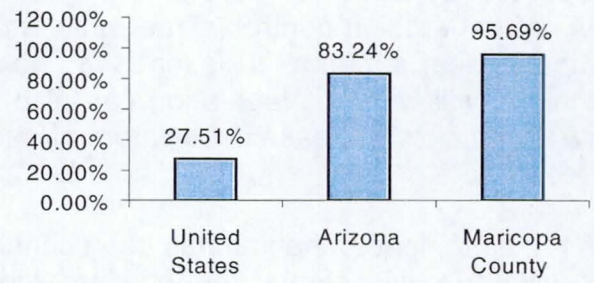
Source: U.S. Bureau of the Census, Population Division PPL-4: Series B

The increase in projected population in Arizona is over three times what is projected for the

why not just use 2025 for consistency

United States as a whole over the 30-year period. Much of the increase in Arizona can be attributed to Maricopa County, which is projected to increase from 2,528,700 people in 1995 to 4,516,100 people in 2020, an increase of nearly two million people.[17] This increase becomes even more impressive when the Maricopa County projections are expanded to the year 2025 to be on the same basis as the United States and the State of Arizona estimates (see Figure 2-3).[18] The estimated population for Maricopa County in 2025 would be 4,948,400 people. This addition of 2,419,700 people over the 30-year period equates to nearly a 96 percent increase or approximately a 3.2 percent growth rate on an annual basis (See Figure 2.4).

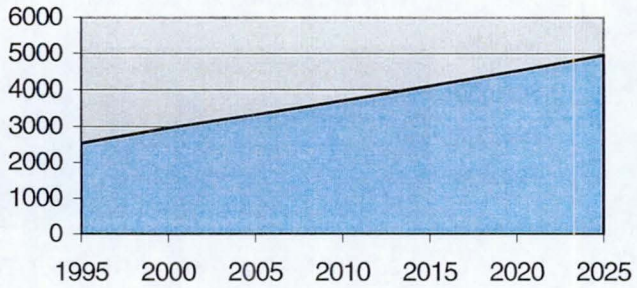
Figure 2-3 Maricopa County, State of Arizona and The United States Projected Population Change 1995 to 2025



United States data source: U.S. Census Bureau
Arizona data source: Arizona Department of Economic Security
Maricopa County data source: Maricopa County Association of Governments

The significance of this growth rate is that Maricopa County will have a net average increase in population of 80,656 people each year over the 30-year period. Maricopa County ranked first of all the counties in the United States in total gain in population between 1996 and 1997. This total gain was 82,789 people which was over 20,000 more than Los Angeles County, the number two county of the ten biggest numerical gainers for that year (see Table 2-4).[19] Maricopa County will be growing at approximately the same amount of people every year for the next 30 years as it was doing in 1996 when it ranked first in the Country in numerical growth.

Figure 2-4 Maricopa County Growth 1995 - 2025
[Thousands, Resident Population]



Source: MAG for the years 1995-2000, DES for 2025

Table 2-4

Ten Biggest Numerical Gainers in Population, 1996 to 1997

Rank	County	State	Number Increase
1	**Maricopa**	**Arizona**	**82,789**
2	Los Angeles	California	61,623
3	Clark	Nevada	59,549
4	Orange	California	54,733
5	San Diego	California	45,447
6	Harris	Texas	43,296
7	Riverside	California	33,113
8	Broward	Florida	30,216
9	Dallas	Texas	28,918
10	Collin	Texas	27,991

Source: Censu Bureau, 1997 County Population Projections
http://www.census.gov/Press-Release/cb98-41.html

There will be implications for the ~~Flood Control~~ District if this rate of growth continues to take place in Maricopa County. This data is reported here in order to make a series of assumptions to identify future flooding, erosion, and sedimentation problems.

Continued rapid growth will put more people in harms way from flooding hazards. The District has assessed where and when these people will

locate in order to prioritize future projects, studies, and programs. Chapters 4 and 5 of this Plan will address remaining flood hazard problems and prioritization of watershed for future projects.

In order to make these determinations, the District looked at historic data and trends provided by the following sources: the U.S. Census Bureau, the Arizona State University Morrison Institute for Public Policy, Urban Land Use Planning (Kaiser/Godschalk/Chapin, Jr.), Maricopa Association of Governments (MAG), and the Maricopa County Comprehensive Plan 2020. Assumptions are made based on data from these sources.

Some key numbers from these sources used to make assumptions for development of the criteria used in the phase I prioritization analyses of watersheds are shown in Table 2-5.

Table 2- 5
Housing Units Authorized for Installation in Maricopa County - 1999[20]

Type	Number	% of Total
Single Family	35,430	75
Multi-Family	9,225	20
Mobile Home	2,447	5
TOTAL	**47,406***	**100**

* Averages approximately 3,950 per month.

These averages were used to make assumptions for development trends and amount of land needed for future growth. However, the individual watersheds of the County will develop with different densities and land use patterns based on geographical and regulatory constraints. These issues serve as critical elements in a phase II prioritization analysis of each watershed. The following assumptions based on the data from Table 2-5 were used for determining priority of each watershed for future projects:

Assumptions

1. The projected population for Maricopa County, based on the 1995 Census, in 2025 is 4,948,400 based on MAG data. [4,948,400 (2025) – 2,528,700 (1995) = 2,419,700 additional people]

2. The U.S. Census Bureau shows an average of 2.59 persons per household in Maricopa County in 1990.[21] (2,419,700 ÷ 2.59 = 934,247 new households ÷30 = 31,141 average per year)

3. The Morrison Institute for Public Policy has calculated a table showing that average lot size for new homes in the metropolitan Phoenix Region in the 1990's was 6,677 square feet.[22] Additional area will be taken up by streets and roads - a ratios of lot sizes by block to street widths and lengths per block produced a figure of 22.43 percent per lot (1,498 square feet) of urban development being attributed to transportation corridors.[23] Each single-family unit will use an average of 8,175 square feet or 5.3 units per acre.

4. A small number of apartment complexes were selected at random from the east, central and western parts of the Phoenix Metro Area and then looked up on the County Assessor's records for square footage for Maricopa County.[24] The average number for this small random sample came out to be 990 square feet per housing unit, plus 405 square feet for 2.5 parking spaces per unit at 162 square feet for each parking stall (for the purposes of this study 9 feet wide by 18 feet long is used)[4], plus 350 square feet of open space per unit deemed reasonable for each

housing unit in a complex. The 22.43 percent per unit for transportation corridors must be added (390 square feet per unit). The average multi-family unit uses approximately 2,135 square feet per unit. This is approximately 20.4 units per acre. Most complexes are two-story which reduces the amount of land area covered. Dividing the 990 square feet in half would adjust for the second story. The total land covered for an apartment unit would be 1,640.

5. A typical lot in a mobile home park averages about 2,100 square feet. The 22.43 percent per lot for streets and roads must be added (471 square feet) for a total of 2,571 square feet per unit or 16.9 units per acre.

6. An average estimate of commercial and industrial development is about 21.65 percent of residential development or 1,426 square feet per household. How was this calculated? I couldn't duplicate.

7. Public Safety (fire, police) facilities will require approximately 1,120 square feet per household.

8. On the average, there are 60 children of nursery school age per 1000 persons, 175 children of elementary school age per 1000 persons, and 75 students each of junior high and high school age per 1000 persons. The average nursery school uses about 0.138 acres, an elementary school uses approximately 14 acres, a junior high uses about 26 acres, and a high school about 40 acres. Average square ft per household

9. An estimated 10.5 acres per 1,000 persons ~~in~~ is needed for libraries, community facilities, recreation, and open space.[26] This is 1,138 square feet per household. Detailed calculations to arrive at the numbers for assumptions 7, 8, and 9 for Table 2-6 are in Appendix D.

In Table 2-6 below the area per household is multiplied by the estimated number of units for residential development to arrive at total land area needed for future development. Each non-residential use area per household is multiplied by the total number of housing units (934,247) to arrive at the total land area needed for those categories.

Table 2-6 Additional Land to be Developed 1995 - 2025

Type of Development	Area per Household * (square feet)	Average % of Development	Estimated No. of Units	Total Land Area Needed for Future Development		
				square feet	acres	sq. miles
Single Family	8,175	75%	700,685	5,728,099,875	131,499	205.47
Multi-Family	1,640**	20%	186,850	306,434,000	7,035	10.99
Mobile Home	2,571	5%	46,712	120,096,552	2,757	4.31
Subtotal	**N/A**	**100%**	**934,247**	**6,154,630,427**	**141,291**	**220.77**
Commercial / Industrial	1,426	21.65%	N/A	1,332,236,222	30,590	47.80
Public Safety Facilities	1,120	0.79%	N/A	1,045,440,000	24,000	37.50
Schools	723	0.51%	N/A	675,180,000	15,500	24.22
Open Space	1,138	0.81%	N/A	1,062,864,000	24,400	38.13
TOTAL	Subtotal 4,407	N/A	N/A	**10,270,350,649**	**235,781**	**368.42**

* Total includes areas for parking and open space as detailed in assumptions.
** This number is adjusted down to account for two story buildings (see assumption 4).

Maricopa County will need to develop an additional 141,291 acres for residential uses by 2025 to accommodate the population increases that are projected. Total land needed for intensive

development by 2025 is projected at about 236,000 acres or 368 square miles. Where and how this additional acreage is developed will have a major impact on the operation of the ~~Flood Control~~ District for years to come.

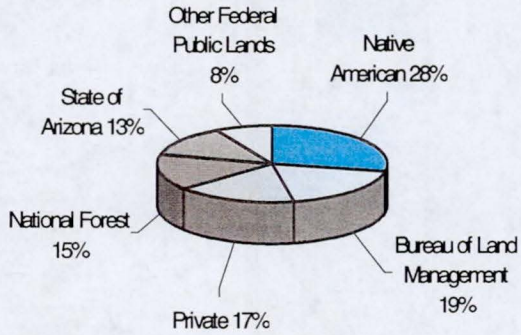
The population projects by watershed

Each watershed is expected to increase in population. ~~These numbers~~ are shown in Chapter 4 of this report. In some areas the increased population will lead to build-out putting pressure on regulators to allow floodplains, erosion hazard zones, and hillsides to be developed. Requests for higher densities may be another option pursued to accommodate this increased population growth in the areas indicated. Both options may put greater numbers of people in high-risks areas for flood hazards. MAG population projections for 2025 put more people in some watersheds than developable land area can accommodate at current land use densities and trends. Population may spill over to neighboring watersheds shifting the burdens and risks.

Land Ownership and Land Use

The breakdown for land ownership for Arizona from the Arizona State Land Department is shown on Figure 2-5. Approximately 70 percent of the land area of the State ~~are~~ is under some level of federal control.[26(27)] In comparison, 60 percent of land in Maricopa County is federally controlled leaving 40 percent either privately or state controlled. Map 2-6 shows the location and breakdown of these land ownership groupings for the County. Approximately 625 square miles of the County's 9,226 square miles have been developed for residential or commercial use as of 1995. Map 2-7 gives a breakdown of land use in Maricopa County through 1995.

Figure 2-5 Land Ownership in Arizona per the Arizona State Land Department

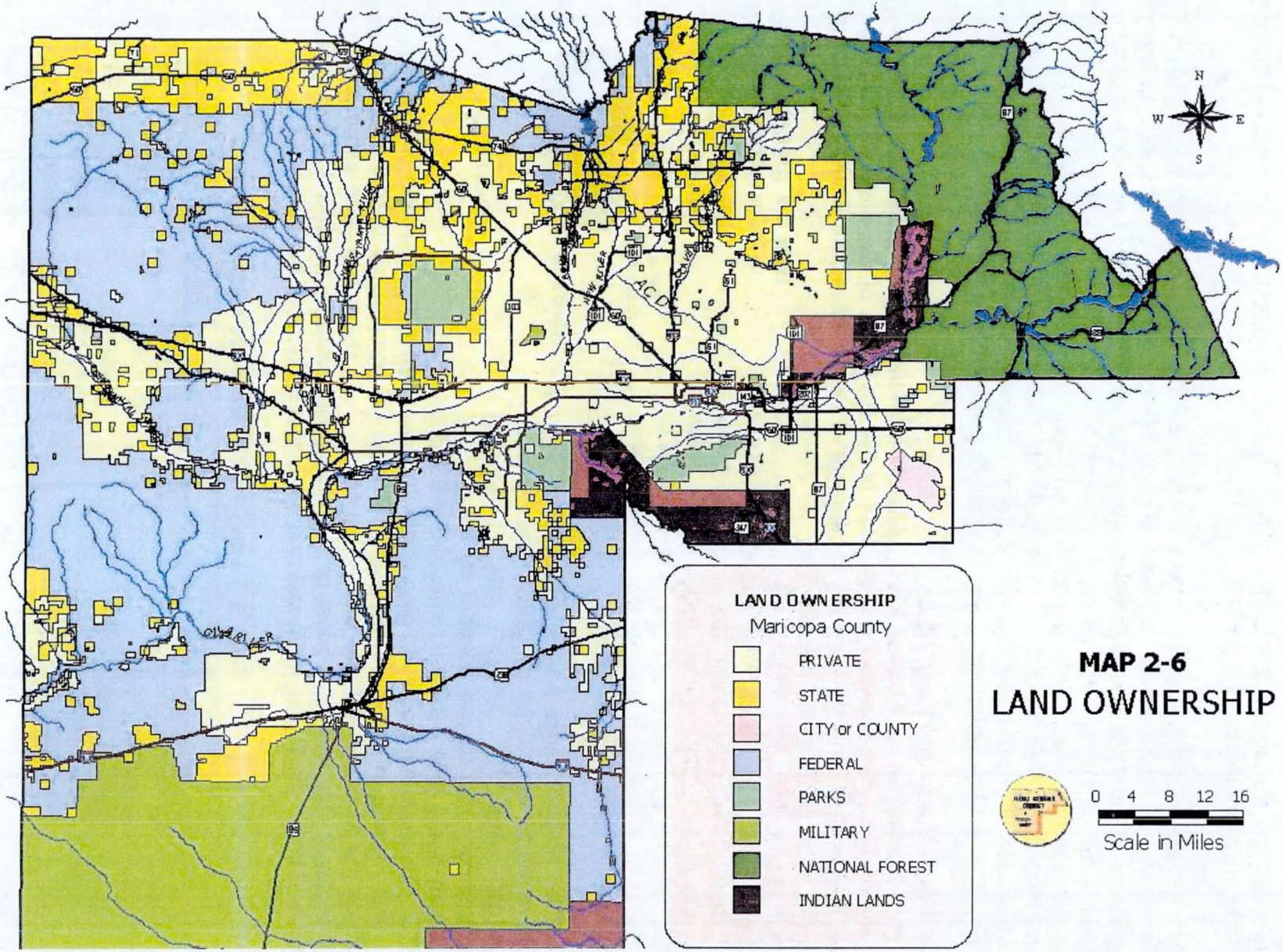


Location plays a large part in determining what land might be developed by 2025. The Morrison Institute study[27(28)] shows new residential development has moved outward by an average of nearly half a mile each year between 1993 and 1998. Development was averaging about 20 miles from the intersection of Washington Street and Central Avenue in downtown Phoenix. Residential completions over the last ten years tend to support the Morrison Institute Study (see Map 2-8). There has been some infill of areas within the Phoenix City limits but most of the residential completions over the last three years have occurred in the southeast, northeast and northwest sections of the Valley.

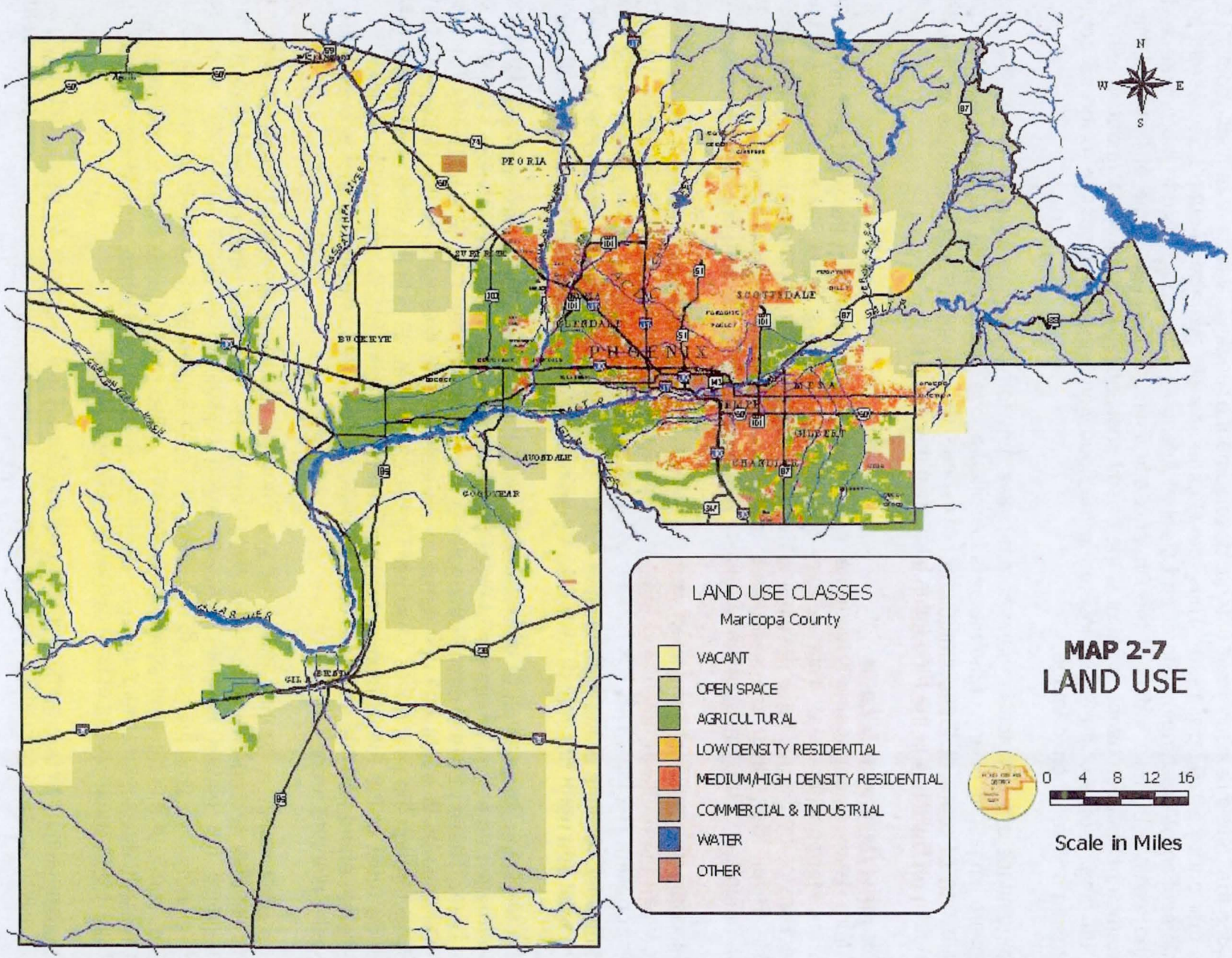
Table 2- 7 Land Area In Maricopa County - 2000

Type	Acres	Square Miles	Percent
National Forest	410,240	641	6.95%
Gunnery Range	818,560	1,279	13.86%
Already Developed	400,000	625	6.77%
Undevelopable	2,593,280	4,052	43.92%
Potentially Developable *	1,682,560	2,629	28.50%
TOTAL	5,904,640	9,226	100.00%

* Land in private and state trust ownership with less than 15% slopes.



MAP 2-6
LAND OWNERSHIP



MAP 2-7
LAND USE

Using the "half-mile each year" criteria, development boundaries will have moved about 13.5 miles further out by 2025 from 1998. Thus, development would average about 33.5 miles out from the intersection of Washington Street and Central Avenue which would include the private and state land within a 20 mile radius of the Phoenix city limits.[29] However, some of this land may have characteristics such as too great of slope or soil unsuitability to support a foundation for a road or a building. Some of it may be located in the floodway, 100-year floodplain, or be susceptible to erosion and sediment damage.

Regulations are in place in many communities now for prohibiting development of the land with severe limitations of any of the hazards identified above. However, in the past a number of acres with one or more of these limitations have been developed. (For an example of this see the section on Buildings in the Floodplain later on in this chapter.)

Potential Developable Land

Future development seems likely to be most heavily concentrated in the west and north sections of the Metropolitan area. This appears likely for two reasons. First, the southeast and the east sections of the County have development master plans almost developed to the boundaries of the Gila River, Salt River Pima-Maricopa and Fort McDowell Mohave-Apache Native American Communities. Thus, most of the remaining potential developable land lies to the north and west.

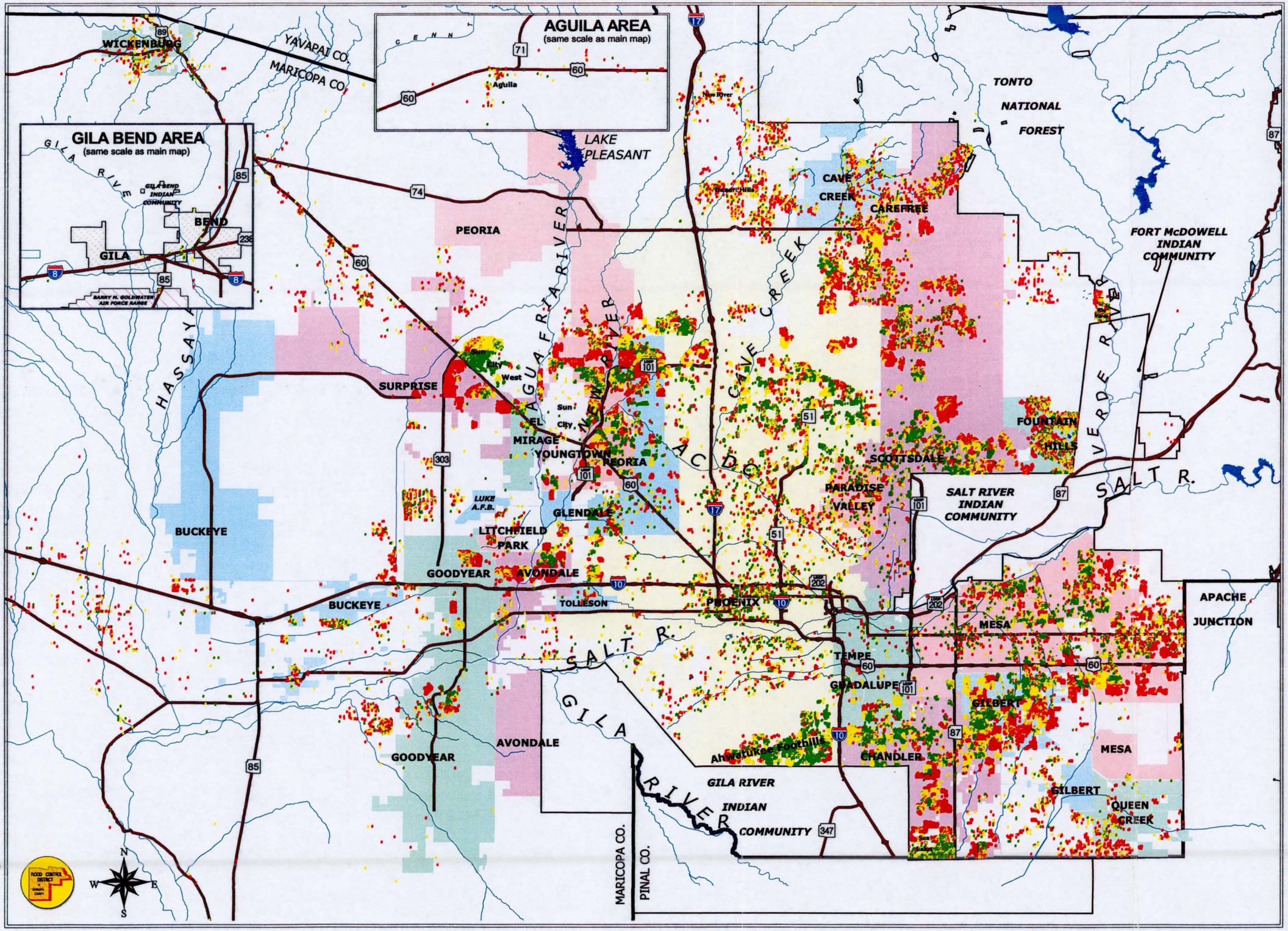
Secondly, the recently completed western section of Loop 101 has created a transportation link between the northern reaches of Interstate 17 and the western portion of Interstate 10 within the Metropolitan Region. This link is seen as an important stimulus for development in the west and northwest sections of the Metropolitan Area. The future plans for the continuation of SR303L to the west and north of Loop 101 will also increase the likelihood of development in these areas.

The Maricopa Association of Governments (MAG) has assembled a development database with information on active, planned and proposed development projects in Maricopa County as of July 1, 1995. These potential development areas are shown on Map 2-9. The total area in all of these developments is about 234,000 acres or enough land to take care of the projected population needs through the year 2025. Over half of this 234,000 acres is in the west and northern sections where most of the future development is projected to take place. Assumptions from Table 2-6 estimate about 236,000 acres for development through 2025. Additional land will come from non-master planned areas or infill. is needed

ok (1,040,000 acres)

The area within a 20-mile radius of the Phoenix city limits contained 1,625 square miles of developable acreage which includes State trust lands. The state land is in trust to be managed to maximize the benefit to state schools, which makes these lands leaseable or for sale to developers. To date just over 8,100 acres or 12.65 square miles of State Trust Land have been sold, some of this for open space preservation. This 1,625 square miles is reduced to exclude previously developed land, geologic constraints, federally held lands, and preserve areas to leave about 1,240 square miles of land available for development.

Approximately 236,000 acres will likely be developed over the next 30 years and there is about 1.7 million acres of potentially developable land in the County. Where is the most likely area or



MAP 2 - 8

RESIDENTIAL COMPLETIONS APRIL 1990 TO JUNE 1999

1 dot = 1 house

New Residential Completions

- Apr. 1990 - Dec. 1993
- Jan. 1994 - Dec. 1996
- Jan. 1997 - June 1999
- Watershed Boundaries

Residential Completions per year, 1990 - 1999:

1990	9,324*
1991	12,515
1992	17,049
1993	19,752
1994	25,426
1995	26,873
1996	31,990
1997	29,174
1998	32,672
1999	18,182**

*** 1990 data covers April to December.**

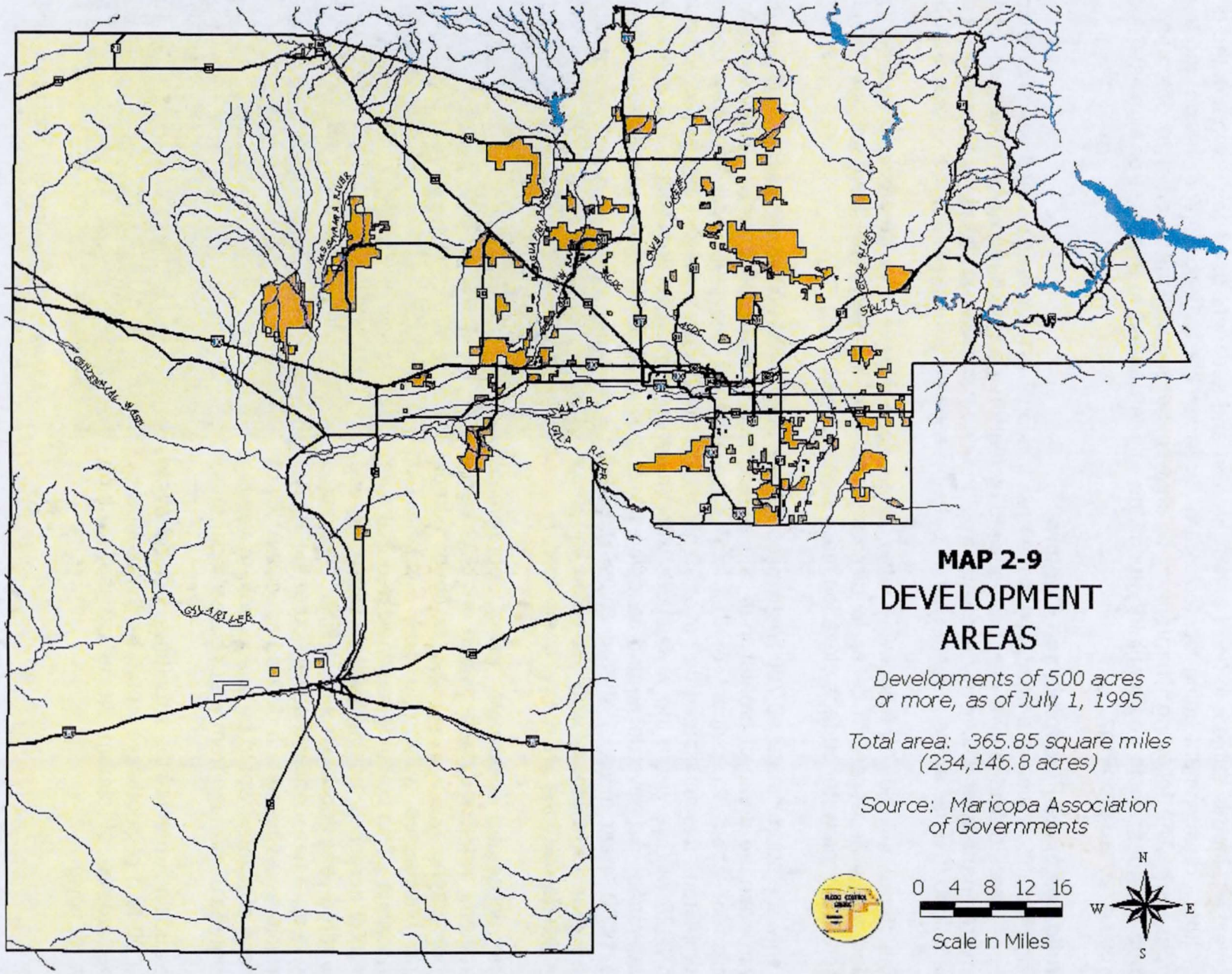
**** 1999 data covers January to June.**

Total new residencies, Apr. 1990 - June 1999: 222,957

0 1 2 3 4 5 6 7 8 9 10 11 12

Scale in Miles

SOURCE: MARICOPA ASSOCIATION OF GOVERNMENTS, MAY 2000.



MAP 2-9

DEVELOPMENT AREAS

Developments of 500 acres or more, as of July 1, 1995

Total area: 365.85 square miles (234,146.8 acres)

Source: Maricopa Association of Governments

areas where this development will take place is the next question? How much of the presently developed land is subject to flood and/or erosion and sediment damages? What is the potential for future development being located in areas susceptible to flood and/or erosion and sediment problems? The following Chapters try to answer these questions in order to determine where flood control projects and regulatory functions will be needed to minimize or eliminate flood and erosion hazard problems.

Buildings in the Floodplain and Floodway

The official definition of a floodplain is the area susceptible to inundation by a base flood including areas where drainage is or may be restricted by man-made structures which have been or may be covered partially or wholly by floodwater from the one hundred-year flood. A base flood is defined as a flood that has a one percent chance of being equaled or exceeded in a one year period.

The official definition for a floodway is the channel of a river or other watercourse and the adjacent land areas necessary in order to discharge the one hundred-year flood without cumulatively increasing the water surface elevation more than one foot.[30]

There are approximately 8,700 lineal miles per the USGS 100,000 Hydrography of stream courses with drainage areas of greater than one square mile in Maricopa County. Approximately 1,780 miles or about 21 percent of the total have detailed floodplain and floodway delineations completed. It is anticipated that over 90 percent of the County's present and projected population to 2025 will live within the watersheds with presently delineated floodplains and floodways. All watersheds will have delineated floodplains and floodways within seven years at a projected rate of 1,000 linear miles of stream course studied per year. Growth is also projected in areas where delineations are not yet completed.

The delineated floodways, using approximate methods, and floodplains placed on 1999 aerial photographs made it possible to count homes and businesses within the one hundred-year floodplain. This counting has indicated that over 22,000 homes or businesses are within the one hundred-year floodplain as of 1999. This same procedure has identified about 430 of the 22,000 structures as being in a defined floodway. All of these structures would be susceptible to varying degrees of damage from water borne sediments.

In addition, many of the structures, located within 1,000 feet of floodways, could be threatened by the erosion of stream banks caused by high water flows.

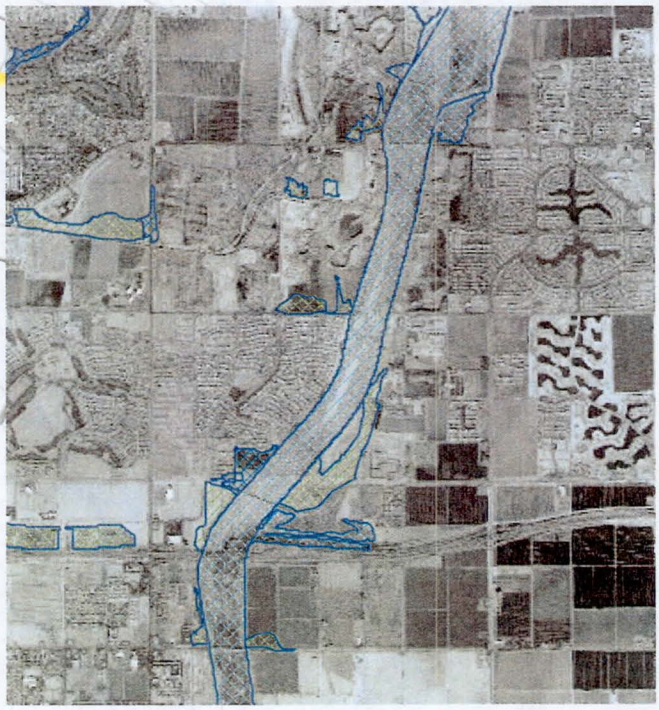
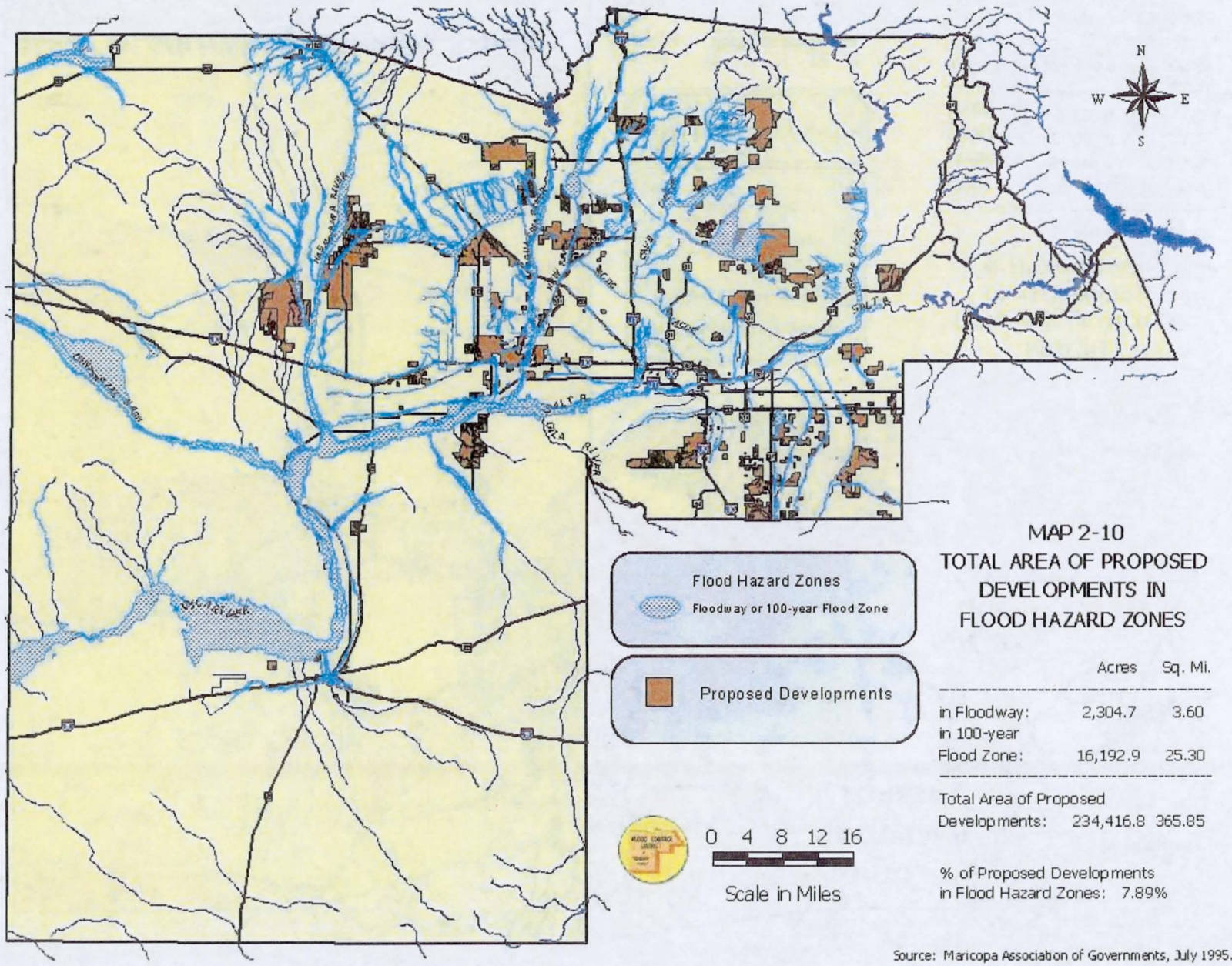


Figure 2 - 6 Example of a Maricopa County Aerial Photo with Delineated Floodplain

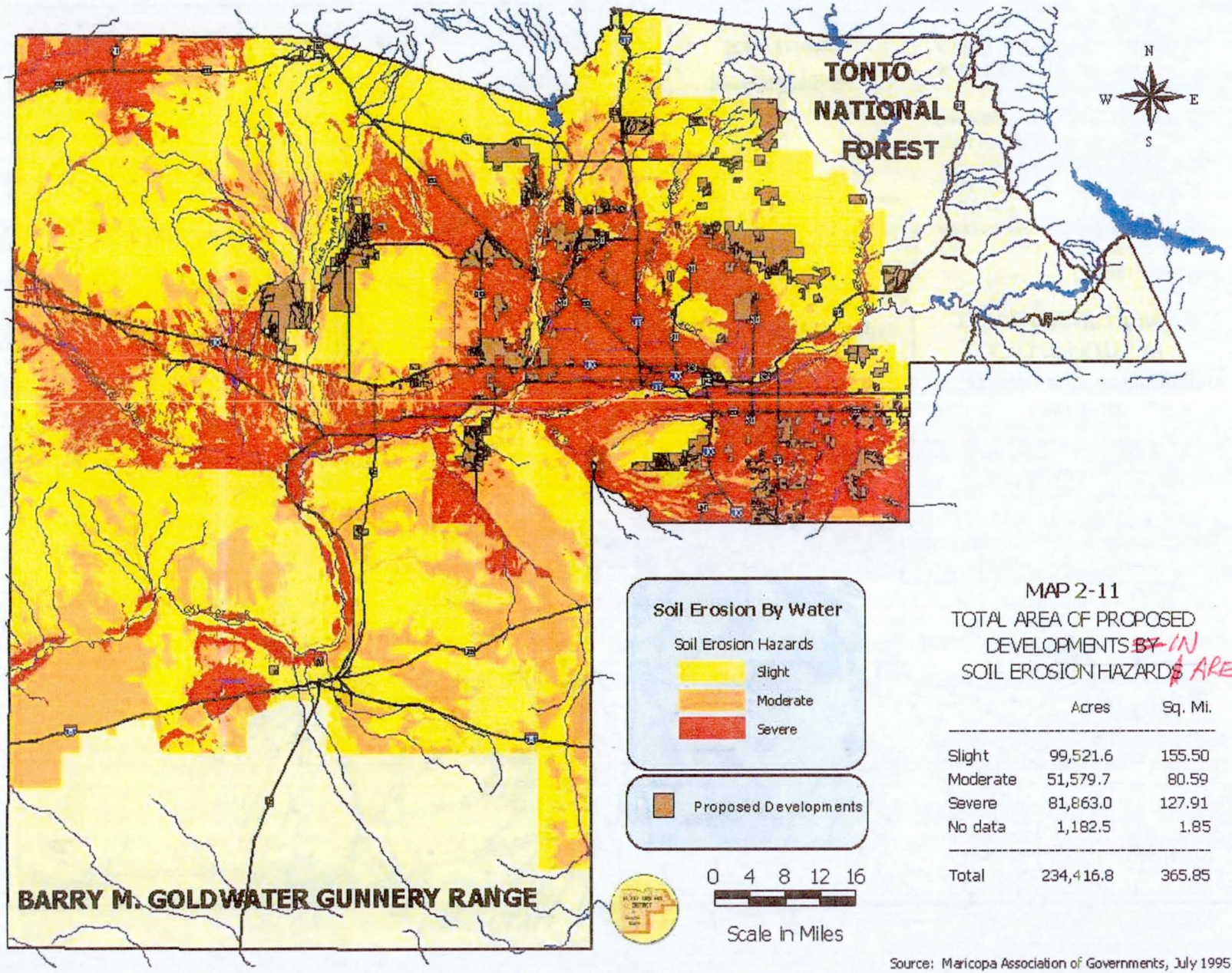


MAP 2-10
TOTAL AREA OF PROPOSED DEVELOPMENTS IN FLOOD HAZARD ZONES

	Acres	Sq. Mi.
in Floodway:	2,304.7	3.60
in 100-year Flood Zone:	16,192.9	25.30
Total Area of Proposed Developments:	234,416.8	365.85

% of Proposed Developments in Flood Hazard Zones: 7.89%

Source: Maricopa Association of Governments, July 1995.



MAP 2-11
TOTAL AREA OF PROPOSED
DEVELOPMENTS ~~BY~~ IN
SOIL EROSION HAZARD~~S~~ AREAS

	Acres	Sq. Mi.
Slight	99,521.6	155.50
Moderate	51,579.7	80.59
Severe	81,863.0	127.91
No data	1,182.5	1.85
Total	234,416.8	365.85

Source: Maricopa Association of Governments, July 1995.

Potential flooding and erosion problems also exist in the 234,146 acres projected as future development areas. These areas were overlaid onto the delineated floodways and one hundred-year floodplains in Maricopa County (See Map 2-10). This procedure would place about 2,300 acres in the floodway and an additional 16,200 acres within the currently designated one hundred-year floodplain. It is possible that future structures could be built in the floodway and in the 100-year floodplain without adequate safeguards in place.

Potential erosion hazard areas are even more pronounced. Map 2-11 shows the soil erosion hazard areas overlain on the future development areas. Nearly 82,000 acres or 35 percent of the development areas are classified as having severe erosion hazard potential from flowing water. The same issue as above applies to severe erosion hazard area delineations.

Constructing structures within a floodway is prohibited under the current Maricopa County floodplain regulations. The 430 structures identified within the floodways would have been constructed prior to completing the studies documenting the floodway. Therefore, construction within currently designated floodways is not a concern. There is a potential for development to take place within areas where floodplains have not yet been delineated. Table 4-3 shows, by watershed, the watercourse lengths for which floodplain delineations have not yet been completed.

Completion of the A-Zone delineation, using approximate methods, will provide necessary flood hazard information to give notice to landowners such that precautions can be taken. Additional study may be required in these areas to more precisely determine floodwater elevations and floodplain or floodway boundaries. Until floodplains are defined for all of the watercourses in Maricopa County additional structures could be constructed in flood prone areas.

Summary

The combination of physical characteristics plus a large and continuing growth in population has made Maricopa County residents susceptible to flooding and/or erosion and sediment damages. As more floodplain delineations are completed by the District it is possible that additional structures will be identified in the floodplain. It is crucial to get ahead of development with delineations to prevent this from occurring in the future. Numerous Flood Control District programs have been initiated over the past 40 years to address alternative solutions to flood hazard elimination. These programs will be identified and described in Chapter 3. Chapters 4 and 5 will further define problem areas by watersheds and how the Flood Control District programs have been and will be used to eliminate or reduce these problems.

Endnotes

[1] Information for this paragraph came from the Maricopa County web site.

[2] Much of the information in the preceding two paragraphs is taken from the Draft Maricopa County Comprehensive Plan. (current P 7 d Plan 2000)

[3] General Soil Map with Soil Interpretations for Land Use Planning, Maricopa County. United States Department of Agriculture, Soil Conservation Service, March 1973

[4] Assumption is based on evaluating and reviewing PL83-566 Small Watershed Projects for the Soil Conservation Service, now Natural Resources Conservation Service, over a 30-year period.

[5] A one hundred year rainfall has a one percent chance of being equaled or exceeded in any given year. A fifty year storm has a two percent chance and a ten year rainfall a ten percent chance of being equaled or exceeded in any given year.

[6] Figures taken from NOAA Technical Memorandum NWS WR-177, Climate of Phoenix, Arizona, December 1986(Revised) pp.92.

[7] Reynolds, 1988 in Maricopa County, 1995

[8] Ibid.

[9] Vogt, Brandon J., *The Arroyo Problem in the Southwestern United States.*

[10] Brown, David E., Ed. 1994. *Biotic Communities: Southwestern United States and Northwestern Mexico.* Salt Lake City: University of Utah Press.

[11] Ibid.

[12] Arizona Department of Water Resources (ADWR). 1994. *Arizona Riparian Protection Program Legislative Report.*

[13] U.S. Bureau of Census (www.census.gov.)

[14] Ibid.

[15] Figures taken from Maricopa Association of Governments.

[16] This was done by projecting the same percentage increase over the period of 2020 to 2025 as Maricopa County was to Arizona and the United States over the period 1995 to 2020.

[17] Taken from www.census.gov.

[18] Maricopa County Quick Facts from the U.S. Census Bureau.

[19] Maricopa County Quick Facts from the U.S. Census Bureau.

[18] Data for this paragraph comes from the Arizona Real Estate Center, L. William Seidman Research Institute, College of Business, Arizona State University.

[20] Morrison Institute for Public Policy, Arizona State University.

[21] Original percentage for streets to lot sizes taken from a study entitled "Economic and Social Costs of Urban Sprawl Versus a Proper Urban Density in Spokane County," Washington, October 1975.

[22] Metroscan for Windows 2.64.

[23] these dimensions were determined by measuring a typical parking space in the Flood Control District parking lot.

[24] Native American lands have their own governing bodies. However, The Bureau of Indian Affairs, U.S. Department of Interior, has certain responsibilities for Native American lands.

[25] Morrison Institute for Public Policy. September 2000. Hits and Misses: Fast Growth in Metropolitan Phoenix.

[26] Less than 12 miles to the east, west and south but much greater than 12 miles to the north.

[27] All three definitions are taken from Floodplain Regulations for Maricopa County, Flood Control District of Maricopa County, 11/01/2000.

(Note: endnotes need to be corrected.)

CHAPTER 3. FLOOD CONTROL DISTRICT ORGANIZATION & PROGRAMS

District Organization

The Flood Control District of Maricopa County was organized in August of 1959 as noted in Chapter 1. For the next 30 years District programs and staffing revolved around the need for designing and installing flood control structures previously identified in the 1963 report. By the late 1990's approximately 70 structures had been installed, including 21 structures the District took over from other agencies, which necessitated increased emphasis on the operation and maintenance (O&M) program. The O&M program has continued to gain prominence as more and more of these structures reach the end of their design life.

Having completed a majority of the 1963 program, opportunity was present to look at non-structural solutions to eliminate or reduce flooding problems in Maricopa County. The District began to focus more on programs that would keep people and property out of areas that were prone to flooding rather than proposing solutions once a problem developed. Non-structural solutions, such as floodplain management and drainage ordinances, evolved as programs to be administered by the District.

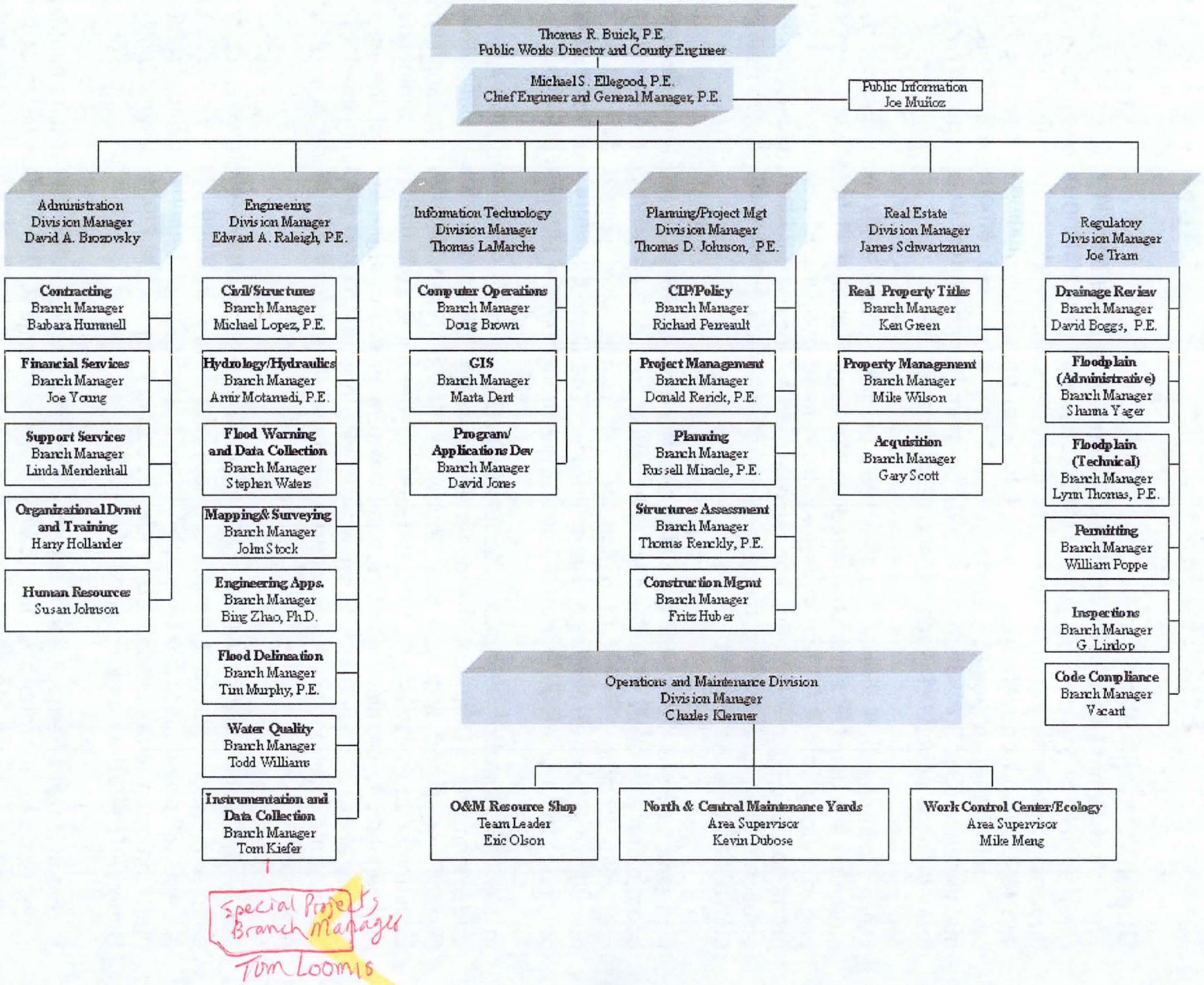
Non-structural solutions required a land use planning emphasis to provide a regional, uniform and coordinated approach to watershed management. This approach works to minimize the public cost of protecting citizens from flooding that results from private and public development's cumulative effects on drainage characteristics. The District prefers this regional approach which continues to have a high degree of importance throughout the planning process.

In 1993 the Board of Supervisors adopted the *County-Wide Comprehensive Plan Goals, Policies and Standards*. Many of the goals and policies reflected a close relationship between the District's programs and Maricopa County's stated planning initiative. In addition, the National Environmental Policy Act of 1969 gave environmental factors national prominence. These laws and regulations coupled with a general awareness of the importance of the environment have brought about a change in how project planning and installation are conducted. The District has been at the forefront of incorporating environmental features into all aspects of its flood control programs.

Today, the Flood Control District of Maricopa County is an organization with a chief engineer and general manager, public information office, and seven divisions. (See Figure 3-1). There are currently 33 branches in the Divisions. These branches work together to support the District's four major program areas as defined in the "Strategic Plan for the Flood Control District of Maricopa County." These four major program areas are:

- Flood Hazard Remediation Program – Provides structural and non-structural mitigation of flood hazards for the public so they can live with acceptable risk of loss of life or property due to flooding. Major activities under this program include structural measures, the Capital Improvement Program, structural assessment initiative, operations and maintenance, property management, acquisition and relocation, and environmental activities.

Figure 3-1 Flood Control District Org Chart



- Flood Hazard Regulation Program – Provides guidance, direction, and enforcement for the public so they can use their property safely and in compliance with applicable state and federal laws. Leading activities in this program include floodplain administration (national flood insurance program/CRS), drainage administration, storm water quality administration, and sand and gravel mining administration.

- Flood Hazard Education Program – Provides flood hazard information, technical data, and flood safety guidance to public agencies and individuals so that they are aware of and can respond to flood hazards. Important activities, in this program are public information and outreach, public project involvement, hydrometeorology, and flood warning and data collection.

- Flood Hazard Identification Program – Provides flood and erosion hazard information and documentation through planning to the public so they can be knowledgeable about the dangers of erosion and flooding, the areas in which they occur, and required future remediation measures. Major activities for this program are floodplain delineation, Area Drainage Master Plans, Watercourse Master Plans, integration of projects into the natural and urban environment, and strategic and comprehensive planning.

Revenue Sources

The majority of the District's revenue is derived from a secondary property tax for flood control placed on each residential parcel in Maricopa County. The County Board of Supervisors sets the rate of this tax and the assessed real property valuations to which the tax is applied on an annual basis. The tax rate was 50 cents for every $100 of valuation approximately ten years ago (see Table 3-1). This rate has been steadily declining and was set at 23.2 cents per $100 valuation for Fiscal Year 2001-2002.

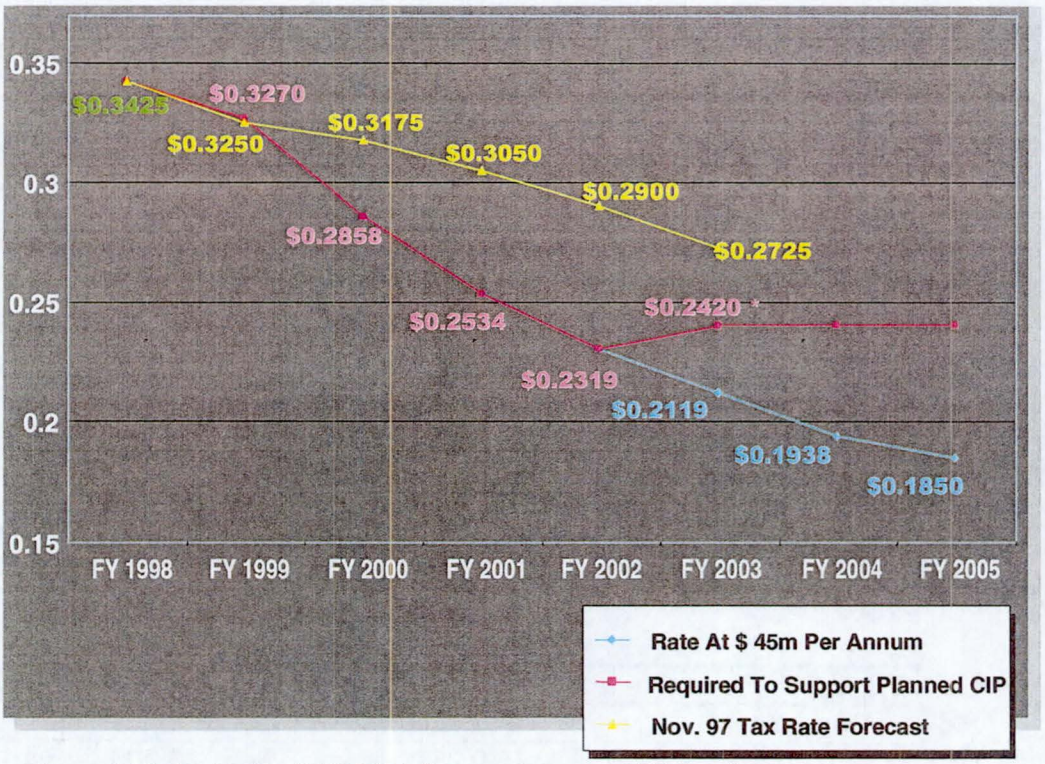
Table 3-1 Flood Control Tax Rates and Revenue by Fiscal Year[1]

Fiscal Year	Tax Rate	Tax Revenue	
01/02	0.2319	$45,323,000	Est.
00/01	0.2534	43,874,335	
99/00	0.2858	43,992,461	
98/99	0.3270	44,995,000	
97/98	0.3425	42,697,000	
96/97	0.3413	38,501,000	
95/96	0.3632	36,085,500	
94/95	0.3332	35,300,000	
93/94	0.3632	35,400,000	
92/93	0.3901	39,715,000	
91/92	0.4447	46,879,000	
90/91	0.4235	45,797,000	
89/90	0.4303	46,408,000	
88/89	0.5000	51,345,000	
87/88	0.5000	46,059,000	

Tax revenues have held fairly constant over the past ten years because of the large amount of building taking place and the increase in real property valuations for previously built construction.

However, District tax revenues have been steadily declining in real terms when inflation is taken into account (see Figure 3-2). It is anticipated that the District's tax revenues over the coming five years will be capped at a maximum of $45 million on an annual basis and will continue to result in continued reduction of the property tax rate.

Figure 3-2 Property Tax Rate Comparative Chart



Note: * EDP & Co. 06/22/01 future Assessed Valuation

Another source of revenue for the District is the sale or lease of rights-of-way. The Flood Control District owns approximately 22,000 acres in fee simple title and holds perpetual easements on an additional 38,000 acres. Revenue from easements and rights-of-way was approximately $564,000 in the fiscal year that started July 1, 1999 and ended on June 30, 2000. Revenue from land sales during this same time frame was $2,103,000. This figure can vary widely from year to year depending on the size and location of land available and the strength of the real estate market at any given time.

A third source of revenue has been from fees that developers and individuals are required to pay to obtain building permits within Maricopa County. Building permit applications are reviewed by the Floodplain Management Branch if the structure is to be located within the delineated 100-year floodplain and reviewed by the Drainage Administration Branch if the building is to be located outside of the 100-year floodplain. This revenue stream is closely tied to the number of building

permits issued each year, which in turn is a function of the health of the economy in Maricopa County. In Fiscal Year July 1, 1999 through June 30, 2000 this income source totaled $337,000.

A fourth revenue source is that of cost sharing with other entities for project installation. Most of the early flood control structural projects were installed through cost sharing arrangements with the U.S. Army Corps of Engineers or the U.S. Department of Agriculture, Soil Conservation Service. The federal agency normally paid for project construction and the District furnished the land on which the structure would be built. The District took over operation and maintenance responsibilities once the project was completed. Federal cost sharing monies have been drastically cut in the last ten years as federal budgets have been reduced at the national level. Most recent cost sharing has been with local municipalities such as cities and other county agencies, with some monies coming from various state agencies.

Almost $556 million has been spent on flood control structures in Maricopa County since the District's inception. Approximately $333 million or nearly 60 percent of the total has come from federal sources.[2]

Flood Control District Programs

The flood control programs including activities and services of the District have continued to evolve over the years. New and varied programs were the result of two conditions. First, no one program would solve the flooding problems that were developing in Maricopa County, but proactive programs that prevent new development in flood prone areas and eliminate the need for future reactive programs made sense for certain locations. Reactive programs were very efficient in preventing damages in areas where development had previously taken place. The type of program used or combinations thereof became a function of the conditions found where the investigation was taking place.

Secondly, outside influences have played a large role in the evolution of District programs. The National Environmental Policy Act of 1969 and subsequent state laws have helped raise environmental awareness. Environmental safeguards have lengthened installation time and increased the cost of reactive type measures. Water quality safeguards and wetland preservation have placed additional emphasis on non-structural measures that make use of and conserve these environmental values.

The result has been the development of new programs, activities and services to fit the ever changing landscape and some new and innovative uses of the original programs of the District. The following sections describe the major services available from the District in support of the four program areas as defined in the Strategic Plan. Specifics, by watershed, for each service can be found in Chapter 4 of this Plan and Appendix B.

Flood Hazard Remediation Program

Structural Measures

Webster's New World Dictionary defines a structure as "something built or constructed". Thus, any permanent addition to the landscape, for the express purpose of flood control, would qualify as a structural measure.

Structural measures can reduce floodwater damages by controlling the floodwater and associated erosion and sedimentation. Structural measures in this category include dams and reservoirs, floodwater retarding structures, channel work, levees and dikes, floodways, floodwater diversions, sediment basins, grade stabilization structures, and stream bank stabilization.

Structural measures to control or reduce flooding, erosion and sedimentation have been the primary program utilized by the District. The 1963 Comprehensive Plan evaluated 41 projects of which all were structural in nature. Thirty of the 41 were recommended for installation as soon as funding was available. All or parts of 20 of these projects have been constructed.

A large majority of these projects were installed through a federal/District partnership. The federal partner was responsible for facilities construction in most cases, with the District being accountable for the necessary land rights. The District also took on all the operation and maintenance responsibilities for these projects. This federal/District partnership has produced structures worth nearly $650 million at 2000 prices.[3] Most of the projects installed under this partnership were started and essentially installed in the 30 years after the District was organized. Since then, federal project monies have become extremely scarce reducing the opportunity for these types of projects.

Other measures that would qualify as structural include raising foundations of buildings, blocking off low-level entrances and windows, strengthening existing walls and foundations and installing protective walls. These measures help minimize flood losses. They do not attempt to control floodwater or erosion and sedimentation. They do permanently alter the landscape. These measures are not normally preferred by homeowners because of the perceived lowering of housing values through these alterations.

The last ten years has seen a decided shift in the structural measures program of the District. First, the overall emphasis on structural measures is not as great as it was in the past. Where once it was the program of choice, it now is just one of many programs available, depending upon the circumstances. Secondly, the program is no longer predominantly funded through federal cost sharing. The District has assumed the lion's share of structural measure costs. However, more and more of these projects have cost sharing arrangements with cities and towns or with other county and state agencies. There are approximately $196 million of structures at 2000 prices that were primarily built by the District and partners.[4]

Capital Improvement Program

Arizona Revised Statute 48-3616, which created the need for the comprehensive plan, also provided the basis for the five-year Capital Improvement Program. This statute requires a five-year capital improvement program that "shall separately identify capital improvements for engineering, rights-of-way and land acquisition and construction with such supporting explanations, cost estimates and completion schedules as the board may require."

The five-year Capital Improvement Program (CIP) for the Flood Control District identifies spending for all anticipated capital projects and implements flood control and storm water management projects identified through the planning process. The CIP addresses both modification and replacement of existing infrastructure, development of new facilities, and studies to accommodate present and future growth. The CIP also enables the District and its stakeholders to identify

needed capital projects and co-ordinate financing and construction timing. To increase effectiveness, the CIP consists of two crucial segments; an administrative process to identify and prioritize future capital projects (the Prioritization Procedures) and the fiscal plan to provide for the funding of those projects.

The Prioritization Procedures serve as the mechanism for ranking potential new CIP projects. Potential CIP projects are identified either by local cities, towns and other agencies, or through other District programs. The potential projects are evaluated on an annual basis for inclusion in the latter years of the CIP.

The prioritization procedure is accomplished in two major steps. First, all newly proposed projects are evaluated according to predetermined and weighted criteria by a committee of senior District staff members. The selected projects that require additional information are included in a District managed and prioritized pre-design study program. Requesting agencies may complete prioritized pre-design studies using consultants or in-house resources, provided the information produced meets the minimum requirements of District-sponsored studies. The purpose of the pre-design study program is to develop more detailed information on potential CIP projects. This includes design and construction costs, land acquisition requirements, required permits, mitigation and multiple-use potential. During the pre-design study, a Memorandum of Understanding (MOU) is developed to define how the staff of the District and the other agencies will proceed with the project.

The second step includes the budgeting and scheduling of projects for inclusion in the District's Five-Year CIP. For projects requiring an Intergovernmental Agreement (IGA), the information developed in the pre-design study and MOU will serve as the basis for negotiations. When Area Drainage Master Plans are completed, a number of future pre-design studies and CIP project requests are identified. Input regarding the priorities for projects identified within these plans, will continue to be provided to local cities, towns and other agencies. Project IGA's will usually be signed prior to the District's commencement of the design activities. When a CIP project has progressed to the stage where the engineering design, plans and construction specifications are being prepared, its place in the Five-Year CIP program is generally maintained. The stability and timeliness of CIP project implementation are important to the timing of interrelated projects.

The CIP links the planning and budget activities of the District. It can support past policy decisions by establishing priorities between existing and competing projects but can also measure and evaluate the merits of new proposals. Typically, a CIP describes each capital project proposed for development over the forthcoming five-year period by listing the year that it is to be started, the cost per year, and, when applicable, the proposed method of cost-sharing. Based on these details about each project, the District has developed annual cost schedules for capital expenditures. Thus, the CIP presents both the cost and funding for all the project requirements for flood control purposes as tempered by current and future financial capability. The CIP, for FY 01/02- 05/06, has $275.5 identified for capital improvements for the five-year period.

m

Structures Assessment Initiative

The role of flood control dams and floodwater retarding structures (FRS) has been to protect downstream cropland and property from floodwater damages. This protection has not only been

more than adequate for existing development, but it has also allowed ~~these~~ many historic floodplains to be developed for a variety of intensive uses. These intensive uses, in many cases, require protection levels in excess of what many of these structures were designed to provide creating liability risks. Many of these dams and FRS are now reaching or will reach the end of their designed life in the next few years. However, this does not necessarily mean their useful life has been exceeded. Each dam and FRS will need to be evaluated on an individual basis to assess the risk of failure.

sentence does not make sense

Because these structures are not inundated with flood waters all year round, providing multi-use opportunities with these structures in addition to their flood and erosion control provides benefits. Examples of these other uses include hiking, camping, boating, fish and wildlife conservation, and groundwater recharge. These other uses can increase the risk and liability around the dams and reservoirs in addition to that added by the changes in land use downstream.

The above factors plus changes in methodology for determining the inflow design flood, proposed rule changes by the Arizona Department of Water Resources (ADWR) on dam safety requirements, and subsidence impacts on structures in Maricopa County have necessitated a Structures Assessment Program.

The Flood Control District of Maricopa County owns, operates and maintains 22 Flood Control Dams and FRS and is mandated by state and federal law to comply with dam safety regulations. The District has initiated a service called the Structures Assessment Initiative to assess and evaluate these structures and related features due to an ever-increasing urbanized environment and to assure continued compliance with current regulations, standards and guidelines. The Structures Assessment Initiative is intended to address issues related to urbanization and dam safety as well as to enhance and improve the District's ongoing Dam Safety Service.

The Structures Assessment Initiative has three phases. Phase I Assessments primarily involve collection and review of records, field inspections of dams, subsidence surveys, risk assessments and the development of planning level recommendations for future actions to be considered for each dam or group of dams. Structural and non-structural solutions are to be evaluated with emphasis on project partnering and multi-use opportunities for District facilities. Phase I Assessments for District Dams located in eastern and western Maricopa County are currently being performed under two District on-call contracts and are anticipated to be completed by FY 2003-2004.

Phase II work will ~~involve~~ include development of detailed alternatives and pre-design work which will result in structural and non-structural solutions to address issues related to urbanization and dam safety. It is currently anticipated this work will be performed under consultant contracts upon completion of Phase I Assessments. Phase II work will also ~~involve~~ include geotechnical field investigations, analysis, and development of site specific corrective actions as needed to address potential dam safety issues. This work was initiated in October of 2000. The work may also involve implementation of the site-specific dam safety corrective measures when feasible in conjunction with the field investigation work.

Phase III would continue the long-term dam safety service implementing projects to correct any identified dam safety concerns and address urbanization issues. These could include items like structural modifications, land acquisitions below spillways, and alternative, lower risk solutions.

hello: Is this Phase II work defined as a preliminary outcome of Phase I? Where's the link to Phase I, if there is one? The need to do Phase II early, prior to completion of Phase I needs to be better explained.

Move to start of subsection?

The District has established a branch of the Planning and Project Management Division to oversee the Structures Assessment Initiative. This branch, titled Structures Management, is responsible for seeing that the Structures Assessment Initiative is carried out in a timely manner.

Operation and Maintenance

In addition to the flood control dams and floodwater retarding structures, the District oversees many miles of underground conduits and improved channels. This infrastructure is designed to eliminate or greatly reduce the amount of floodwater damages that could occur in Maricopa County. This infrastructure must be managed to its optimum potential in order to achieve the damage reduction for which it is designed. The Operations and Maintenance Division is responsible for ensuring that each flood control structure functions as designed and that all dams comply with the licensing standards set by the Arizona Department of Water Resources, (ADWR), as outlined in Arizona Revised Statutes (ARS).

mitigating the effects of erosion and sedimentation

what does this mean? define?

It is the goal of the Operations and Maintenance (O and M) Division to protect the lives and property of the citizens of Maricopa County by reducing the risks associated with storm water runoff by maintaining all flood control facilities to the highest functional standards. Maintenance activities for District structures include erosion, vegetation and vector control; maintenance of channels, floodways and outflow devices; and storm damage repair. O and M staff must also maintain excess property from severances and/or buy-out programs.

obtained

The Division provides both emergency response and storm monitoring services during a flood emergency or storm event. When an emergency exists, crews are dispatched to monitor the functions of the structures and operate outflow devices to control the release of storm water. Maintenance crews also transport and operate heavy equipment used to protect the public during emergencies and to perform temporary repairs to structures.

The significant objectives adopted by the Division include the following:

- Conduct annual inspections of each structure with the sponsoring agency and when applicable ADWR.
- Perform quarterly dam operational inspections to guarantee the proper operation of outlets and spillways.
- Maintain structure features to design standards. Keep floodways free and clear of silt, debris and obstructive vegetation. Maintain protective linings of banks and dikes for the long-term functional life of the structure.
- Monitor all significant impoundments.
- Participate in the District's Dam Safety Service.
- Develop comprehensive weed abatement and rodent and vector treatment service that correspond with the Division's maintenance activity.

The Division has also developed performance measures to help determine the effectiveness of their maintenance activities as well as for budgetary purposes. These performance measures include:

space

- Maintenance costs for improved channels and floodways per each thousand linear feet.
- Maintenance costs for unlined channels and floodways per each thousand linear feet.

- Maintenance costs for flood retarding structures, dams, levees, etc. per acre.
- Maintenance costs for mitigation projects, advance construction properties, basins, etc. per acre.

Property Management

The Property Management Activity was initiated when the District was formed in 1959. Funding for Property Management is accomplished through a combination of property rental/leasing, property sale and the District tax levy receipts. Currently, this activity is administered through the Lands Division, which is responsible for leasing, selling and managing District real property to generate income on an interim basis. This activity 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 activity 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 Activity are to aggressively manage all District property to their maximum benefit. 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 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. 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.) Excess lands comprise a small but valuable fraction of District ownership.

Acquisition and Relocation

The Acquisition activity was initiated for acquisition of the land rights, which are necessary to construct, operate and maintain Flood Control District (District) projects. These acquisitions are accomplished by fee purchase, easements, rights of entry, and leases. Acquisitions are initiated by the District's project managers, who after project confirmation, supply the Lands Division with delineation maps outlining the property area needed for each particular project. Title reports are then ordered by the acquisition staff to insure ownership and clarity of title. If needed, environmental surveys or site assessments are also ordered. Appraisals are ordered on each property affected, early on in the process. This is needed to give the acquisition negotiator and the property owner a current value of the property.

never use the word "ensure" or "insure"

In some cases, when a mutually agreed to acquisition price can not be reached by both parties, it is necessary for the District to utilize its condemnation authority, and acquire property by eminent domain. The District is given immediate possession of the property for project use through court action, while litigation takes place to determine fair and equitable value for the property acquired.

This requires the District to deposit what is perceived to be fair value until such time that a judge or jury can determine the final acquisition cost.

Another function of the acquisition process is relocating real property owners, or real property owner' tenants from property acquired by the District. The District performs these relocations in compliance with the "Uniform Act amended in 1987 by the Surface Transportation and Uniform Relocation Assistance Act of 1987, Title IV" (Public Law 100-17) regulations. This includes assistance in finding comparable real property or housing, as well as assistance with moving personal belongings from the acquired dwelling to the relocation dwelling.

An advanced land acquisition policy is in place to acquire property recognized to be needed for future projects. These advanced acquisitions will create a project inventory that will allow projects to be pulled from the shelf and quickly implemented, should the need arise. Advanced acquisition allows the District to acquire property at current values rather than wait and to acquire property at higher prices due to the rapidly appreciating market.

Environmental Activities

District structures receive stormwater runoff from over 9,200 square miles of watersheds within central Arizona. This water has varying levels of water quality characteristics. Consequently, conveyance and discharge of this stormwater runoff from ~~FCD~~ District structures has resulted in potential environmental impacts. The goal of the District's environmental process is to ensure that the operation, maintenance and construction of flood control structures comply with federal and State regulatory environmental requirements.

The ~~FCD~~ District's Environmental Process is directed at achieving several important and interrelated objectives. They are the following:

- 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, native dessert and riparian ecosystems and cultural resources.
- Reduce potential environmental hazards associated with hazardous materials that may exist on ~~FCD~~ District property.
- Develop a process to design and implement structural and nonstructural controls to improve stormwater quality.
- Implement a regional stormwater management process to assist Maricopa County municipalities in complying with National Pollutant Discharge Elimination System (NPDES) stormwater permitting requirements.
- Establish and implement a County policy regarding the use of ~~FCD~~ District 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 the following:

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

Flood Hazard Regulation Program

Floodplain Administration

The United States Congress passed the National Flood Insurance Act in 1968 which created the National Flood Insurance Program (NFIP). It was recognized that the success of the NFIP required widespread community participation. To meet the objectives, the 1968 Act required the publishing of flood insurance studies within five years for every community with a special flood hazard. These studies identify the special flood hazard areas and establish flood risk zones within the community. During the first years of the NFIP operation, it became evident that the time required to complete the detailed flood insurance studies would delay implementation in many communities. The Housing and Urban Development Act of 1969 expanded participation by authorizing an Emergency Program under which insurance coverage could be provided during the period prior to completion of a community's flood insurance study to offset the delay problem.

describe 1970 NFIP?

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.

Is this true? I thought ADEM was first, and they delegated to ADWR. Check with Ferrel Miller.

more?

Flood Hazard Boundary Maps, which delineated the boundaries of the community's special flood hazard areas, were prepared by FEMA in July 1979 using available data and approximate methods until detailed engineering studies could be conducted. These identified, on an approximate basis, the areas within a community subject to inundation by the 100-year flood (Zone A). The Flood Hazard Boundary Map was intended to assist communities in managing floodplain development, and identifying areas where development ~~would be~~ could occur within a floodplain.

Maricopa County entered into the Emergency Program in 1970 and proposed flood damage prevention requirements to regulate development in 1971. Flood Prone Area Maps, generated by

the "Emergency Program" has not been defined previously in that case, unless the previous paragraph was intended to do this. The date is wrong. We need more description here. lead in

the United States Geological Survey (USGS), were used for floodplain management during this time. The U.S. Army Corps of Engineers delineated portions of major watercourses such as the Salt, Gila, Agua Fria and New Rivers and Skunk and Cave Creeks after the District entered into the Emergency Program but prior to entering the regular NFIP program in 1979. The Federal Emergency Management Agency (FEMA) during this same period hired a private contractor to delineate additional reaches of the major watercourses and some of the major tributaries.

In 1990, the County volunteered to participate in the National Flood Insurance Program/Community Rating System (NFIP/CRS) 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. 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 NFIP/CRS is a means of comparing the Districts' floodplain management services with others nationwide. This activity provides a valuable benchmark to measure internal progress. This rating activity also provides an incentive to the ~~County~~ District because flood insurance policy holders receive a reduction on their insurance premiums based on the performance of the ~~County~~ Districts's floodplain management.

Under the CRS activity, premium rates are adjusted when a community meets three goals: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance.[5] Credits are awarded for 18 activities and the CRS recognizes ten classes. The first class has the most credit points and receives the largest premium discounts. The District currently has class 5 status and is a Category **C** community (10 or more repetitive losses).

In 1991, the District rated a five percent (5%) discount on flood insurance rates within the unincorporated County. In 1993, this improved to a fifteen percent (15%) discount rating. In 2001, the ranking improved to a 25 percent discount rating. Maricopa County rated in the top one percent in the nation. In 1994, Maricopa County was rated second highest in the nation. Other local communities participating in the CRS Program can receive credit based partly upon certain District activities within their corporate limits. This allows policyholders within those communities to also receive premium discounts.

More these to earlier. Try to maintain a timeline.

In 1975, Maricopa County adopted its first floodplain regulations administered and funded through the office of the County Manager. 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 were transferred from the County to the District.

Services provided by the Floodplain Management activity include the identification and regulation 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.

Restudies 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 ADMS have delineated floodplains in support of this program.

Drainage Administration

The Drainage Administration Activity reached maturity when the Drainage Regulations for Maricopa County were adopted by the Board of Supervisors on September 26, 1988. Adoption of the Regulations resulted in more efficient administration of the activity since the development drainage requirements came directly out of the Regulation as opposed to referencing the Subdivision Regulations, Zoning Ordinance and State Statutes. The Regulations 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. A revised drainage (as well as floodplain) fee schedule has been adopted in an attempt to reflect actual costs of the permitting/plan review effort.

Drainage Administration 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 activity 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.

Four primary services are provided by this activity. 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 to ~~ensure~~ enforce compliance with the Drainage Regulation. The intent is ~~to ensure the~~ that drainage is conveyed in a manner that does not adversely impact ~~any~~ property, including property within the development.

adjacent lots and property

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 requires formal notification

Kelli: "ensure" and "any" or "all" are legal nono's in this context.

to the violator. 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.

Drainage Administration 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. The services of this activity are available within the unincorporated areas of Maricopa County and the town of Care Creek.

Water Quality Administration

Sand and Gravel Administration

Flood Hazard Education Program

Public Information

Public Involvement and related activities were initiated as a separate function in 1985. Until this time, the District had no specific policy 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 activities for several key projects.

Prior to the development of a Public Involvement Program, public involvement responsibilities were often performed by technical staff (Project Managers and Engineers). Transferring these tasks and responsibilities to someone trained in the Public Relations field improved consistency of implementation and the effectiveness of public involvement programs. Project Managers were able 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 are very different from public information activities. The required specific knowledge about projects is obtained through close daily coordination with the project managers. The District has been able to realize considerable cost savings and better communication and coordination with project managers by having public relations expertise in-house.

For many years, the public was not as involved in the District's flood control studies or projects. Shifts in social values, technology, heightened neighborhood activism and awareness, and increased expectations of tax-supported services have made the District more visible and accessible. By striving to improve the level of involvement by the public in the decision-making process (through a pro-active public involvement activity) the District has improved its credibility. These positive results have greatly increased the District's chances for accomplishing its mission of flood protection.

Flood Warning and Data Collection

The flooding of the late 1970's and early 1980's made it clear that local authorities, including the District, lacked sufficient hydrometeorologic data to make decisions concerning evacuations and flood fighting efforts. 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. Maricopa County is just over 9,000 square miles yet it is affected by runoff from a drainage area greater than 50,000 square miles. 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.

The Board of Directors, realizing the importance of real-time hydro-meteorologic data, authorized District staff to initiate a flood hazard information/mitigation 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 Automated Local Evaluation in Real Time (ALERT).

Flood Hazard Identification Program

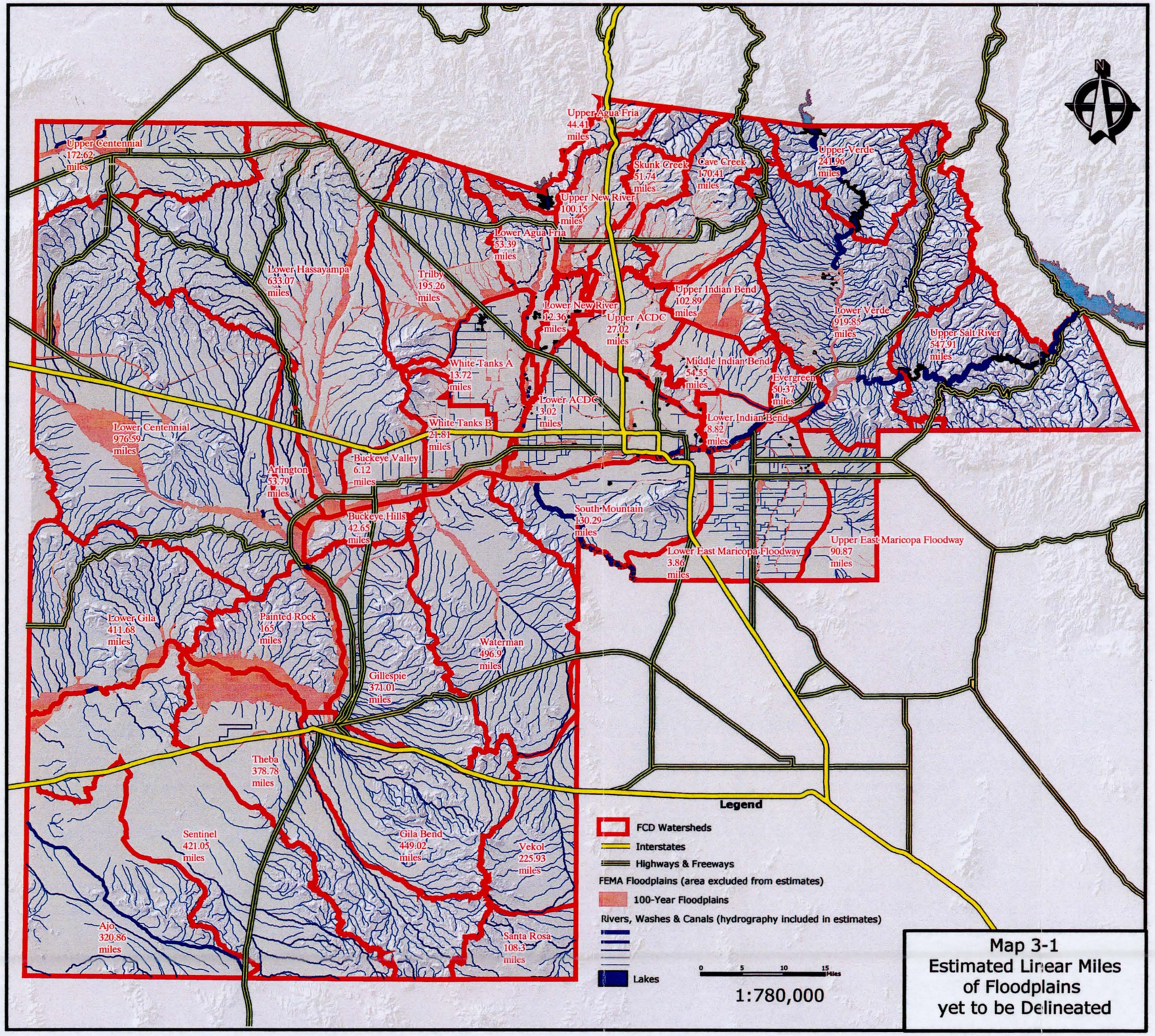
General

The first step towards an independent planning function began with the initiation of Area Drainage Master Studies (ADMS) in 1983. This activity 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.

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.

Planning promotes the District's mission of "...reducing flood risks for the people of Maricopa County..." by preparing comprehensive regional studies and analyses, identifying locations and property at risk from potential flooding and identifying regional flood control facilities which will be required in growth areas. Following an analysis of existing and future flooding problems, alternative solutions are developed to determine the most cost effective and publicly acceptable project. Recommended projects are then prioritized for inclusion in the District's CIP.

The District's planning activities are integrated with the regulatory and floodplain delineation activities. Information developed by the planning branch is utilized for completing floodplain delineations and regulation of new developments. Conversely the planning branch utilizes information developed in the regulatory and floodplain delineation activities. Activities in the Planning Program include: Area Drainage Master Studies (ADMSs) and Master Plans (ADMPs); Watercourse Master Plans (WCMPs); site specific master plans; as well as project pre-design studies; and the coordination of interagency cooperative projects and agreements.



Map 3-1
Estimated Linear Miles
of Floodplains
yet to be Delineated

Floodplain Delineation

The District, recognizing the importance of a pro-active floodplain management program and the potential for problems resulting from the continual growth of new development within the County, initiated a floodplain delineation activity in 1986. This service was established to add detail to the remainder of the original Flood Prone Area Maps and to delineate those watercourses yet to be studied. The District has been studying about 130 linear miles of floodplains per year with approximately 1,780 linear miles now completed and about 6,950 linear miles remaining to be done.

Map 3-1 shows the watersheds designated by stream symbology on USGS quadrangle and existing floodplain maps which will help assess and prioritize the remaining work. It should be noted that these watercourses are also depicted on the current Flood Insurance Rate Maps (FIRMs) for Maricopa County, which reflect the regional streams needing delineation to preserve the conveyance of runoff from the mountains to the confluence with the existing mapped floodplains.

The Floodplain Delineation Activity is currently identifying floodplains using both detailed and approximate methods, with the priority shifting to the approximate methodology. These approximate delineations will be converted to detailed delineations as Area Drainage Master Studies and Plans are developed. This effort allows for sound floodplain management so that future development will not impede, divert or retard the conveyance of floodwaters to the detriment of others as well as reducing the flood damage potential to the development.

Ongoing A Zones and detailed delineations as of February 2000 totaled 384 linear miles for a cost of $2.5 million. The proposed delineations from this February report was 700 linear miles for an ? estimated cost of $1.5 million. The February 2001 report update indicated 3,184 linear miles of delineations to be ongoing. There were 1,200 linear miles being proposed at $2.7 million that the Floodplain Delineation Branch would be undertaking and 500 additional linear miles in the current ADMP studies in process. On the average approximately 1,000 linear miles a year for next 6-7 years are being completed each year.

We need to distinguish between approximate and detailed study lengths. This is confusing as is.

Area Drainage Master Studies/Plans Program

Area Drainage Master Studies (ADMS) were originally conceived in 1983 to provide technical information to define and quantify flood hazards. Authority for these studies is found in the Floodplain/Drainage Regulations. The information obtained is then used to identify areas that which require flood mitigation, and to guide future development. A goal of the District is to complete Area Drainage Master Plans for all of the developable portion of the County by 2010 subject to available funds. The enormity of the ADMS program required that the county be divided into smaller study areas. The ADMS study areas were identified by first establishing the watershed boundaries, and then subdividing these to arrive at study areas which could reasonably be completed. There are forty-eight ADMS areas established from the watershed boundaries, ranging in size from 15 to 580 square miles. The areas with known existing flooding areas and with existing and expected development are given priority.

The purpose of the ADMS studies is to identify existing flood-prone areas as well as projections of future conditions. To identify flood hazards a series of tools such as computer rainfall-runoff models; topographic mapping; soils data developed by the U.S. Department of Agriculture Natural

Resources Conservation Service; and land use data developed by the Maricopa Association of Governments are used.

The purpose of the ADMP studies is to develop plans to mitigate the flood hazards identified in the preceding ADMS. The major components of the ADMP studies include public involvement, biological and archaeological inventories, landscape character assessment, inventory of known hazardous waste sites, engineering analysis and cost estimates for alternative flood protection facilities, evaluation of multi-use potential, and detailed engineering analysis of the recommended project features.

The planning program has been acceleration to get ahead of development. The various studies completed and underway are listed in Chapter by watershed. Additionally, Map 5-1 shows the location and status of the current ADMS/ADMP's and Watercourse Master Plan.

Watercourse Master Plans (WCMPs)

ARS §48-3609.01 authorizes the District to perform Watercourse Master Plans. These are similar to ADMS/ADMP program but focused on watercourses not watersheds. The intent of the watercourse master plan concept is to bring together the public, the business community, and the concerned agencies for the purpose of identifying unique characteristics that should be preserved, and to plan for ongoing uses, both commercial and recreational, that are often neglected in traditional floodplain management. Too often, neglect of these issues results in structural approaches to solve problems that traditional methods have created.

The primary goal of the WCMP activity is to protect existing and future residents from possible damages associate with floods up to and including the 100-year event. In addition, minimization of future expenditures of public funds for flood control and emergency management is also of paramount importance.

Watercourse Master Plans develop and identify alternative plans for providing flood control. Traditional structural flood control alternatives are compared to non-structural flood control alternatives. Selected solutions are based upon system hydrology, hydraulics, lateral migration potentials, and sediment trends. It is the objective of the District to provide opportunities for multiple uses including recreation, groundwater recharge, and other related enhancements that would be implemented by others providing they are consistent with the District's flood control mission. The non-structural flood control alternatives are in addition to traditional floodplain management tools. It is the District's objective to partner with the sand and gravel industry and other property owners to develop plans and implementation strategies that are mutually beneficial.

Integrating Projects into the Natural & Urban Environment

The District has made a commitment to insuring that new flood control projects not only protect people and property from flooding threats, but also provide additional benefits. These benefits can include increased protection for natural habitat, new recreational facilities and open space, and aesthetically pleasing designs that contribute to the revitalization of urban areas. Although Maricopa County is located in a largely desert environment, much of the County is subdivided by canals, rivers, creeks and washes, and these linear attributes are a significant feature of the physical character of the area. Dams, retention basins, channels and outfalls can also be found

throughout the County, and can have a major beneficial or negative impact on adjacent neighborhoods and natural areas depending on the design and management of these facilities.

Summary

Maricopa County is a vast area with a mix of issues. The complexity of the range of geologic conditions in conjunction with rapid population growth has resulted in the development of a series of programs for flood management. In 1960 the County's population was 663,510. In 2000 it was at 2,954,150. With growth spreading outward as indicated in Chapter 2, no one program can provide the solutions to the entire County's flood hazard remediation. In addition to the expanse of programs now provided by the District to meet the challenges of the diverse environment as well as the desires of the public, the District is starting other initiatives. The strategic direction of the District is addressed in Chapter 6 as well as descriptions of some of the newer initiatives.

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Endnotes

[1] Taken from Five-Year Capital Improvement Program, FY 99-00 to 03-04, October 15, 1999. p. 11.
[2] Figures taken from Mike Alexander analysis dated 6/27/00
[3] Ibid.
[4] Updated to 2000 values by Mike Alexander, 06/27/00.
[5] FEMA. Community Rating System. (2000). http://www.fema.gov/nfip/crs.htm. (September 14, 2000).

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CHAPTER 4. FLOOD CONTROL PROGRAM REPORT

Overview

The previous chapters give an insight into the physical and man-made conditions in Maricopa County. This information and data are then used to assess flood control problems for the District as required by the Arizona Revised Statutes (ARS). An initial survey of the flood control problems was done in the1963 Report, discussed in Chapter 1. A series of reports and Capital Improvement Programs have followed to address the recommended solutions in accordance with the guidance from ARS. In general those reporting requirements are as follows:

Arizona Revised Statute Requirements (§ 48-3616)

- Prepare a report describing existing flood control facilities in the area (see chapters 1 and 4),
- Recommendations as to cooperation between the District and the owner(s) of existing facilities, recommendations and a preliminary plan for the construction or other acquisition of facilities to carry out the purpose of the District,
- A description of the property proposed to be acquired or damaged in performing the work,
- A program for carrying out the regulatory functions (see chapter 3),
- A map showing the District boundaries and location of the work proposed to be done and property taken or damaged,
- An estimate of the cost of the proposed work, and
- Such other things as the Board of Directors may request.

This report shall be prepared at least every five years beginning in 1985 discussing past efforts of the District in eliminating or minimizing flood control problems and stating the planned future work of the District to eliminate or minimize remaining flood control problems.

In the 42 years the District has been in existence significant changes and growth have taken place in Maricopa County. In Chapter 1, Table 1-1 list approximately 35 structural projects and several maintenance projects identified for flood management in Maricopa County as determined at the time of the District's 1963 Program Report. The population of Maricopa County was approximately 800,000 in 1963 and approximately 120 square miles of land were covered with urban development. The population of Maricopa County is 2,954,150 from the 2000 U. S. Census numbers and growth has expanded to over 625 square miles of the 9,226 square miles of land in the County. This rapid growth has necessitated numerous projects and studies to be identified and completed.

Present Status of all Projects Since 1990

In Chapter 1 the 1963 and 1991 Comprehensive Flood Control Program Reports are discussed. An update to the 1963 list of projects to present is depicted in Table 4-1. Capital Improvement Programs have been prepared by the District for the last 30 plus years, prioritizing additional projects beyond those identified in the 1963 Report for the purpose of eliminating or minimizing flooding problems. Some projects have been identified over the years but were never done. This is due to funding constraints, changed site conditions, or other reasons. Completed projects are described in more detail for each watershed in the Watershed reports found in Appendix B.

Table 4-1 Structural Project Update from 1963 to present

Group No. 1 - Projects Recommended for Immediate Construction

Drainage Area	Location	Job Description	Status
1	Gillespie Dam to 107th Ave.	Channel Clearing	Begun 1980
27	Lower Indian Bend	Floodway Channel	completed 1980, maintained by Scottsdale
19-23	Agua Fria, New River, and Skunk Cr.	Channel Clearing	completed 1989-1990
22	Arizona Canal-Cave Cr. To Skunk Cr.	Divert flood water North of Canal	completed 1992
25	Dreamy Draw	Earth Dam	completed 1973
22	North Mt.-Arizona Canal, 20th St. to 23rd Ave	Construct Channel	begun 1990
22	New River NW of Glendale	Earth Dam	
22	NW of Adobe	Earth Dam	completed May 6, 1982
22	Lower Cave Cr. Dam Site	Earth Dam	completed 1980
22	Union Hills Diversion	Lined Channel	started in FY 1992-1993
22	64th St. to New River	**Total Deer Valley**	
22	Marywale-Glendale Drain	Line Channel	partially done - Sunset Basin
22	Glendale-Peoria Drain	Lined Channel	
7	Casandro Wash	Earth Dam	complete 1996
7	Sunset & Sunny Cove Washes	Earth Dams	completed September 15, 1976
32	Buckborn-Mesa	Levees & Channels	completed 1988 except Weekes Wash FRS
12	Bender & Sand Tanks Washes, Gila Bend	Levees	No Action

Recommended Projects Group II - Subject to Availability of Funds

32	Apache Junction-Gilbert	Levees & Channels	Powerline FRS & Floodway completed 1967 - East Maricopa Floodway completed 1989
32	Mesa-Chandler-Gilbert	Channel	replaced by Price Road Drain
32	Williams-Chandler	Levees & Channels	Vineyard FRS completed 1968 - Rittenhouse FRS completed 1969
9	Buckeye-Palo Verde	Levees & Channels	FRS #1 completed 1974 - FRS #2 completed March 1975
22	W. Phoenix-Marywale	Channel	Marywale Stadium
22	North Phx. Mt.-Old Cross-Cut Canal	Channel	part of ACDC dedicated in 1993

Table 4-1 Structural Project Update from 1963 to present (con't)

Recommended Projects Group III - Subject to Availability of Funds			
7	Sols Wash	Channel Alignment & Protection	no action
7	Powder House Wash	Earth Dam	
7	Cave Creek Town	Earth Levee	no action
31	Maxwell Dam (Flood Control)	Earth Dam	modifications to existing dams, renamed Orme Dam
24	Cave Creek Dam (Old)	Levee	eliminated, Cave Buttes Dam constructed
33	Queen Creek	Channel	completed 1989 - part of the EMF
Group IV - Projects Deferred as not Feasible at this time			
7	Flying "E" Wash Wickenburg	Earth Dam	to be considered in Wickenburg ADMS FY 1990/1991
26	Guadalupe Watershed	Levees & Channels	FRS completed April 1975
26	South Mountain, 40th St. to 75th Ave.	Levees & Channels	to be looked at in Laveen ADMS FY 1990/1991
28	Indian Bend Wash Above Arizona Canal	Channels	completed April 1979
33	Santan Watershed	Levees & Channels	no action
4	Harquahala Valley	Levees & Channels	completed
6	Box Canyon	Earth Dam	no action
7	Sols Wash (Matthie Dam)	Earth Dam	to be considered in Wickenburg ADMS FY 1990/1991
8	Upper New River	Earth Dam & Channel	completed in February 1985
4	Tonopah and Winters Valley	Levees and Channels	no action
4	Eagle Tail Mountain	Levees and Channels	no action

Table 4-1 Structural Project Update from 1963 to present (con't)

	Addition Projects since 1963 Report	
southeast	Alma School Drain	1969
	Sossaman Channel and Basin	1977
	Guadalupe Channel	1989
	Gilbert Crossroads Park Basin	1992
	University Drive Basin	1993
	Price Drain	1997
	Rittenhouse Road Channel	1998
	Salt River Channel	
	Holly Acres Levee and Bank Stabilization	1984
	Agua Fria Channelization	1988
	Old Cross Cut Canal	1991
	New River Channelization	1993
	Arizona Canal Diversion Channel (ACDC)	1994
	Camelback Ranch Levee	1999
	Indian School Road Drain	
	48th Street Drain	
	Ivanhoe and Erie Storm Drains	2001
northeast	Sun City Drain	1991
	Skunk Creek Channel and Levee	
	Adobe Dam	1984
	Paradise Valley Detention Basin #4	
	PVSP Cactus Road Improvements	1991
	Cave Creek Channelization	1991
	Skunk Creek Channelization	1991
	Scatter Wash Channel	1995
	Upper East Fork Cave Creek	1996
	10th Street Wash Basins	1997
northwest	Centennial Levee	1985
	Saddleback FRS and Diversion	1981
	Casandro Wash Dam and Outlet	1996
	El Mirage Drain	1990
	Sun City West Drains	1990
	Dysart Drain	1996
	Colter Channel	
	Bullard Wash	2001

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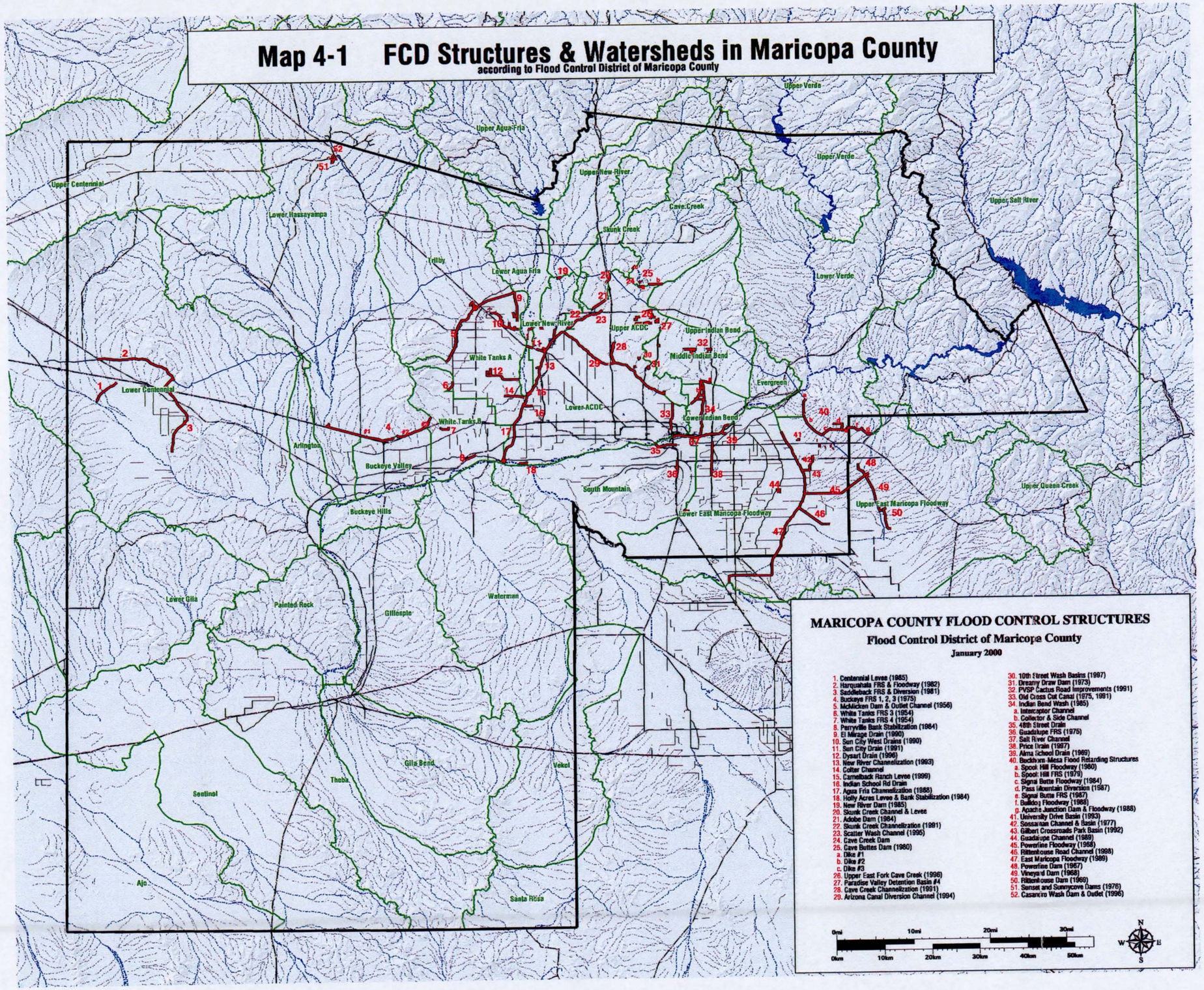
Map 4-1 FCD Structures & Watersheds in Maricopa County

according to Flood Control District of Maricopa County



MARICOPA COUNTY FLOOD CONTROL STRUCTURES

Flood Control District of Maricopa County

January 2000

1. Centennial Levee (1985)
2. Harquahala FRS & Floodway (1982)
3. Saddleback FRS & Diversion (1981)
4. Buckeye FRS 1, 2, 3 (1975)
5. McMicken Dam & Outlet Channel (1956)
6. White Tanks FRS 3 (1954)
7. White Tanks FRS 4 (1954)
8. Perryville Bank Stabilization (1984)
9. El Mirage Drain (1990)
10. Sun City West Drains (1990)
11. Sun City Drain (1991)
12. Dysart Drain (1996)
13. New River Channelization (1993)
14. Colter Channel
15. Camelback Ranch Levee (1999)
16. Indian School Rd Drain
17. Agua Fria Channelization (1988)
18. Holly Acres Levee & Bank Stabilization (1984)
19. New River Dam (1985)
20. Skunk Creek Channel & Levee
21. Adobe Dam (1984)
22. Skunk Creek Channelization (1991)
23. Scatter Wash Channel (1995)
24. Cave Creek Dam
25. Cave Buttes Dam (1980)
    a. Dike #1
    b. Dike #2
    c. Dike #3
26. Upper East Fork Cave Creek (1996)
27. Paradise Valley Detention Basin #4
28. Cave Creek Channelization (1991)
29. Arizona Canal Diversion Channel (1994)
30. 10th Street Wash Basins (1997)
31. Dreamy Draw Dam (1973)
32. PVSP Cactus Road Improvements (1991)
33. Old Cross Cut Canal (1975, 1991)
34. Indian Bend Wash (1985)
    a. Interceptor Channel
    b. Collector & Side Channel
35. 48th Street Drain
36. Guadalupe FRS (1975)
37. Salt River Channel
38. Price Drain (1997)
39. Alma School Drain (1969)
40. Beckhorn-Mesa Flood Retarding Structures
    a. Spook Hill Floodway (1980)
    b. Spook Hill FRS (1979)
    c. Signal Butte Floodway (1984)
    d. Pass Mountain Diversion (1987)
    e. Signal Butte FRS (1987)
    f. Bulldog Floodway (1988)
    g. Apache Junction Dam & Floodway (1988)
41. University Drive Basin (1993)
42. Sossaman Channel & Basin (1977)
43. Gilbert Crossroads Park Basin (1992)
44. Guadalupe Channel (1989)
45. Powerline Floodway (1988)
46. Rittenhouse Road Channel (1998)
47. East Maricopa Floodway (1989)
48. Powerline Dam (1967)
49. Vineyard Dam (1968)
50. Rittenhouse Dam (1969)
51. Sunset and Sunnycove Dams (1976)
52. Casandro Wash Dam & Outlet (1996)

0mi 10mi 20mi 30mi
0km 10km 20km 30km 40km 50km

N W E S

this list could be bigger. Its hard for 48 year old eyes to read.

Analyzing the Remaining Problems by Watersheds

Within the boundaries of Maricopa County there are 37 watersheds now identified and 2 outside the District's jurisdiction that are analyzed in this Plan (see Map 4-2). A number of the 37 watersheds are partially outside the District's jurisdiction. This Plan concentrates on those areas that are within Maricopa County. These watershed boundaries were generally determined by major drainage areas and are usually named for watercourses or other features within the watershed boundary. In this Report the watersheds are divided into four regions for ease of mapping and discussion. These are not political boundaries but geographic. The regions are labeled as follows:

- Southeast Region
- Northeast Region
- Northwest Region
- Southwest Region

A broad summary of each Region is presented in this chapter with specific lists by each watershed for the District's completed and planned projects. Detailed descriptions of those completed projects are in the individual watershed write-ups in Appendix B. As noted in Chapter 2, Maricopa County is made up of mountains, hills and valleys with a variety of soils and vegetation types. These vast differences ~~from one part of~~ the County make it necessary to study watersheds individually in order to determine what the appropriate solutions are for flood management in those areas. In addition, these watersheds are at varying stages of urbanization which requires different levels of activity on the District's part.

Table 4-2 lists the watersheds alphabetically and a summary of information such as area, expected population growth, linear miles of delineations, County road closures, remaining land to be developed, structures in the floodplain and erosion hazard zones, and floodplain and drainage permits issued. This information is critical for prioritizing the order in which studies and projects will be done.

Table 4-3 shows a summary of the priority ranking of each of the watersheds. The individual ranking sheets are included with the watershed write-ups in the Appendix. There are several levels of ranking needed to fully address the issues across the County and identify the appropriate projects. The phase I prioritization weighs the criteria presented above. A phase II risk assessment will look in more detail at soil types, slopes, type of future development, projects underway, and the District's flood management responsibilities within that region. The prioritization and phase assessment processes are discussed in Chapter 5.

The District performs ongoing operations and maintenance (O and M) of projects throughout the County. Natural channel clearing and maintenance of excess land also must be addressed in the maintenance program. The Districts budget for O and M is approximately 6.1 percent of the overall budget. Maintenance requirements must also be addressed when future projects are being considered for each watershed.

Table 4-4 lists the upcoming CIP projects for FY 01-02 to 05-06 for the District and Map 4-3 shows the location of each project. In addition, there are four maps for each Region that depicts the following: Developable Lands, Soil Erosion, and Floodplains; Land Use; Land Ownership and Projected Populations; and Residential Completions.

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Table 4-2 Watershed Summary and Prioritization Critical Elements

Watershed	Area (square miles) inside County Boundary	Population (1995)	Projected Population (2025)	Population Change (1995-2025)	100,000 USGS Hydrography (linear miles)	Detailed Delineations (linear miles) [1]	Delineations remaining to be done (linear miles) [2]	County Road Closures (1996-2000)	Potential Developable Land (square miles) [3]	Structures in the Floodway	Structures in the Floodplain	Structures in a Moderate or Severe Erozion Hazard Zone	Floodplain Use Permits Issued (1990 - 1999)	Drainage Clearance Permits Issued (1990 - 1999)
Ajo ***	418.0	4	59	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arlington	65.9	606	5,011	4,405	66.9	13.0	53.9	21	59.40	9	4	13	6	162
Buckeye Hills	57.5	78	5,640	5,562	52.3	10.0	42.3	0	3.78	0	0	0	1	9
Buckeye Valley	70.0	8,440	39,983	31,543	43.0	37.0	6.0	32	57.91	0	37	37	7	497
Cave Creek	193.0	16,669	105,000	88,331	280.3	109.9	170.4	37	63.00	52	2,173	370	402	9,392
Evergreen	39.0	1,969	14,377	12,408	60.0	9.6	50.4	0	2.15	0	0	10	0	1,195
Gila Bend	350.0	1,095	1,752	657	468.0	19.0	449.0	12	24.93	12	116	14	0	40
Gillespie	321.0	379	10,220	9,841	409.0	38.0	371.0	11	84.70	0	0	0	0	29
Lower ACDC	234.0	772,467	1,134,100	361,633	83.0	80.0	3.0	26	77.31	58	6,370	6,235	50	20,000
Lower Agua Fria	105.5	20,882	68,698	47,816	118.4	65.0	53.4	18	47.70	1	13	13	2	3,561
Lower Centennial ***	989.5	1,589	16,993	15,404	1,073.0	97.0	976.0	103	347.03	4	42	35	17	130
Lower East Maricopa Floodway ***	265.0	556,096	986,188	430,092	72.0	68.0	4.0	31	87.00	0	3,959	3,761	39	57,600
Lower Gila ***	379.4	195	2,000	1,805	440.5	28.9	411.6	11	62.90	0	4	3	1	4
Lower Hassayampa ***	799.9	9,691	32,457	22,766	927.5	294.5	633.0	79	390.82	122	252	246	18	677
Lower Indian Bend	41.9	94,551	103,704	9,153	27.0	18.2	8.8	3	0.50	1	692	1	5	694
Lower New River	41.4	61,321	143,475	82,154	28.0	15.7	12.3	35	16.93	2	40	42	N/A	14,038
Lower Verde	558.9	23,556	111,277	87,721	996.5	76.6	919.9	24	55.20	3	11	1	8	6,950
Middle Indian Bend	93.0	184,042	236,070	52,028	54.6	16.5	38.0	0	9.06	2	330	279	2	16,307
Painted Rock	187.7	91	663	572	205.8	40.8	165.0	3	16.20	0	0	0	0	0
Santa Rosa ***	106.6	N/A	N/A	N/A	108.3	0.0	108.3	N/A	0.00	N/A	N/A	N/A	N/A	N/A
Sentinel ***	627.0	134	1,426	1,292	446.0	25.0	421.0	0	55.23	0	3	3	0	2
Skunk Creek	88.0	11,814	79,628	67,814	105.3	53.6	51.7	46	41.10	85	155	148	93	3,123
South Mountain	245.0	226,051	409,043	182,992	167.0	36.0	131.0	29	46.90	1	453	449	12	17,000
Theba ***	433.0	608	2,220	1,612	429.0	50.0	379.0	10	125.65	0	28	12	0	3
Trilby (Wittmann) ***	289.0	3,474	27,623	24,149	372.6	177.0	195.6	77	210.36	4	28	31	60	530
Upper ACDC	118.5	341,822	462,706	120,884	89.8	62.8	27.0	0	25.00	51	1,661	1,595	18	20,722
Upper Agua Fria **	61.5	11	1,771	1,760	66.4	22.0	44.4	0	7.23	0	0	0	N/A	2
Upper Centennial ***	231.0	257	9,017	8,760	194.3	22.0	172.3	20	172.20	11	131	141	24	106
Upper East Maricopa Floodway **	131.3	96,565	299,706	203,141	118.0	27.0	91.0	196	68.00	0	70	70	16	16,600
Upper Hassayampa *	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Upper Indian Bend	98.6	13,165	185,240	172,075	144.7	41.8	102.9	0	63.99	0	4,818	1,000	72	12,525
Upper New River ***	143.0	2,984	76,017	73,033	160.8	60.7	100.2	15	68.58	3	40	19	17	360
Upper Queen Creek *	[143]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Upper Salt River **	357.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Upper Verde **	168.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vekol ***	189.6	16		-16	225.0	0.0	225.0	0	25.06	0	0	0	0	2
Waterman ***	461.0	2,982	41,302	38,320	521.5	24.0	497.5	45	144.17	0	1	1	15	1,100
White Tank A	132.1	60,138	206,924	146,786	86.7	72.9	13.7	138	92.25	0	270	270	26	16,751
White Tank B	108.9	14,192	123,353	109,161	88.1	66.3	21.8	78	76.81	4	17	21	25	271
	9,199.7	2,527,934	4,943,643	2,415,654	8,729.13	1,778.84	6,950.3	1100	2,629.05	425	21,718	14,820	936	220,382

* Watershed completely outside of Maricopa County boundary. 2

** 90% of Watershed outside of Maricopa County Boundary. 3

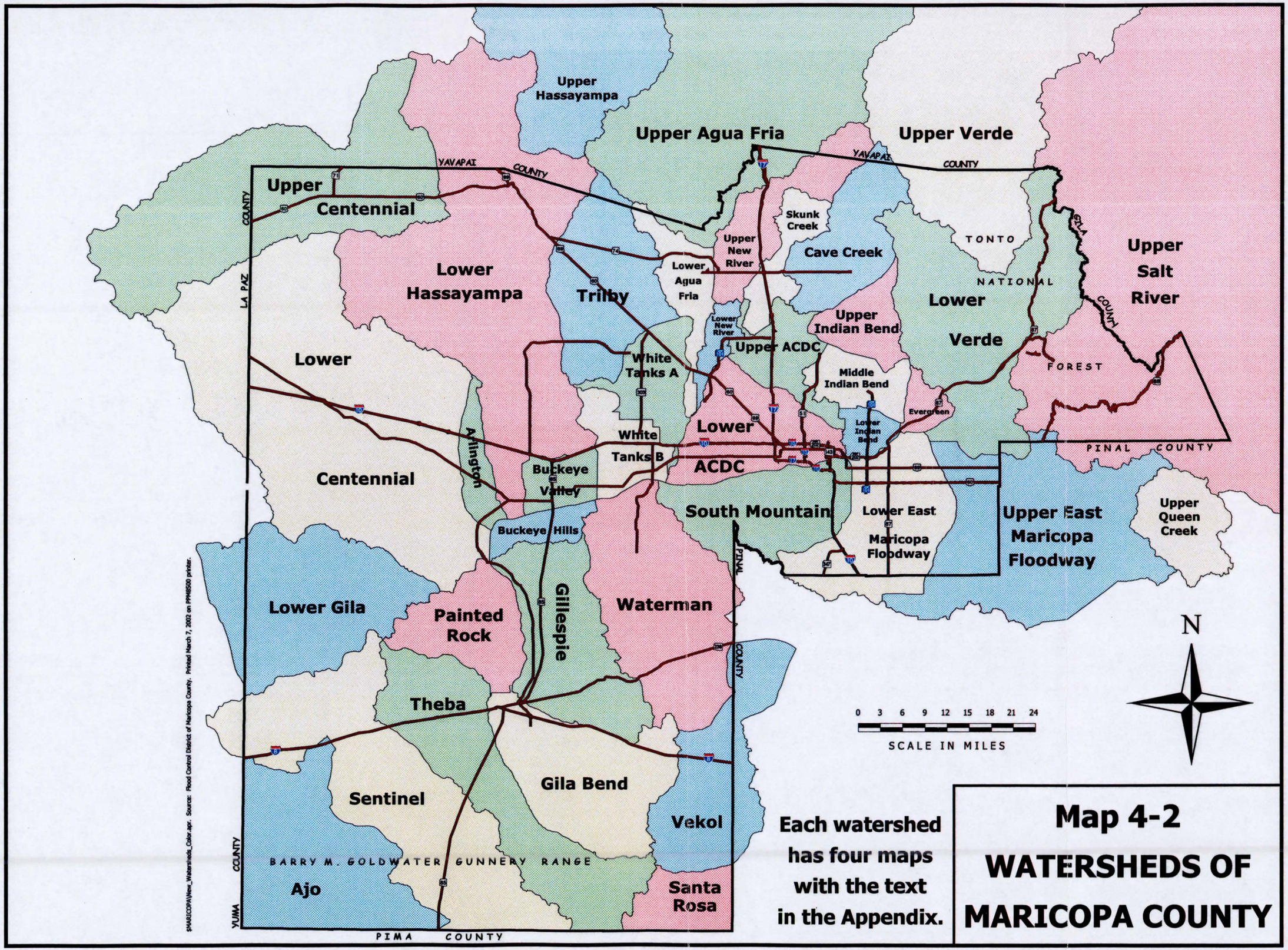
*** A portion of the Watershed outside of Maricopa County Boundary. 12

[1] Linear miles of floodplain already delineated. Based on 100-year floodplains and floodways. 100,000 USGS hydrography used as well as "lineal miles" digitized by hand.

[2] Estimate of linear miles yet to be delineated within each watershed. Developed by subtracting USGS 100,000 hydrography from delineated floodplains and tabulating the remainder for each watershed.

[3] Estimate of land area remaining to be developed within a watershed. Estimated by subtracting areas with 15% or more slope (based on USGS digital elevation model data) and also subtracting areas already developed (based on 1995 MAG landuse data) from state trust land and private land (based on ALRIS's land coverage). Also subtracted from the totals was areas within 100-year floodways (FCD fpznfema cover). FEMA

See Red lines on this sheet.



Can we add colored lines to show the 4 Regional boundaries?

Each watershed has four maps with the text in the Appendix.

Map 4-2

WATERSHEDS OF MARICOPA COUNTY

$MARICOPA\New_Watersheds_Color.apr. Source: Flood Control District of Maricopa County. Printed March 7, 2002 on PM8500 printer.

Table 4-3 Summary of Priority Ranking by Watershed

Watershed	Score	Comments
Lower ACDC	320	8 past structural projects, 6 new
Lower Hassayampa ***	320	
Upper ACDC	280	
Lower East Maricopa Floodway ***	275	I past structural project, 10 new
Cave Creek	270	
Upper Indian Bend	250	
Lower Centennial ***	220	
South Mountain	205	2 past structural projects, 6 new
Skunk Creek	200	
White Tank A	195	
Lower Verde	190	
Upper East Maricopa Floodway **	175	12 past structural projects, 9 new
Trilby (Wittmann) ***	160	
Waterman	155	
White Tank B	155	
Middle Indian Bend	150	
Lower Indian Bend	145	
Lower Gila ***	140	
Sentinel ***	140	
Theba ***	135	
Gila Bend	130	
Upper Centennial ***	130	
Upper Salt River **	130	
Gillespie	125	
Upper New River ***	125	
Arlington	120	
Lower New River	120	
Ajo ***	115	
Buckeye Valley	115	
Upper Verde **	115	
Buckeye Hills	100	
Evergreen	100	
Lower Agua Fria	100	
Painted Rock	100	
Santa Rosa ***	100	
Upper Agua Fria **	100	
Vekol ***	100	
Upper Hassayampa *	0	Watershed outside of County boundary
Upper Queen Creek *	0	Watershed outside of County boundary

* Watershed completely outside of Maricopa County boundary. (2)
** 90% of Watershed outside of Maricopa County boundary. (3)
*** A portion of the Watershed outside of Maricopa County boundary. (12)

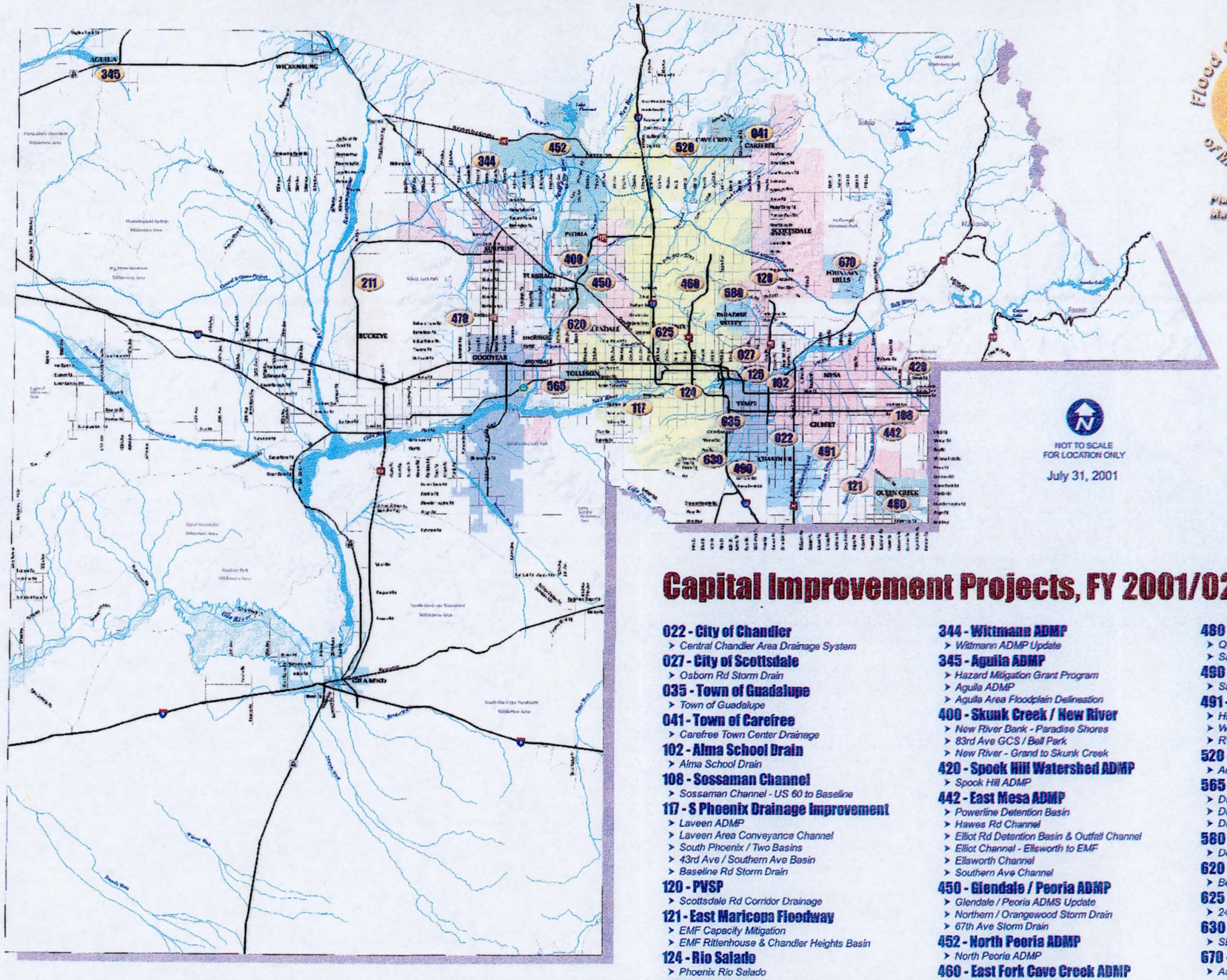
Table 4-4 Five Year CIP FY 01/02 to FY 05/06

Summary				Five-Year CIP x $1,000					
City	Dist.	Act#	Description	FY 01/02	FY 02/03	FY 03/04	FY 04/05	FY 05/06	5-Yr Total
			Tax Rate:	0.2319					
Multiple	All	C001	FCD Operations	154	0	0	0	0	**154**
Chandler	1	C022	Central Chandler Area Drainage System	1,673	805	1,635	1,269	0	**5,382**
Scottsdale	2	C027	City of Scottsdale	542	0	0	0	0	**542**
Guadalupe	5	C035	Town of Guadalupe	1,621	2,700	0	375	0	**4,696**
Carefree	2	C041	Town of Carefree	275	0	0	0	0	**275**
Multiple	All	C050	Dam Safety Project	1,308	1,250	1,100	1,100	6,100	**10,858**
Multiple	All	C051	Candidate Assessment Reports	100	100	100	100	100	**500**
Mesa/SRP	1	C102	Alma School Drain	100	0	0	0	0	**100**
Mesa	2	C108	Sossaman Channel	82	0	0	0	0	**82**
Phoenix, UMC	5	C117	South Phoenix Drainage Improvement	10,985	7,800	150	2,500	2,500	**23,935**
Scottsdale	2	C120	PVSP	150	150	1,000	2,100	0	**3,400**
Gilbert/Mesa/UMC	1	C121	East Maricopa Floodway	3,197	3,461	4,000	6,000	6,000	**22,658**
Phoenix	5	C124	Phoenix Rio Salado	8,386	0	0	0	0	**8,386**
Tempe/Mesa	2	C125	Tempe/Mesa Habitat Mitigation	250	0	1,000	0	0	**1,250**
Buckeye/UMC	4	C211	Buckeye/Sun Valley ADMP	600	1,200	0	0	0	**1,800**
Surprise/UMC	4	C344	Wittmann ADMP Update	600	1,200	0	0	0	**1,800**
Aguila	4	C345	Aguila ADMP	1,212	0	0	0	0	**1,212**
Multiple	4	C400	Skunk Creek/New River	450	1,550	2,300	0	0	**4,300**
Mesa/UMC	2	C420	Spook Hill ADMP	414	0	0	800	5,000	**6,214**
Mesa/UMC	1,2	C442	East Mesa ADMP	8,081	9,135	5,555	5,000	1,500	**29,271**
Multiple	4	C450	Glendale/Peoria ADMP	239	0	0	0	1,385	**1,624**
Peoria/UMC	4	C452	North Peoria ADMP	205	0	0	0	0	**205**
Phoenix	3	C460	East Fork Cave Creek ADMP	1,000	0	0	0	0	**1,000**
Multiple	4	C470	White Tanks ADMP	3,504	6,480	15,400	13,600	10,600	**49,584**
Queen Creek	1	C480	Queen Creek ADMP	960	1,050	300	2,000	2,700	**7,010**
Chandler	1	C490	Gilbert/Chandler ADMP	74	0	0	0	0	**74**
Multiple	1,2	C491	Higley ADMP	2,178	415	250	4,000	5,000	**11,843**
Phoenix/UMC	3,4	C520	Adobe Dam ADMP	1,100	500	0	0	0	**1,600**
Multiple	5	C565	Durango ADMP	2,293	4,700	8,200	6,900	4,000	**26,093**
Paradise Valley	2	C580	ACDC ADMP	0	0	0	0	0	**0**
Phoenix/Glendale	4,5	C620	Maryvale ADMP	995	8,099	6,000	6,000	6,000	**27,094**
Phoenix	3	C625	Metro ADMP	0	3,500	3,500	0	0	**7,000**
Phoenix	1	C630	Foothills ADMP	41	0	0	0	0	**41**
Fountain Hills	2	C670	Fountain Hills ADMP	0	0	0	0	700	**700**
			Estimated External Expense	**$52,769**	**$54,095**	**$50,490**	**$51,744**	**$51,585**	**$260,683**
			CIP Project Contingency	$2,551	$2,455	$2,510	$2,256	$2,415	
			Force	$2,626					
			Projects Total	**$57,946**	**$56,550**	**$53,000**	**$54,000**	**$54,000**	

*Projects not completed during the five year CIP

it would be helpfull if this table ~~was~~ was color-coded by region.

FIVE-YEAR CAPITAL IMPROVEMENT PROGRAM



Flood Control District of Maricopa County

Planning and Project Management Division

Capital Improvement Projects, FY 2001/02 - 2005/06

022 - City of Chandler
- Central Chandler Area Drainage System

027 - City of Scottsdale
- Osborn Rd Storm Drain

035 - Town of Guadalupe
- Town of Guadalupe

041 - Town of Carefree
- Carefree Town Center Drainage

102 - Alma School Drain
- Alma School Drain

108 - Sossaman Channel
- Sossaman Channel - US 60 to Baseline

117 - S Phoenix Drainage Improvement
- Laveen ADMP
- Laveen Area Conveyance Channel
- South Phoenix / Two Basins
- 43rd Ave / Southern Ave Basin
- Baseline Rd Storm Drain

120 - PVSP
- Scottsdale Rd Corridor Drainage

121 - East Maricopa Floodway
- EMF Capacity Mitigation
- EMF Rittenhouse & Chandler Heights Basin

124 - Rio Salado
- Phoenix Rio Salado

125 - Salt River
- Tempe / Mesa Habitat Mitigation

211 - Buckeye / Sun Valley ADMP
- Buckeye / Sun Valley ADMP

344 - Wittmann ADMP
- Wittmann ADMP Update

345 - Aguila ADMP
- Hazard Mitigation Grant Program
- Aguila ADMP
- Aguila Area Floodplain Delineation

400 - Skunk Creek / New River
- New River Bank - Paradise Shores
- 83rd Ave GCS / Bell Park
- New River - Grand to Skunk Creek

420 - Spook Hill Watershed ADMP
- Spook Hill ADMP

442 - East Mesa ADMP
- Powerline Detention Basin
- Hawes Rd Channel
- Elliot Rd Detention Basin & Outfall Channel
- Elliot Channel - Ellsworth to EMF
- Ellsworth Channel
- Southern Ave Channel

450 - Glendale / Peoria ADMP
- Glendale / Peoria ADMS Update
- Northern / Orangewood Storm Drain
- 67th Ave Storm Drain

452 - North Peoria ADMP
- North Peoria ADMP

460 - East Fork Cave Creek ADMP
- Greenway Parkway Channel

470 - White Tanks ADMP
- White Tanks FRS #3 Modifications
- Loop 303 Corridor / White Tanks ADMP Update
- Reems Rd Channel
- Bullard Wash Phase II
- Northern Ave Channel & Basin

480 - Queen Creek ADMP
- Queen Creek Channelization
- Sanokai Wash Channelization

490 - Gilbert / Chandler ADMP
- San Tan Collector Channel Phase III

491 - Higley ADMP
- Higley ADMP
- Warnor / Groonfield Park Basin
- RWCD Tailwater Analysis

520 - Adobe Dam ADMP
- Adobe Dam / Desert Hills ADMP

565 - Durango ADMP
- Durango ADMP
- Durango Regional Outfall Channel
- Durango Regional Conveyance Channel

580 - ACDC ADMP
- Doubletree Ranch Rd System

620 - Maryvale ADMP
- Bethany Home Outfall Channel

625 - Metro ADMP
- 24th Ave / Camelback Basin

630 - Foothills ADMP
- SE Phoenix Regional Drainage

670 - Fountain Hills ADMP
- Ashbrook / Balboa Wash Imp.

Map 4-3

Southeast Region

Description

The Southeast Region covers five of the watersheds which are the Lower ACDC, Lower East Maricopa Floodway, South Mountain, Upper East Maricopa Floodway, and Upper Queen Creek. Map 4-2 ~~shows the exact location of these~~. These watersheds contain 875.3 square miles. The Upper Queen Creek Watershed and the majority of the Upper East Maricopa Floodway are outside of the County boundary. A portion of the Lower East Maricopa Floodway is outside the County. Four of the watersheds are on the south side of the Salt River. The Gila River runs through the South Mountain Watershed. Queen Creek and Sanokai Washes run through the Upper East Maricopa Floodway. The Western and Highline Canals run through the South Mountain Watershed. The Kyrene, Consolidated, Eastern, and Roosevelt Conservation District Canals run through the Lower East Maricopa Floodway. The ACDC Canal serves as the northeast boundary for the Lower ACDC Watershed. The Arizona, Grand, and Roosevelt Irrigation District Canals also run through the Lower ACDC Watershed. The Highland and Western Canals are in the South Mountain Watershed. Powerline, Vineyard, and Rittenhouse Dams are in this Region.

These watersheds are shown on

Approximately half of the land is developed and is served by an extensive arterial grid street system and numerous freeways crossing the area.

Portions of the Gila River and Salt River Pima-Maricopa Indian Communities are in this region. All or parts of the municipal boundaries of Avondale, Apache Junction, Chandler, Gilbert, Glendale, Guadalupe, Mesa, Peoria, Phoenix, Tempe, Tolleson, and Queen Creek fall within this region. Of these municipal areas the District performs Floodplain Management for Chandler, Guadalupe, Mesa, Tolleson, and Queen Creek.

Physical Characteristics

The area in general is flat with only the South Mountains with slopes over 15 percent. The majority of the land area in the five watersheds falls into the B and C Hydrologic Groups for soils. South Mountain Park, which is situated in the center of the South Mountain Watershed, is unclassified (consisting primarily of rock out cropping). Map 4-4 shows areas of soil erodability by water and the flood hazards for this Region. The numerous watercourses and canals in this area pose potential flooding hazards, which are being mitigated. Run-off from the urban development throughout the region and the irrigated farm land in the Lower East Maricopa Floodway, Lower ACDC, and South Mountain Watersheds may cause water quality problems. The majority of the land in the South Mountain Watershed, which includes the South Mountain Park, still retains its natural desert vegetation. Landscaped yards make up a majority of the area. River restoration along the Salt and Gila Rivers is being planned with clean-up projects in the Rivers underway. This should restore riparian areas along these corridors.

Land Status

Land ownership patterns in the Maricopa County portion of the Southeast Region are decidedly different from the County as a whole. Private ownership accounts for 73 percent of the total land in this Region versus 30 percent for the total County. Native American lands account for over 17 percent of ownership versus just under five percent for the County as a whole. State, federal,

military, and national forest ownership are all under one percent of the total, which is well under the total for the entire County. Map 4-5 shows the land use patterns over this Region.

The land use pattern for the Southeast Region is also vastly different from the total County averages. Residential and commercial development is much more pronounced while the percentage of vacant land is approximately half as much. There is also a much higher percentage of land still classified as agricultural when compared to the overall County figures. Breakdowns of percentage of each land use for the individual watersheds can be found in Appendix B.

Approximately 400 square miles of the 875 square miles of the total area have already been developed or are considered undevelopable. This leaves 279.21 square miles of land to still be developed.

? 875-400=475

Socioeconomic Characteristics

The Southeast Region (Maricopa County portion only) had a population of 1,651,400 in 1995. Nearly two-thirds (65 percent) of the total residents of Maricopa County lived in this Region as of 1995. The projected population for the Region is expected to be 2,825,900 by 2025 or an increase of 1,174,500 over the 30-year time frame. The additional 1.17 million people is an increase of approximately 71 percent over the 30 years. This 2.37 percent growth rate on an annual basis lags behind the state average of 2.77 percent and well behind the overall Maricopa County rate of 3.2 percent per year. The Lower ACDC and Lower East Maricopa Floodway Watersheds are expected to have the largest population gains over this 30-year period.

District Activities Completed

Structural

Structures that have been constructed in the Southeast Region are the following (detailed descriptions are in Appendix B under each watershed write-up):

Upper Queen Creek
- No District Structures

Upper East Maricopa Floodway
- Powerline Dam (1967)
- Powerline Floodway (1968)
- Vineyard Dam (1968)
- Rittenhouse Dam (1969)
- Alma School Drain (1969)
- Sossaman Channel and Basin (1977)
- Guadalupe Channel (1989)
- East Maricopa Floodway (1989)
- Gilbert Crossroads Park Basin (1992)
- University Drive Basin (1993)
- Price Drain (1997)
- Rittenhouse Road Channel (1998)

Lower East Maricopa Floodway
- Salt River Channel

Point size

Lower ACDC
- Holly Acres Levee & Bank Stabilization (1984)
- Agua Fria Channelization (1988)
- Old Cross Cut Canal (1975, 1991)
- New River Channelization (1993)
- Arizona Canal Diversion Channel (1994)
- Camelback Ranch Levee (1999)
- Indian School Road Drain

South Mountain
- Guadalupe FRS (1975)
- 48th Street Drain

Non-Structural

211 linear miles of watercourse delineations have been completed in the five watersheds out of an estimated 440.0 linear miles from the 100,000 USGS Hydrography. The South Mountain Watershed has 131 lineal miles of these detailed delineations. About 111,200 drainage permits and 117 floodplain use permits were issued from 1990 to 1999.

Studies

The following studies have been completed or are in process for the Southeast Region:

- Maryvale ADMS (1997) and the Durango ADMP (2000-01) were done for the Lower ACDC Watershed.
- Mesa/Gilbert/Chandler ADMS (1987-88, 1993-94), Lower East Maricopa Floodway Study (1980's), Southeast Mesa ADMP (1996), Higley ADMP (1999-00), and EMF Capacity Mitigation Study (2000) for the Lower East Maricopa Floodway Watershed.
- Hohokam (1980's), Foothills ADMS (1980's), Laveen ADMS (1990, 1994), South Phoenix/Laveen ADMP (1997), Laveen ADMP (2001) for the South Mountain Watershed.
- East Maricopa County ADMS (1986-87), Queen Creek ADMS (1991), and East Mesa ADMP (1998) for the Upper East Maricopa Floodway Watershed.
- No studies have been done by the District for the Upper Queen Creek Watershed.
- Queen Creek/Sanokai Wash Hydraulic Master Plan (2000) for the Lower East and Upper East Maricopa Floodways Watersheds.

Hazard and Problem Assessment

The Southeast Region is more heavily populated than the other three regions. Population projections show the largest 30-year increase in total numbers of people among the four regions. The population is expected to increase 1,177,858 over the 30-year period. There are 279 square miles of area still available for development to hold this population. However, 229 linear miles of delineations out of 440 still remain to be done so that these new residents will not develop in flood and erosion hazard areas.

Kelli: How many homes have had rep. losses?

?

This Region also contains one of the County's largest repetitive loss areas. There are 59 structures in the floodway and 10,852 structures in the floodplain. The majority, 10,515 structures, are also in a moderate or severe erosion hazard zone. In addition, there were 86 County road closures from 1996-2000 which were roughly equally split between South Mountain, Lower ACDC, and the Lower East Maricopa Floodway. No Maricopa County road closures were reported in Upper Queen Creek and Upper East Maricopa Floodway Watersheds. Reported flooding problems for each watershed are in the individual write-ups in Appendix B. This Region also contains the County's only repetitive loss area. Huh?

Table 4-3 shows the Southeast Region Watersheds that are inside the County's boundary all falling in the top third for priority in need of a series of projects per the District's programs. Problems that need to be addressed ~~are~~ the following:

include

- A number of storm water drainage and channel projects need to be completed for this Region. ~~A number~~ Several of them have been identified in recent ADMP's and are listed in the next section.
- The 229 linear miles of watercourses need to be delineated.
- A buy-out program needs to be presented to the property owners with their structures in the floodway, with priority given to ~~the~~ residential homes in the highest hazard category.
- A more detailed look at the approximate 10,800 structures at risk in the floodplain and severe erosion hazard areas needs to be done.
- The dams and flood retarding structures were built approximately 30 years ago. Remedies identified in the Structural Assessment Program will need to be undertaken.

Each of the above issues needs to now be prioritized through the various different District programs. The District is responsible for the Floodplain Management for the majority of this area and, as the lead agency, has done a number of studies to identify the hazards and solutions for these watersheds. The next section identifies the flood control projects in the current CIP to mitigate these flooding hazards for the watersheds in the Southeast Region.

Future Activities Identified

Capital Improvement Program

The CIP for Fiscal Years 2001/2002 to 2005/2006 (see Table 4-4 for project cost and year) indicates that the following projects are planned for the Southeast Region as follows:

Upper East Maricopa Floodway Watershed

This reads as if it were already completed. Is it?

- *108 Sossaman Channel* – The previous channel section did not have sufficient capacity to convey the 100-year peak discharge. This project completed the Sossaman drainage system. The landscaping element of this project has been designed and will be installed by Fall of 2001.

- *442 East Mesa ADMP*
  - *Hawes Road Channel* – The project will consist of a channel and culvert improvements from Apache Trail to Emelita Avenue to help resolve drainage problems along Hawes Road within the City of Mesa.
  - *Elliot Channel (Ellsworth to EMF)* – This project includes a study to evaluate potential for combining flows from the proposed Elliot Road Channel and Basin with drainage facilities for the proposed San Tan Freeway.
  - *Elliot Road Detention Basin and Outfall Channel* – The basins collect runoff from the Crimson Channel and are intended to become multi-use facilities. The outfall channel conveys discharge from the Elliot Road Basins, and from the Elliot Road Channel.
  - *Ellsworth Channel* – This project includes construction of a flood control channel to mitigate existing and future flooding along Ellsworth Road. Flooding occurs frequently at 5 dip crossings on the existing roadway.
  - *Powerline Detention Basin* – This project involves construction of a detention basin adjacent to the Powerline Floodway near Meridian and the Warner Road alignment. The

basin will reduce peak flows in the existing Powerline Floodway and intercept surface runoff from Pinal County.

- *Southern Avenue Channel* – The existing channel, which is deteriorating, does not have adequate capacity to convey the 100-year flow and must be enlarged. This channel is an integral part of the drainage system in this area.

- *480 Queen Creek ADMP* – 2 projects
  - *Queen Creek Channelization* – Based on the Flood Insurance Study on Queen Creek Wash there are areas of significant breakouts particularly along the north bank of this reach. This project will increase the ~~cross-section~~ hydraulic capacity of the wash to contain the 100-year flows.
  - *Sanokai Wash Channelization* – Channelization of portions of the wash will be done to ~~maintain~~ improve? the hydraulic conveyance capacity.

Lower East Maricopa Floodway Watershed

- *022 Central Chandler Drainage System* – The City of Chandler has requested the District cooperate and cost share in the modification and enhancement of its existing storm water facilities to provide a 100-year level of protection and a regional outfall for the system. Five improvements have been identified that would help the City accomplish its goal of alleviating flooding problems in the Chandler's central area.

  Phase 1 – Ivanhoe and Erie Storm Drains (complete)
  Phase 2 – Arrowhead Pump Station and Force Main (design is complete)
  Phase 3 – Galveston Basin and Erie Drains (design is scheduled for FY 01-03)
  Phase 4 – Denver Basin Pump Station
  Phase 5 – Hartford Force Main and Pecos Road Drain

- *102 Alma School Drain* – The District, the City of Mesa, SRP, and the Arizona Department of Transportation (ADOT)) entered into IGA 371-67-F on November 16, 1967 for the Alma School Drain, from the Tempe Canal to the Salt River located in Section 17, T1N, R5E. Future plans for the Alma School Drain include lining the invert of the un-lined reach of the channel and reconstructing the lined reach of the channel.

- *121 East Maricopa Floodway (EMF)*
  - *Capacity Mitigation Plan* – This plan includes in-line and/or off-line detention basins with channel improvements between Broadway Road and Main Street to increase the capacity of the Floodway to convey the 100-year flows originating within the East Mesa watershed. The channel improvements, scheduled to be completed during FY 2002-03, will include increasing the bank height by raising the maintenance roads on both sides of the channel between Rittenhouse Road and Warner Road.

  - *EMF Rittenhouse & Chandler Heights Basins* - The East Maricopa Floodway (EMF) Mitigation Study identified several drainage and flooding problems along the EMF. The capacity of the EMF is at about 8,000 cfs. The existing condition 100-yr. is about 16,000 cfs. The study proposed to mitigate the problem by constructing two large off line retention basins. The Chandler Heights Basin will mitigate flows from the Sanokai Wash, Queen

Creek Wash, and the EMF. Rittenhouse Basin will mitigate flows from the Rittenhouse Channel and the EMF.

- *490 Gilbert/Chandler ADMP*
  - *San Tan Collector Channel Phase III* – This project consists of approximately 2.5 miles of storm drain. This outfall will provide a storm drain with a 10-year level of protection for contributing areas and will reduce drainage problems.

Has not been defined previously. Spellout

- *491 Higley ADMP*
  - RWCD Tailwater Analysis – This project is a study to evaluate the conveyance capacity of the existing RWCD Tailwater Ditch located adjacent to the Eastern Canal.
  - *Warner/Greenfield Park Basin* – This basin will accommodate passage of flows along the east side of the SRP Eastern Canal to the Crossroads Park Basin.

South Mountain Watershed

- *035 Town of Guadalupe* – This project will provide a storm drain collection system and four retention basins located along the Highline Canal that will capture and convey the 10-year storm event within the Town and east of Avenida Del Yaqui. Three of the basins will also serve as parks in the Town. This will alleviate flooding for a number of homes in the area.

(Is this one of the repetitive loss areas?)

- *117 South Phoenix Drainage Improvements*
  - *43rd Avenue / Southern Avenue Basin* – This basin is an integral component of the Laveen Area Conveyance Channel and will be a multi-use facility.
  - *Laveen Area Conveyance Channel* – This project includes the design and construction of a conveyance channel capable of containing a 100-year flood event in the vicinity of the existing Maricopa Drain.
  - *South Phoenix / Two Basins* – The basins will provide protection from a 100-year event for residents in South Phoenix, farmland, and a proposed high school and elementary school.
  - *Baseline Road Storm Drain* – The proposed system is composed of underground pipes and basins that will provide flood protection to residents and school facilities.

- *630 Foothills ADMP*
  - *Southeast Phoenix Regional Drainage System* – The project is a series of basins and storm drains that will create a 100-year outfall system for a 4.5 square mile watershed. Basins will be used as park sites.

Lower ACDC Watershed

- *124 Phoenix Rio Salado Project* – Involves the environmental restoration of approximately five miles of the Salt River within the City of Phoenix from the I-10 Bridge to 19th Avenue. The project will provide riparian habitat restoration and include channel stabilization, river bank protection, water quality improvements, aesthetic improvements and recreational opportunities. The low flow channel will stabilize the river gradient, safely convey frequent flood flows and reduce the frequency of inundation of channel vegetation from flood events.

- *450 Glendale/Peoria ADMP Update.*

It would be helpfull to describe which projects alleviate repetitive losses. only the Tres Rios

- *Northern/Orangewood Storm Drain* – The project is construction of 10-year storm drains which will benefit 14 square miles of existing development in Glendale, Peoria and unincorporated County that have been subjected to flood events in the past several years. The drain will also provide an outlet for future municipal storm drains and MCDOT and ADOT projects. Three detention basins will be constructed to reduce pipe costs while increasing the future level of protection and providing water quality and recharge benefits.

- *67th Avenue Storm Drain* – 10-year frequency protection for a three square mile area lying within the Cities of Glendale and Peoria. The project will consist of drainage pipes and catch basins and will be constructed in rights-of-way provided by Glendale. The outfalls for the project were constructed by the District along Cactus Road and Olive Avenue and are presently owned and operated by Peoria.

- *565 Durango ADMP*
  - *Durango Regional Outfall Project* – The project consists of a principle outlet channel, three basins and two auxiliary channels. These auxiliary channels, located on 91st and 99th Avenues will intercept and divert storm water runoff which now floods Van Buren Street. The basins will be sited along the principal channel to reduce the storm water peak.

- *620 Maryvale ADMP*
  - *Bethany Home Road Outfall Channel* – Includes a linear basin and channel along the north side of the Grand Canal extending westerly from 64th Avenue to New River. The project will have a 100-year storm capacity removing about 745 structures from the 100-year floodplain. The channel will receive storm water from portions of Peoria, Glendale, Phoenix and unincorporated Maricopa County. Phase 1 of the project has been completed by ADOT with District participation. Phase 2 of the project will include a channel from the Agua Fria Freeway alignment to 73rd Avenue and an earthen, linear, on-line detention basin from 67th Avenue to 73rd Avenue. The ADMP also recommends ten year capacity storm drains, located within Bethany Home Road and Camelback Road, extending from 59th Avenue to the Outfall Channel.

- *625 Metro ADMP*
  - *24th Avenue / Camelback Basin* – This project is proposed to reduce flooding for the area.

Recommended Projects from On-going ADMPs

Additional projects that were recommended through the Area Drainage Master Plans but not yet included in the CIP are the following:

Durango ADMP

- *Buckeye Feeder Diversion Channel* – Begins just south of Van Buren Street near 67th Avenue. It runs in a southerly direction to just below Lower Buckeye Road, where it turns west and eventually empties into the Agua Fria River. The length of the channel system is approximately 10 miles. There are also three basins, one near Van Buren Street and 67th Avenue, one near Buckeye Road and 75th Avenue, and one near Lower Buckeye Road and 91st Avenue. Total cost of this project is estimated at $55,000,000.

- The 47th Avenue Channel is approximately 2.25 miles long. It begins with a detention basin just north of Buckeye Road and drains south to the Salt River. A 1,200 foot lateral channel flows into the north end of the detention basin. Total cost of this project is estimated at $16,000,000.

- The Tres Rios Basins Project is planned for the southwestern portion of the Watershed. The Tres Rios Project calls for four detention basins, two ~~on~~ adjacent to the Salt River and two ~~on~~ adjacent to the Gila River. The basins would be located between 107th Avenue and Dysart Road. This project will remove 21 structures from the floodplain which is approximately 62 percent of the structures in a repetitive loss area (see Figure 4-1). Total cost of this project is estimated at $17,324,000.

Good!

Structures Assessment / Dam Safety Program
?????

Structures Analysis
???

Multi-Use Projects
????

DRAFT

In addition, the District will utilize existing floodplain and drainage regulations to minimize and prevent damages from flooding problems. The Floodplain Delineation Branch has plans to delineate an addition XX linear miles outside of the ADMP's and other studies being prepared. Operation and maintenance of existing structures will be ongoing to preserve the life of facilities and prevent flooding from occurring due to maintenance issues.

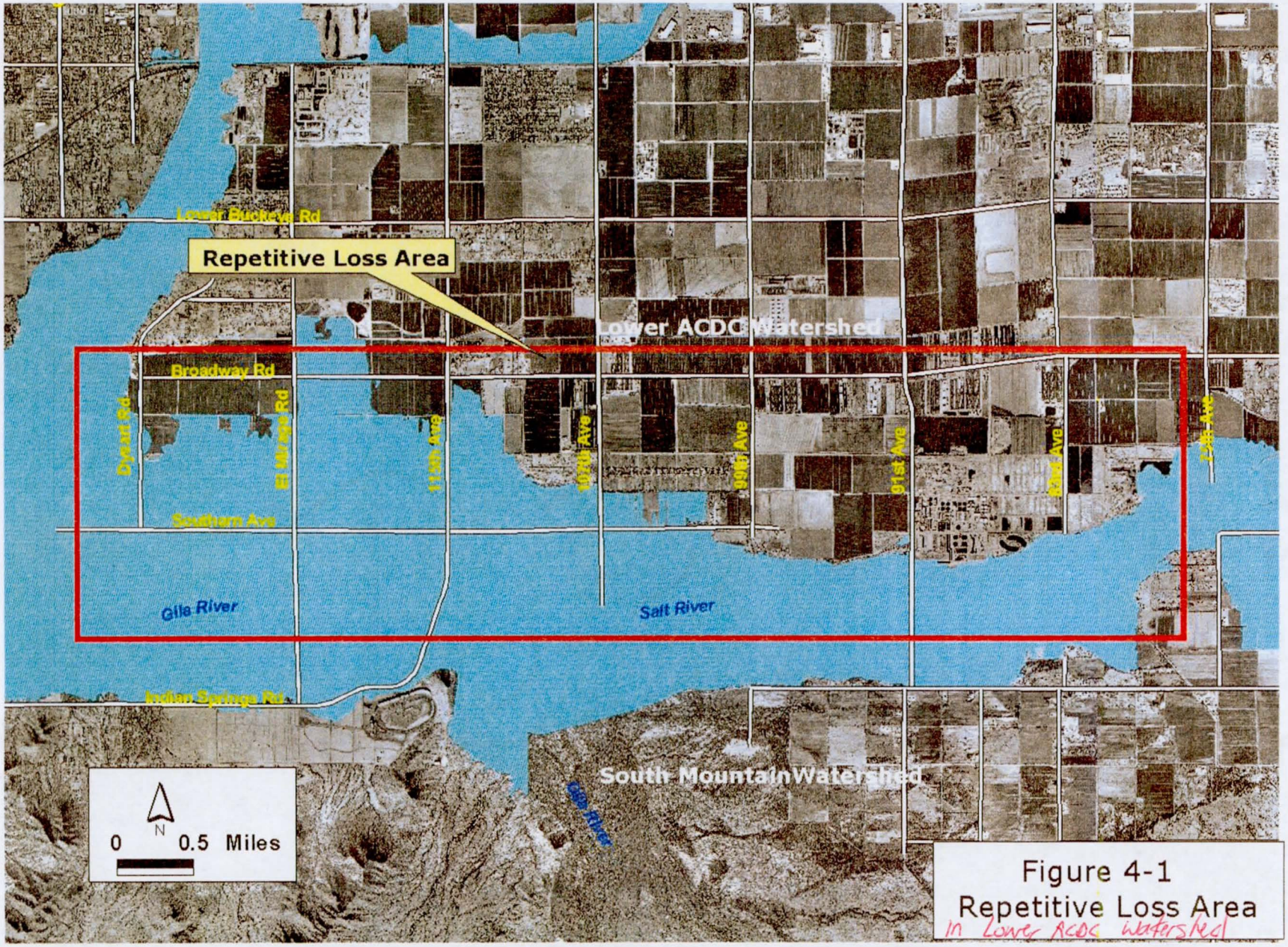


Figure 4-1
Repetitive Loss Area
in Lower ACDC watershed

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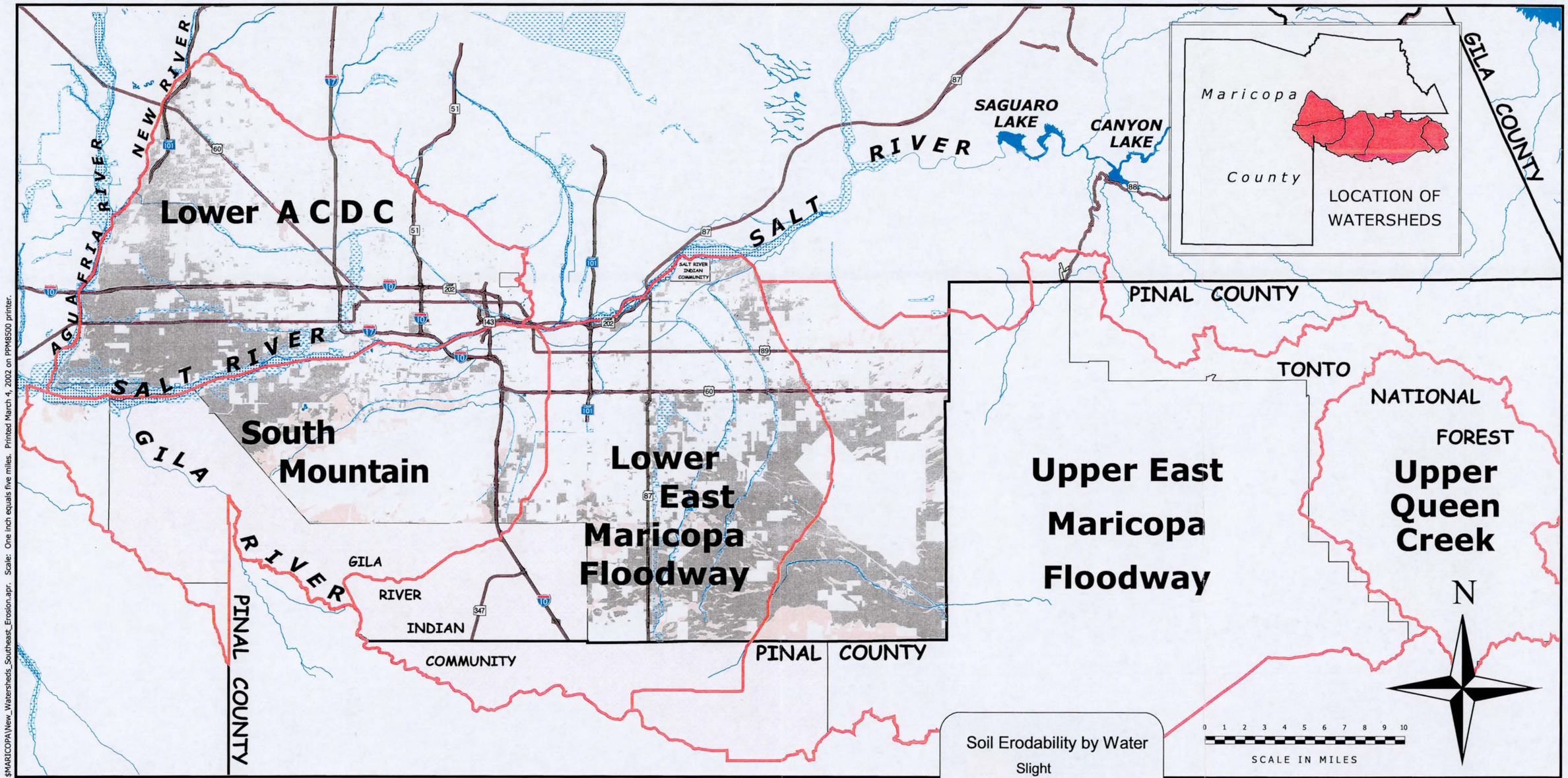
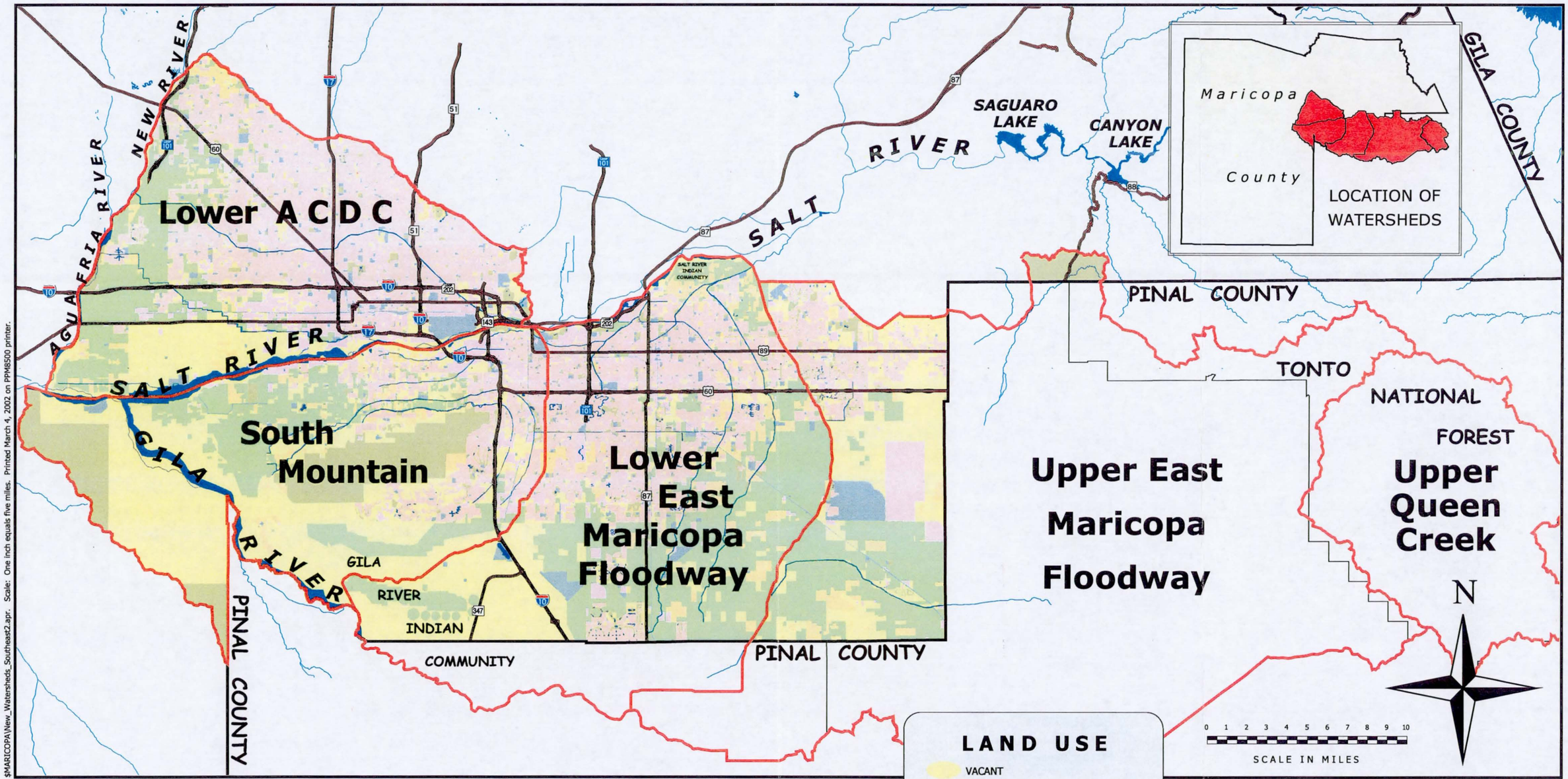


$MARICOPA\New_Watersheds_Southeast_Erosion.apr. Scale: One inch equals five miles. Printed March 4, 2002 on PPM8500 printer.

Map 4-4
Southeast Region
Developable Lands, Soil Erosion, and Floodplains



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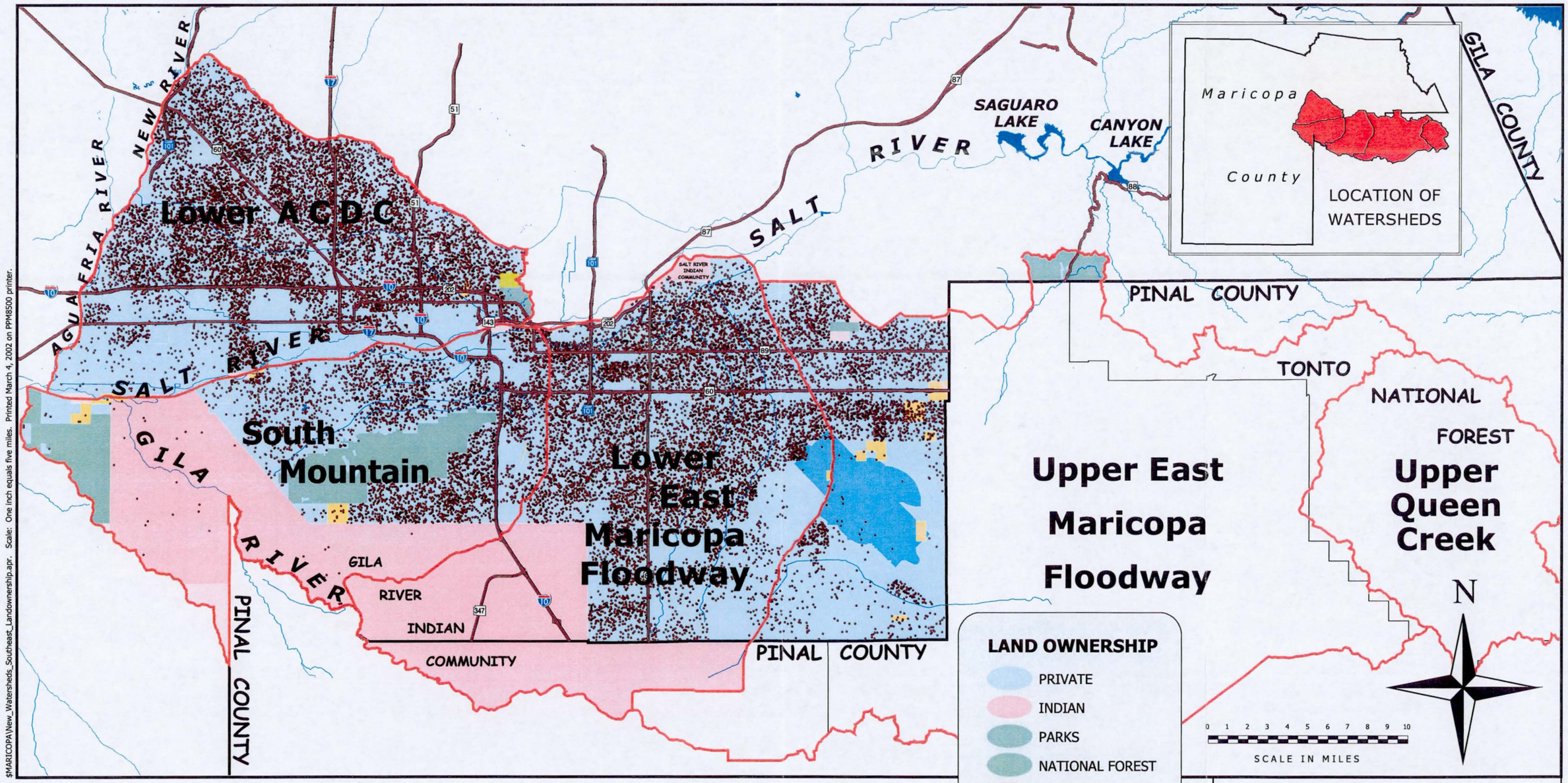
Map 4-5

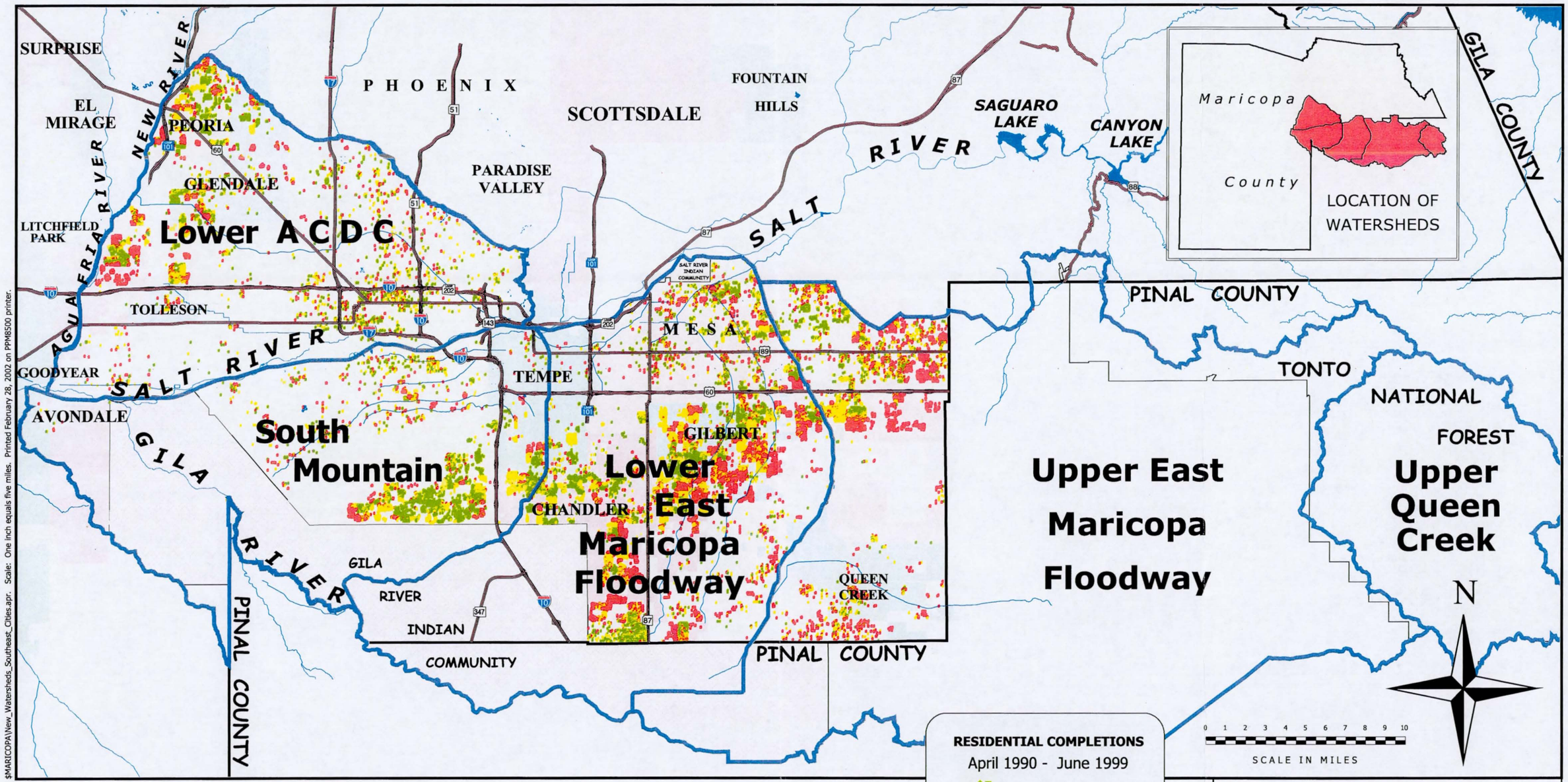
Southeast Region

Land Use



Map 4-6
Southeast Region
Land Ownership and
Population Projections

$MARICOPA\New_Watersheds_Southeast_Landownership.apr. Scale: One inch equals five miles. Printed March 4, 2002 on PPM8500 printer.



$MARICOPA\New_Watersheds_Southeast_Cities.apr; Scale: One inch equals five miles. Printed February 28, 2002 on PPM8500 printer.

Map 4-7

Southeast Region

Residential Completions

Northeast Region

The Upper Verde Watershed extends into Yavapai and Coconino Counties.

Description

The Northeast Region covers 13 watersheds in the northeast portion of Maricopa County. They are Cave Creek, Evergreen, Lower Indian Bend, Lower New River, Lower Verde, Middle Indian Bend, Skunk Creek, Upper ACDC, Upper Agua Fria, Upper Indian Bend, Upper New River, Upper Verde, and Upper Salt River. Map 4-2 shows the location of these watersheds. The watersheds within Maricopa County in this Region contain 2,002 square miles or about 22 percent of the total area in the County. Approximately 88 square miles of this total area is shown as being outside of the District's boundary. Several of these watersheds extend outside of Maricopa County. The Upper Salt River Watershed is primarily located in Gila County ~~with a small portion in~~ but extends into Pinal and Navajo Counties with the Maricopa County portion primarily within the Tonto National Forest. ~~The Upper Verde,~~ The Upper New River and the Upper Agua Fria Watersheds all extend well into Yavapai County. The Cave Creek and Lower Verde Watersheds extend slightly into Yavapai and Pinal Counties respectively. The Northeast Region is bounded on the east by Gila County, on the west by the Agua Fria River, on the north by Yavapai County, and on the south by Pinal County and the watersheds of the Southeast Region.

The Salt, Verde, and New Rivers run through this Region. Lake Pleasant is in the lower portion of the Upper Agua Fria Watershed. Saguaro Lake, Canyon Lake, Apache Lake, Bartlett Reservoir, and Horseshoe Reservoir are in the Upper Verde and Upper Salt River Watersheds. There are five major washes in the area: Cave Creek, Skunk Creek, Indian Bend Wash, Camp Creek, and Sycamore Creek. There are a number of other washes such as Scatter Wash in this Region. In addition, the Central Arizona Project Canal crosses diagonally through the region from the lower portion of the Skunk Creek Watershed through the Evergreen Watershed on its route through Pinal County to the southeast. The Grand Canal is on the lower edge of the Upper New River and Lower Indian Bend Watersheds. The ACDC Canal and Salt-Gila Aqueduct are also in this Region. Granite Reef, Cave Butte, Cave Creek, Adobe Dam, New River, Dreamy Draw, and Apache Dam are all within this Region.

Several regional and interstate transportation corridors, which also serve the population in the southern portion of this region, cross through the area – Interstate-17, State Route Loop 101, and State Routes 51 and 87.

The Salt River Pima-Maricopa and Fort McDowell Mohave-Apache Indian Communities are in this region. All or parts of the municipal boundaries of Apache Junction, Carefree, Cave Creek, Fountain Hills, Glendale, Mesa, Paradise Valley, Peoria, Phoenix, Scottsdale, and Tempe are located within this Region. The District does Floodplain Management for Carefree, and Cave Creek, and the City of Mesa. The Towns of

Geology / Hydrology

The Region in general is mountainous with slopes over 15 percent for more than fifty percent of the area. The majority of the land area in ~~these watersheds~~ the portion within Maricopa County falls into the B Hydrologic Group~~s~~ for soils. The Central portion of the Region consists of C and D Hydrologic Groups. The Eastern half of the Region is National Forest Area. Map 4-8 shows areas of soil erodability by water and the flood hazards for this Region. The numerous watercourses and canals in this area pose potential flooding hazards. Run-off from mountains creates serious threats for the region especially during

Are you talking about just the portion of the Region within Maricopa County? It's not clear.

the monsoon when flash floods occur. The majority of the land in the Region still retains its natural desert vegetation. The Salt River serves as a recreation area and has riparian areas along its' corridor as do many of the other area watercourses.

Land Status

Land ownership patterns in the Maricopa County portion of the Northeast Region follow County percentages fairly close in some areas. For instance, private ownership is 26 percent of the total land versus 30 percent for the County as a whole. Native American lands account for 6 percent of the Region versus just under 5 percent for the County. An extreme is national forest which accounts for 51 percent of the Region versus 11 percent for Maricopa County.

The land use patterns vary in certain aspects from Maricopa County. Open space accounts for nearly 57 percent of the Region versus about 33 percent for the County. This is primarily due to the large acreage of the national forest that is found within the Region. On the other hand, vacant land is about half as much as the County average and agriculture is approximately one-fifth of the County average. Map 4-9 displays the land use patterns.

Socioeconomic Characteristics

The Northeast Region (Maricopa County portion only) had a population of 751,904 in 1995. This was approximately 30 percent of the total population of the County at that time. The Northeast Region is the second most populated of the four in Maricopa County. The projected population for the Region in 2025 is 1,519,814 or an increase of 767,910 people over the 30-year time frame. These additional 767,910 people are an increase of about 102 percent over the 30 years. This 3.4 percent growth rate on an annual basis is greater than the Maricopa County rate of 3.2 percent per year. The Upper ACDC and Upper Indian Bend Watersheds are expected to see the largest increases.

District Activities Completed

Structural

Structures that have been constructed in the Northeast Region are the following:

Cave Creek Watershed
- Cave Creek Dam
- Cave Butte Dam (1980)
  - Includes Dykes #1, #2, #3

Lower New River Watershed
- New River Dam (1985)
- Sun City Drain (1991)

Skunk Creek Watershed
- Skunk Creek Channel and Levee
- Adobe Dam (1984)

Middle Indian Bend Watershed
- Paradise Valley Detention Basin #4
- PVSP Cactus Rd Improvements (1991)

Upper ACDC Watershed
- Dreamy Draw Dam (1973)
- Cave Creek Channelization (1991)
- Skunk Creek Channelization (1991)
- Scatter Wash Channel (1995)
- Upper East Fork Cave Creek (1996)
- 10th Street Wash Basins (1997)

Lower Verde Watershed
- Buckhorn-Mesa Flood Retarding Structures
  - a) Spook Hill FRS (1979)
  - b) Spook Hill Floodway (1980)
  - c) Signal Butte Floodway (1984)
  - d) Pass Mountain Diversion (1987)
  - e) Signal Butte FRS (1987)
  - f) Bulldog Floodway (1988)
  - g) Apache Junction Dam & Floodway (1988)

Non-Structural

487.4 linear miles of watercourse delineations have been completed in the Northeast Region out of ~~an estimated~~ estimated from 2,013.3 linear miles from the100,000 USGS Hydrography. Delineations have been done in all of the watersheds, with the most in the Lower Verde Watershed. About 85,300 drainage permits and 617 floodplain use permits were issued from 1990 to 1999.

Studies

The following studies have been done or are in process for the various watersheds in this Region:

- Cave Creek/Carefree ADMS (1993), Apache Wash Drainage/storm Drain Master Plan (1990), Town of Carefree ADMP (2002) for the Cave Creek Watershed. Upper Cave Creek/Apache Wash Watercourse Master Plan (2001).
- ACDC ADMS (1986, 1993), Glendale/Peoria ADMP (1987, 2001) for the Lower New River Watershed.
- Spook Hill ADMP (1987, 2002) for the Lower Verde Watershed. Isn't this in Upper ACDC?
- Scottsdale/Paradise Valley ADMS (1980's) and Upper East Fork Cave Creek ADMS (1986-87) for the Middle Indian Bend Watershed.
- Adobe Dam (1980's, 2002) and Skunk Creek Watercourse Master Plan (2001) for the Skunk Creek Watershed.
- ACDC ADMS (1986, 1992) covering 69 percent of the Watershed for the Upper ACDC Watershed.
- Desert Greenbelt (1980's) and Fountain Hills (1996-97) for the Evergreen Watershed.
- Pinnacle Peak ADMS (1980's) for the Upper Indian Bend Watershed.
- New River ADMS (1995) for the Upper New River Watershed.

Hazard and Problem Assessment

The Northeast Region is presently not as populated as the Southeast Region. However, the rate of growth for the Northeast Region is over 30 percent or greater per year than the Southeast Region. The population is expected to increase 758,208 over the 30-year period. There are 355 square miles of area still available for development to hold this population. Areas that could be developed are not as extensive in this Region as private land is less than the County average.

Approximately 1,526 linear miles of delineations out of 2,013 still remain to be done so that these new residents will not develop in flood and erosion hazard areas. The low population and high percentage of government held land have potentially caused studies and delineation work to be directed to more urbanized areas. This has resulted in 198 structures in the floodway and 9,228 structures in the floodplain. Approximately 3,400 of these structures are also in a moderate or severe erosion hazard zone. In addition, there were 157 County road closures from 1996-2000 which were concentrated in the Cave Creek, Lower New River, Lower Verde, Skunk Creek, and Upper New River Watersheds. Reported flooding problems for each watershed are in the individual write-ups in Appendix B.

Table 4-3 shows five of the Northeast Region Watersheds that are inside the County's boundary falling in the top ten for priority in need of a series of projects per the District's programs. Four of

the Watersheds are ranked in the top two-thirds. Watersheds that received low scores in the prioritization process are either partially outside the County, mainly government held, or have had extensive projects completed already to alleviate flooding and erosion problems. Additional problems that need to be addressed are the following:

- A good portion of the 1,525 linear miles of watercourses need to be delineated.
- The 12 dams and flood retarding structures were built from 1973 to 1988. Some are reaching the end of their design lives. Remedies identified in the Structural Assessment Program will need to be undertaken.
- A buy-out program needs to be presented to the 198 property owners with their structures in the floodway. A number of them have been identified in recent ADMP's and are listed in the next section.
- A more detailed look at the approximate 9,200 structures at risk in the floodplain and severe erosion hazard areas needs to be done.

Each of the above issues needs to now be prioritized through the various different District programs. The District is responsible for the Floodplain Management for the majority of this area and, as the lead agency, has done a number of studies to identify the hazards and solutions for these watersheds. The next section identifies the flood control projects in the current CIP to mitigate these flooding hazards for the watersheds in the Southeast Region.

Future Activities Identified

Capital Improvement Program

The CIP for Fiscal Years 2001/2002 to 2005/2006 (see Table 4-4 for cost and year) indicates that the following projects are planned for the Northeast Region as follows:

Lower Indian Bend Watershed

- 027 City of Scottsdale
  - *Osborn Road Storm Drain* – The project consist of approximately 2.5 miles of storm drain with 10-year level of protection for contributing areas and will reduce the required pipe sizes for the downstream storm drain.

- *125 Salt River: Tempe/Mesa Habitat Mitigation* – This project includes a study of the vegetation maintenance alternatives to maintain conveyance capacity of the Salt River Channel upstream of the existing Tempe Town Lake.

Middle Indian Bend Watershed

- *120 Scottsdale Road Corridor Drainage* – The first phase of this project is to identify the drainage problems and develop cost-effective solutions for a storm water collection system for the Scottsdale Road Corridor from Thunderbird and Mountain View Roads. The benefit area contains approximately 300 residences and 70 commercial structures.

- *580 ACDC ADMP: Doubletree Ranch Road System* – This storm drain project will provide solutions for the flooding problems that exist within a mostly built out residential area in the

Town of Paradise Valley. The project consists of a 10-year storm drain system in Doubletree Ranch Road, with storm drain laterals extending along the adjacent streets.

Upper ACDC Watershed

- *460 East Fork Cave Creek ADMP: Greenway Parkway Channel* – This project is part of a series of projects to collect and convey storm water and to significantly reduce the 100-year floodplain on the Upper East Fork of Cave Creek. These modifications will allow for the removal of over 400 homes and numerous commercial establishments along Bell Road from the current FEMA delineated floodplain.

Lower New River

- 400 Skunk Creek / New River
  - *New River Bank – Paradise Shores* – This project is to provide bank stabilization and armoring along the west bank of the New River. This is the only portion of the west bank unprotected between Bell Road and the New River confluence with Skunk Creek.
  - *83rd Avenue GCS / Bell Park* – This is one of several projects to improve the conveyance capacity and provide bank protection along the New River. The constructed improvements would be a grade control structure and channelization near the 83rd Avenue crossing. The City of Glendale will be putting a bridged crossing at 83rd Avenue and New River.
  - *New River: Grand to Skunk Creek* – This project would include channelization and bank protection along the reach of the New River from the L101 and Skunk Creek confluence south to Grand Avenue.

State Route Loop

Cave Creek Watershed

- *041 Town of Carefree: Carefree Town Center Drainage* – Flooding in this area has resulted in damages to existing commercial buildings. Improvements to the existing drainage facilities is required.

- *520 Adobe Dam / Desert Hills ADMP*

Lower Verde Watershed

- *420 Spook Hill ADMP*

- *670 Fountain Hills ADMP: Ashbrook/Balboa Wash Improvements* – The project will provide 100-year protection for 39 residents, the Fountain Hills Sewerage Treatment Plant and improve conditions for nine roadway segments and enhance implementation of the Town's recreational trail's plan.

Recommended Projects from On-going ADMPs

No projects are identified for this report.

Structures Assessment / Dam Safety Program

?????

Structures Analysis
???

Multi-Use Projects
?????

In addition, the District will utilize existing floodplain and drainage regulations to minimize and prevent damages from flooding problems. The Floodplain Delineation Branch has plans to delineate an addition XX linear miles outside of the ADMP's and other studies being prepared. Operation and maintenance of existing structures will be ongoing to preserve the life of facilities and prevent flooding from occurring due to maintenance issues.

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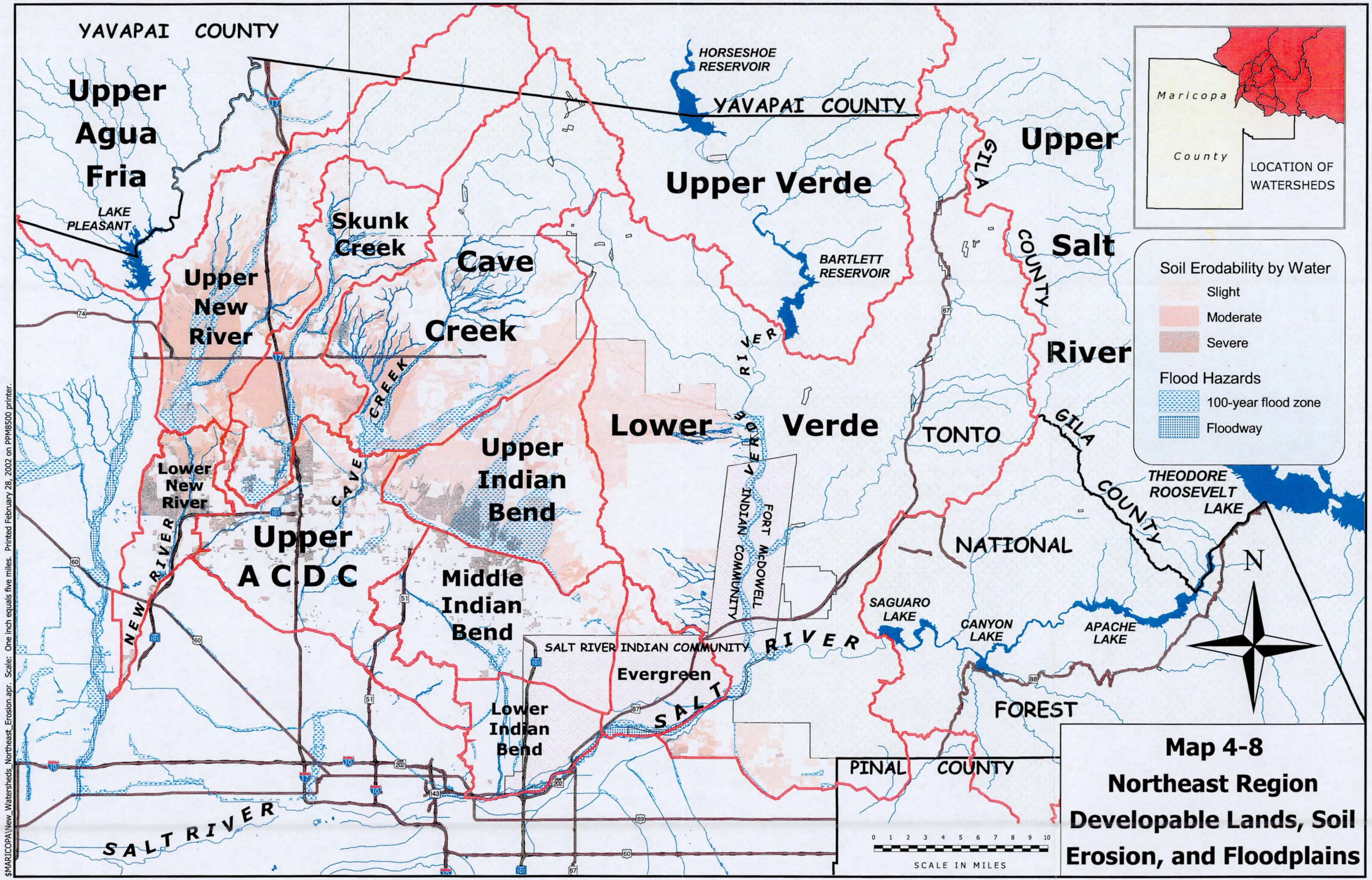

Map 4-8
Northeast Region
Developable Lands, Soil Erosion, and Floodplains

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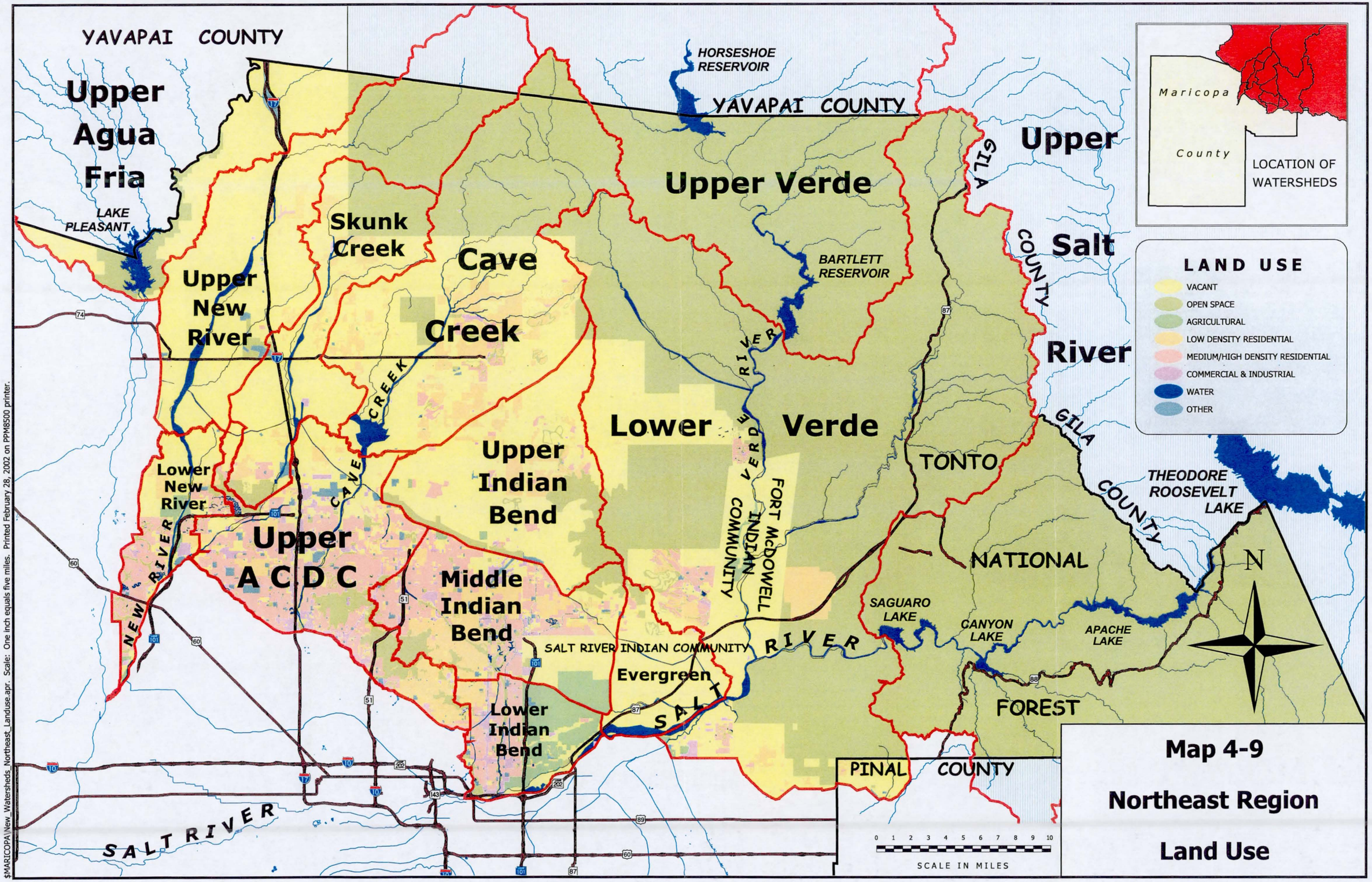

Map 4-9

Northeast Region

Land Use

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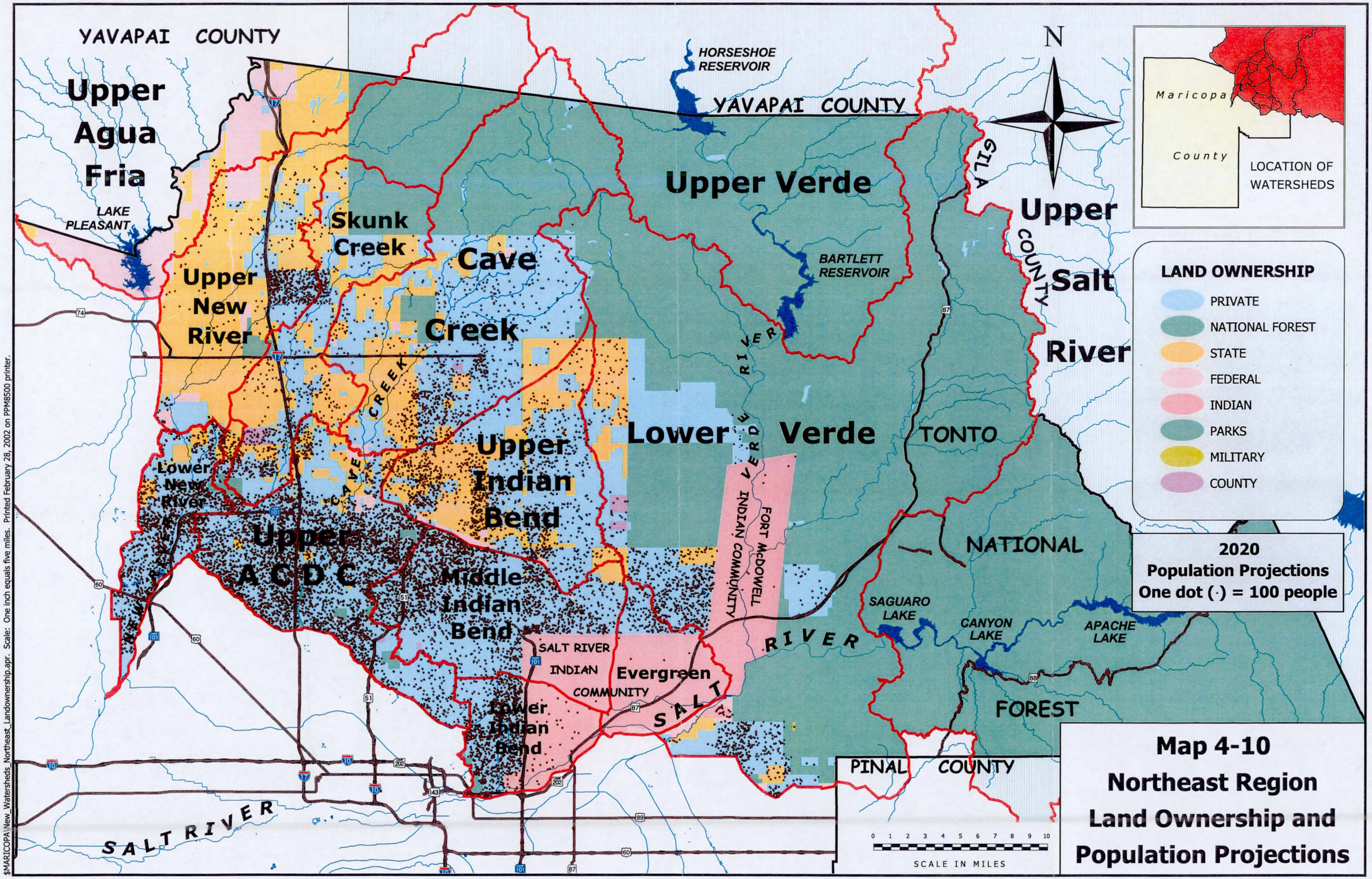
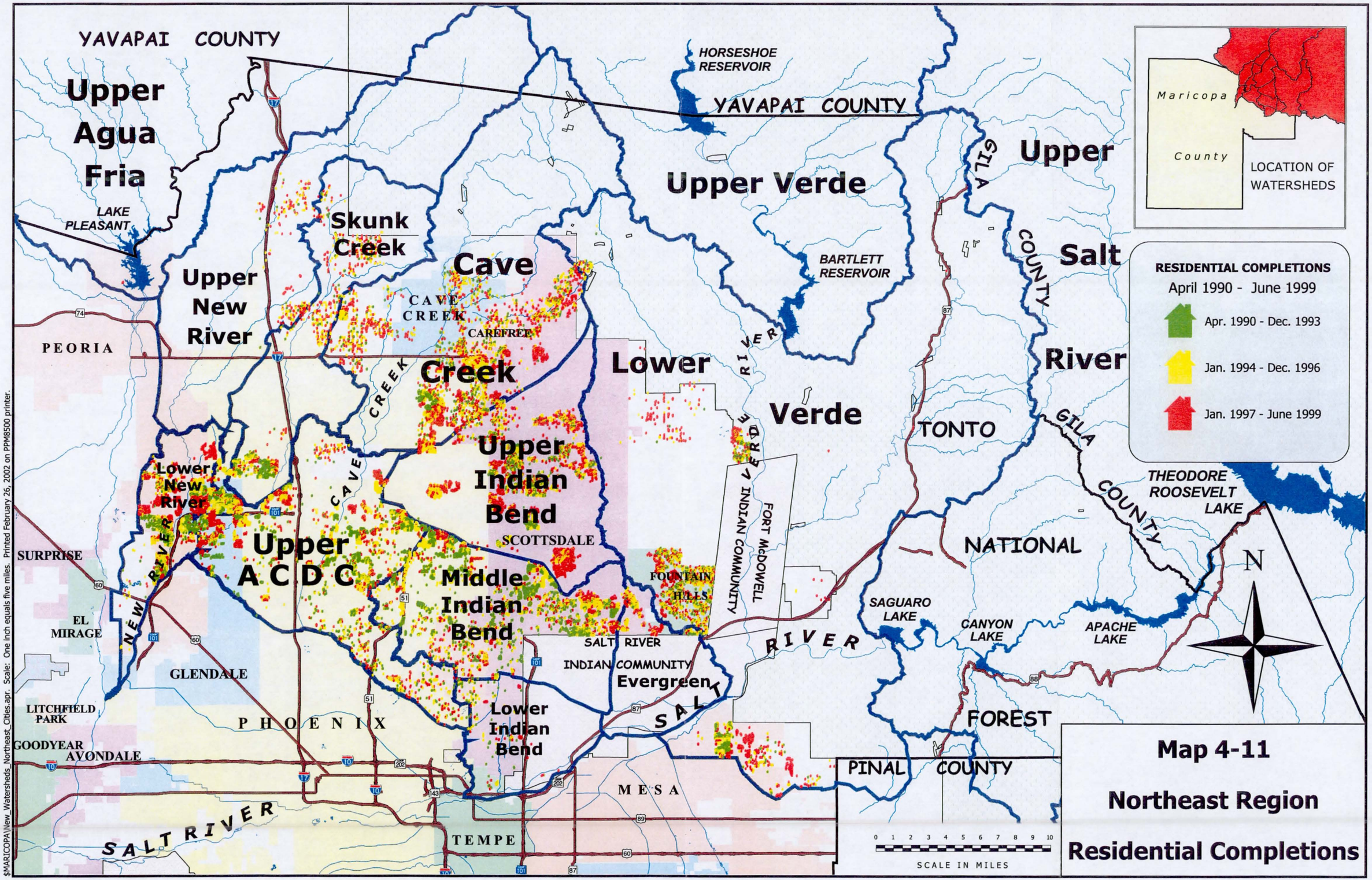


Map 4-10
Northeast Region
Land Ownership and Population Projections

$MARICOPA\New_Watersheds_Northeast_Landownership.apr. Scale: One inch equals five miles. Printed February 28, 2002 on PPM8500 printer.



Map 4-11

Northeast Region

Residential Completions

$MARICOPA\New_Watersheds_Northeast_Cities.apr. Scale: One inch equals five miles. Printed February 26, 2002 on PPM8500 printer.

Northwest Region

Description

The Northwest Region covers 11 watersheds in the northwest portion of Maricopa County. These watersheds are Arlington, Buckeye Hills, Buckeye Valley, Lower Agua Fria, Lower Centennial, White Tanks A, White Tanks B, and Upper Hassayampa. Map 4-2 shows the exact location of these watersheds. Several of these watersheds extend outside of Maricopa County. The County portion covers 2,850 square miles or about 31 percent of the total area in the County. Approximately 1,008 square miles are outside of Maricopa County. The Upper Hassayampa Watershed is outside of the District boundary, entirely located in Yavapai County. A small portion of the Lower Agua Fria Watershed extends north into Yavapai County. Approximately a third of the Trilby and Lower Hassayampa Watersheds are also in Yavapai County. The Upper Centennial Watershed is in also in Yavapai and La Paz Counties in addition to the extreme northwest Maricopa County. The western portion of the Lower Centennial Watershed is located in eastern La Paz County. The Northwest Region is bounded on the west by La Paz County and on the north by Yavapai County. It is approximately bounded on the south by the Gila River and on the east by the Agua Fria River.

The Gila, Agua Fria and Hassayampa Rivers are in this Region. The Central Arizona Project Canal runs northeast from the middle of four of the watersheds. The Roosevelt Irrigation District, Buckeye, Arlington, and Beardsley Canals are located in this Region. Major washes in the Region are Sols, Centennial, Trilby, Morgan City, Jackrabbit, Tiger, and Luke. There are several dams and FRS's in this Region.

The Region is not as populated as the previous two discussed, but a major network of roads for regional and interstate travel crosses through all of the watersheds. These are Interstate-10, U. S. Route 60, State Routes 74 and 85, State Route Loops 101 and 303, Sun Valley Parkway, Old U.S. 80 and MC 85.

All or parts of the municipal boundaries of Avondale, Buckeye, El Mirage, Glendale, Goodyear, Litchfield Park, Peoria, Surprise, Youngtown, and Wickenburg are located within this Region. The District does Floodplain Management for Buckeye, El Mirage, Litchfield Park, Surprise, and Youngtown.

Physical Characteristics

The area in general is mountainous with large developable valleys between ranges. Slopes over 15 percent make up more than fifty percent of the area. The majority of the land area in these watersheds falls into the C and D Hydrologic Groups for soils. A portion of the Region consists of the B Hydrologic Group. The Region has a number of large County parks and conservation areas. Map 4-12 shows areas of soil erodability by water and the flood hazards for this region. The numerous watercourses and canals in this area pose potential flooding hazards which are being evaluated in upcoming studies. Run-off from the urban development in the east portion of the Region and the irrigated farm land in the southern portion may cause water quality problems. The majority of the land west of the Hassayampa River, which includes a number of conservation and preservation areas, still retains its natural desert vegetation. Landscaped yards make up a majority of the area in the east around the Agua Fria River. River restoration along the Gila and

Agua Fria Rivers is being planned with recent studies underway. This ~~should~~ may restore riparian areas along these corridors.

Land Status

Land ownership patterns in the Maricopa County portion of the Northwest Region vary widely from most overall County percentages. For instance, private ownership is nearly 40 percent of the total land versus about 30 percent for the County as a whole. Federal and state land ownership are also about 10 percentage points higher than the Maricopa County average. There are no Native American lands or national forest in the Northwest Region versus nearly five percent and 11 percent respectively for Maricopa County as a whole.

The land use patterns vary in certain aspects from the Maricopa County average. Vacant land accounts for nearly 78 percent of the Region versus about 51 percent for the County. Agricultural use is just over 10 percent as compare to the county average of ~~seven~~ percent. On the other hand, open space is less than one quarter as much as the County average and residential use is approximately 40 percent of this average. Map 4-13 displays the breakdown of land uses in this Region.

Socioeconomic Characteristics

The Northwest Region (Maricopa County portion only) had a population of 119,347 in 1995. This was approximately five percent of the total population of Maricopa County at that point in time. The Northwest Region is the third most populated region of the four in Maricopa County. The projected population for the Region in 2025 is 535,699 or an increase of 416,352 over the 30-year time frame.

These additional 416,352 people equate to an increase of about 349 percent over the 30 years. This 11.6 percent growth rate on an annual basis far exceeds the projected growth rate of 3.2 percent for Maricopa County. Development pressure is intense in portions of this Region.

District Activities Completed

Structural

Structures that have been constructed in the Northwest Region are the following:

Buckeye Valley Watershed
- Buckeye FRS 1, 2, 3 (1975)

Lower Centennial Watershed
- Centennial Levee (1985)
- Harquahala FRS and Floodway (1982)
- Saddleback FRS and Diversion (1981)

Lower Hassayampa Watershed
- Sunset and Sunnycove Dams (1976)
- Casandro Wash Dam and Outlet (1996)

Trilby Watershed
- McMicken Dam and Outlet Channel (1956)

White Tank A Watershed
- El Mirage Drain (1990)
- Sun City West Drains (1990)
- Dysart Drain (1996)
- Colter Channel
- Agua Fria Channelization (1988)

White Tank B Watershed
- White Tanks FRS 3 (1954)
- White Tanks FRS 4 (1954)
- Perryville Bank Stabilization (1984)

Non-Structural

854.7 linear miles of detailed delineations have been completed in the Northwest Region out of an estimated 3,022.8 linear miles from the100,000 USGS Hydrography. Delineations have been done in all of the watersheds, with the most in the Lower Hassayampa Watershed. About 22,700 drainage permits and 186 floodplain use permits were issued from 1990 to 1999.

Studies

The following studies have been done or are in process by the District for this Region:

- Buckeye/Sun Valley ADMS (1989, 2002)for the Buckeye Valley Watershed.
- Glendale/Peoria ADMS/ADMP (1993, 2001) for the Lower Agua Fria Watershed.
- Wickenburg ADMS (1992) for the Lower Hassayampa Watershed.
- Wittmann ADMS/ADMP (1989, 2003) for the Trilby Watershed.
- White Tanks ADMS/ADMP (1989, 1992, 2003) for White Tanks A and B Watersheds.
- The Agua Fria Watercourse Master Plan (2002).

Hazard and Problem Assessment

The Northwest Region is presently not nearly as populated as either of the eastern regions in the County. However, the rate of growth for the Northwest Region is projected to be much greater than for either of the more populated eastern regions over the next 30 years. This percentage increase is primarily due to the smaller population base in this region in 1995. There is a potential population increase of 416,352 over the 30-year period. There are 1,458.26 square miles of area still available for development to hold this population. Areas that are developing rapidly are those watersheds that border on the western edge of the Phoenix Metropolitan Area.

Approximately 2,168 linear miles of delineations out of 3,023 still remain to be done so that these new residents will not develop in flood and erosion hazard areas. There are 154 structures in the floodway and 795 structures in the floodplain. The majority, 524 structures, are also in a moderate or severe erosion hazard zone. In addition, there were 566 County road closures from 1996-2000 which were concentrated in the White Tank A, Lower Centennial, Lower Hassayampa, and the White Tank B Watersheds. Major flooding occurred along the Centennial Wash in the winter of 2000 causing severe flood damage. Additional reported flooding problems for each watershed are in the individual write-ups in Appendix B.

Table 4-3 shows the Northwest Region Watersheds that are inside the County's boundary scattered throughout the priority rating sheet for all Watersheds. The Lower Hassayampa and Lower Centennial Watersheds rank in the top ten in need of a series of projects per the District's programs. These two areas contain the Town of Wickenburg and the community of Aguila where the residents have suffered from serious flooding problems in recent storms. Problems that need to be addressed are the following:

- A number of storm water drainage and channel projects need to be completed for this Region. A number of them have been identified in recent ADMP's and are listed in the next section.

- A portion of the 2,168 linear miles of watercourses need to be delineated.
- A buy-out program needs to be presented to the 154 property owners with their structures in the floodway, with priority given to residential homes in the highest hazard category.
- A more detailed look at the approximate 524-795 structures at risk in the floodplain and severe erosion hazard areas needs to be done.
- Some of the dams and flood retarding structures were built approximately 30 years ago. Fissures in the McMicken Dam have been identified. Remedies identified in the Structural Assessment Program will need to be undertaken.
- A study of the various road crossings that have been closed due to flooding should be done.

Each of the above issues needs to now be prioritized through the various different District programs. The District is responsible for the Floodplain Management for the majority of this area and, as the lead agency, has done a number of studies to identify the hazards and solutions for these watersheds. The next section identifies the flood control projects in the current CIP to mitigate these flooding hazards for the watersheds in the Northwest Region.

Current Future Activities Identified

Capital Improvement Program

The CIP for Fiscal Years 2001/2002 to 2005/2006 (see Table 4-4 for cost and year) indicates that the following projects are planned for the Northwest Region as follows:

Lower Hassayampa Watershed

- *211 Buckeye/Sun Valley ADMP* – Study

Trilby Watershed

- *344 Wittmann ADMP Update* – Study

Upper Centennial Watershed

- *345 Aguila ADMP*
  - *Hazard Mitigation Grant Program* – This project is to purchase and relocate approximately 10 to 20 residences located in the floodplain in Aguila. On November 21, 2000 a severe rainstorm flooded the area, causing extensive damage to homes and placed lives in danger. The District conducted a study and decided to acquire the properties.
  - *Aguila ADMP* – Study
  - *Aguila Area Floodplain Delineation* – This study was identified after homes that were located in a non-flood hazard area were flooded in a 100-year storm. Flooding occurred in areas that were shown to be outside of the existing floodplain limits on the FEMA Flood Insurance Rate Map (FIRM). Re-delineation of the floodplain limits for Upper Centennial and Grass Washes and the Aguila Farm Channel. New hydrology will need to be produced for this study.

Lower Agua Fria Watershed

- *452 North Peoria ADMP* – Study

White Tank A and B Watersheds

- *470 White Tanks ADMP*
  - *White Tanks FRS # 3 Modifications* – This existing facility requires corrective action to bring the structure into compliance with dam safety standards and requirements. Alternatives to dam rehabilitation have recently been completed by the District which would allow for the removal of dams by replacing the FRS with a combination of other flood control features that can also provide multi-use opportunities.
  - *Loop 303 Corridor / White Tanks ADMP Update* – Study

Lower Hassayampa Watershed

- *343 Sols Wash Hassayampa Water Course Master Plan* – Study

Recommended Projects from On-going ADMPs

Additional projects that were recommended through the Area Drainage Master Plans or other studies but not yet included in the CIP are the following:

- *Reems Road Channel* – The proposed project includes the construction of a channel along Reems Road to convey off-site drainage for the 100-year storm water event. The project would protect one arterial roadway, three collector roadways, the City of Surprise's waste water treatment plant, and other utilities.
- *Bullard Wash Phase II* – This phase includes an earthen greenbelt channel along Bullard Wash from Lower Buckeye Road to McDowell Road. This diversion channel will divert a portion of the peak storm flows from Bullard Wash through existing detention basins located north of I-10, and then outlet to the Agua Fria River. This project will reduce the floodplain and protect the Phoenix-Goodyear Airport and nearby development.

Structures Assessment / Dam Safety Program

?????

Structures Analysis

???

Multi-Use Projects

????

In addition, the District will utilize existing floodplain and drainage regulations to minimize and prevent damages from flooding problems. The Floodplain Delineation Branch will delineate an addition XX linear miles outside of the ADMP being prepared. Operation and maintenance of existing structures will be ongoing to preserve the life of facilities and prevent flooding from occurring due to maintenance issues.

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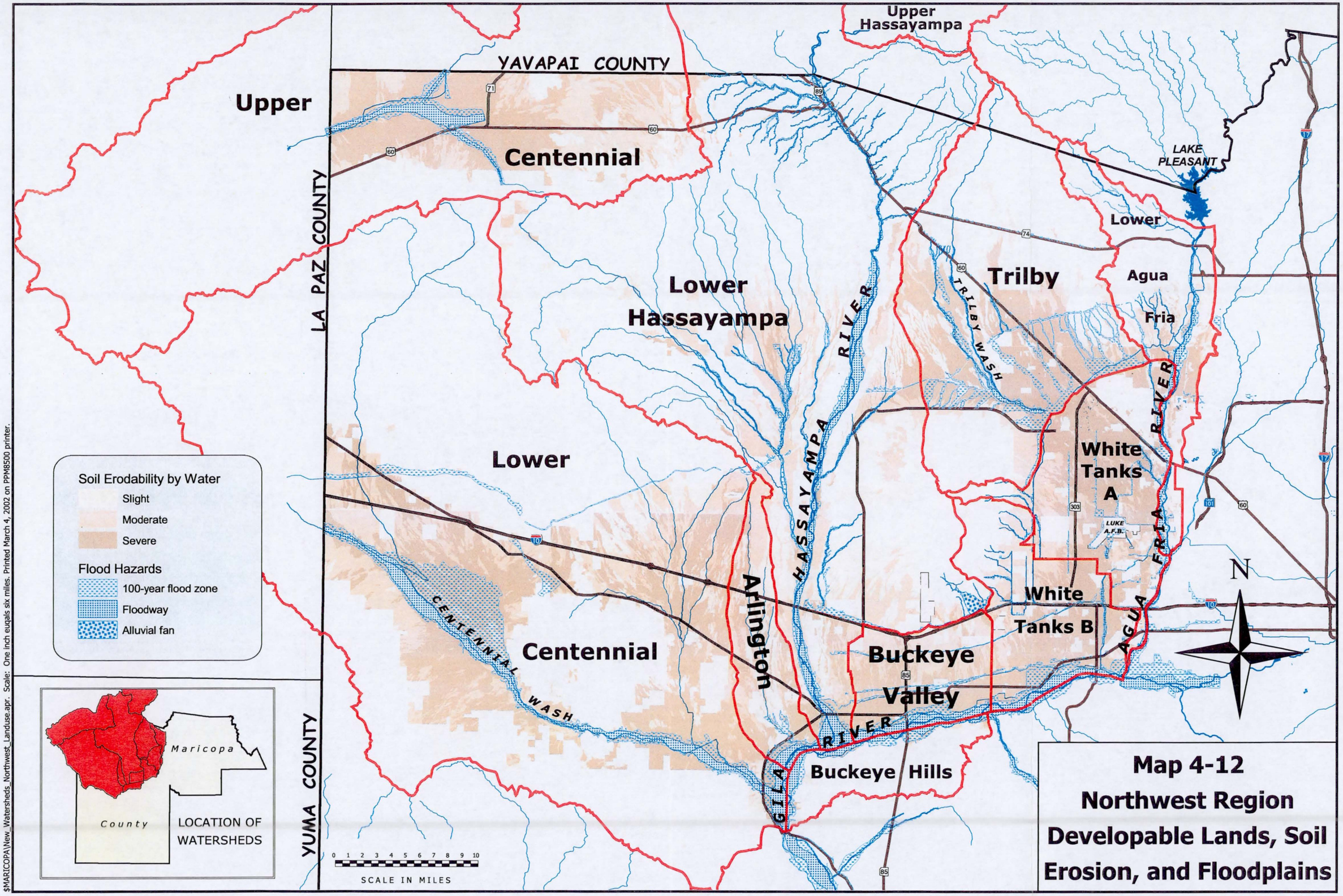

Map 4-12
Northwest Region
Developable Lands, Soil Erosion, and Floodplains

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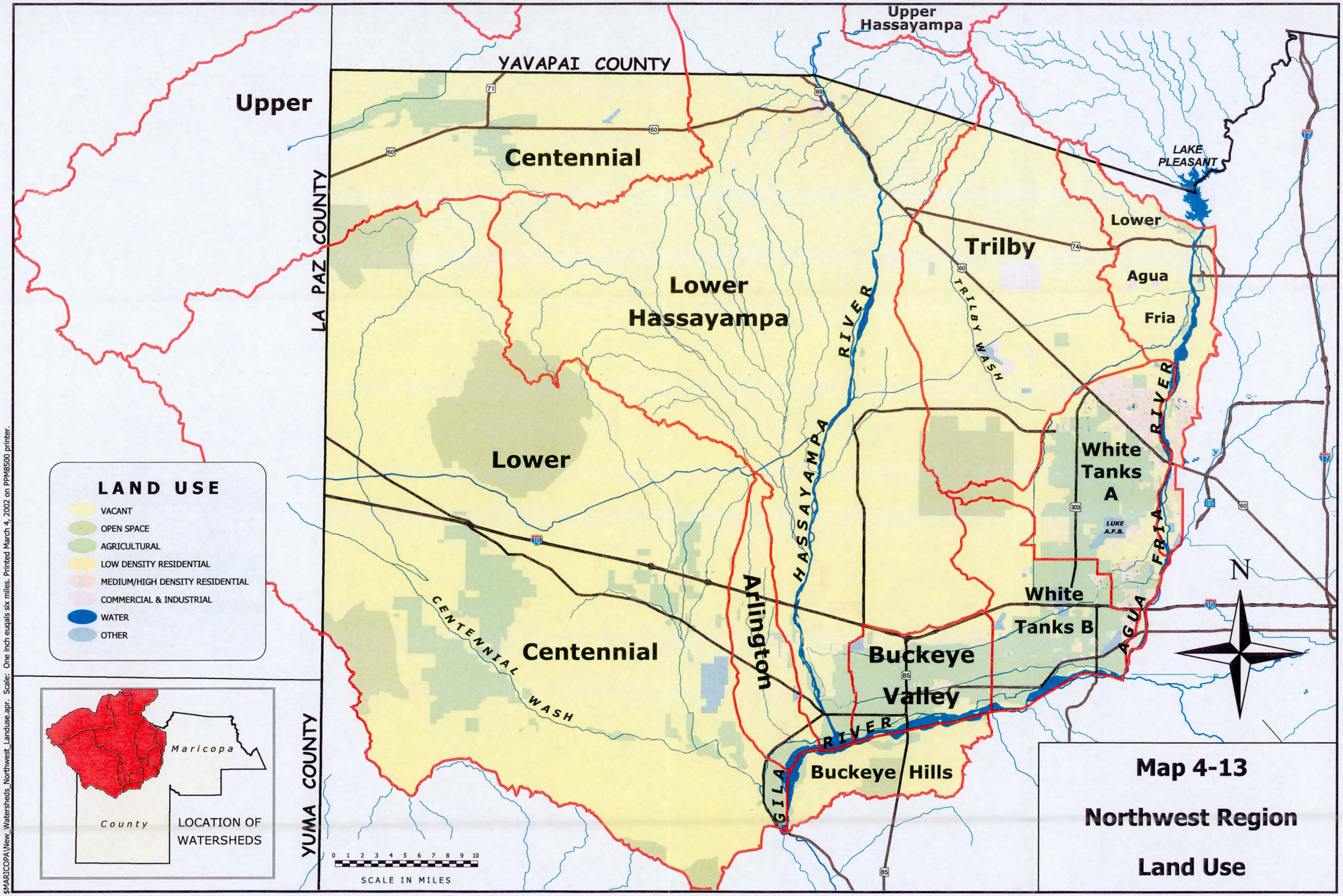

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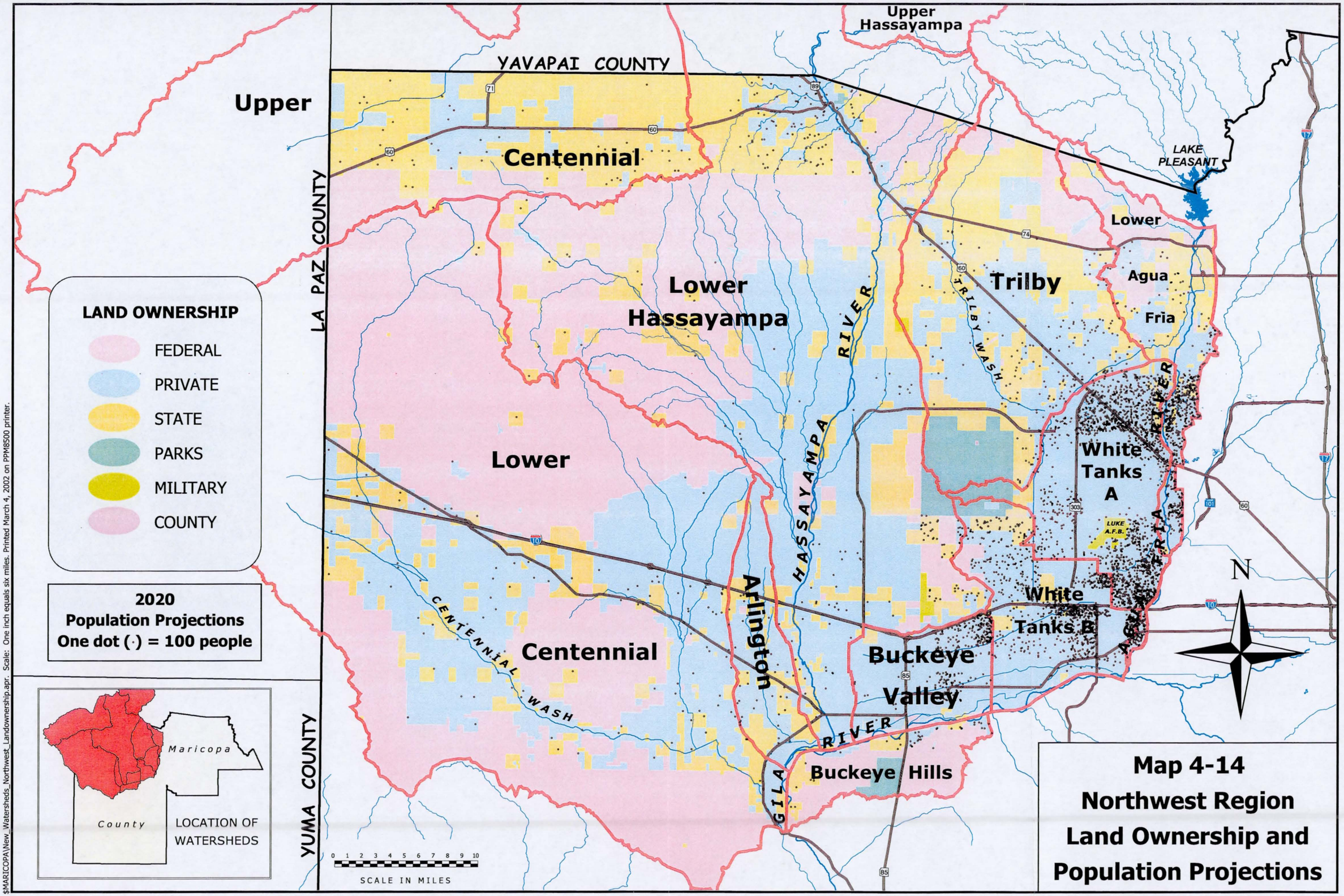
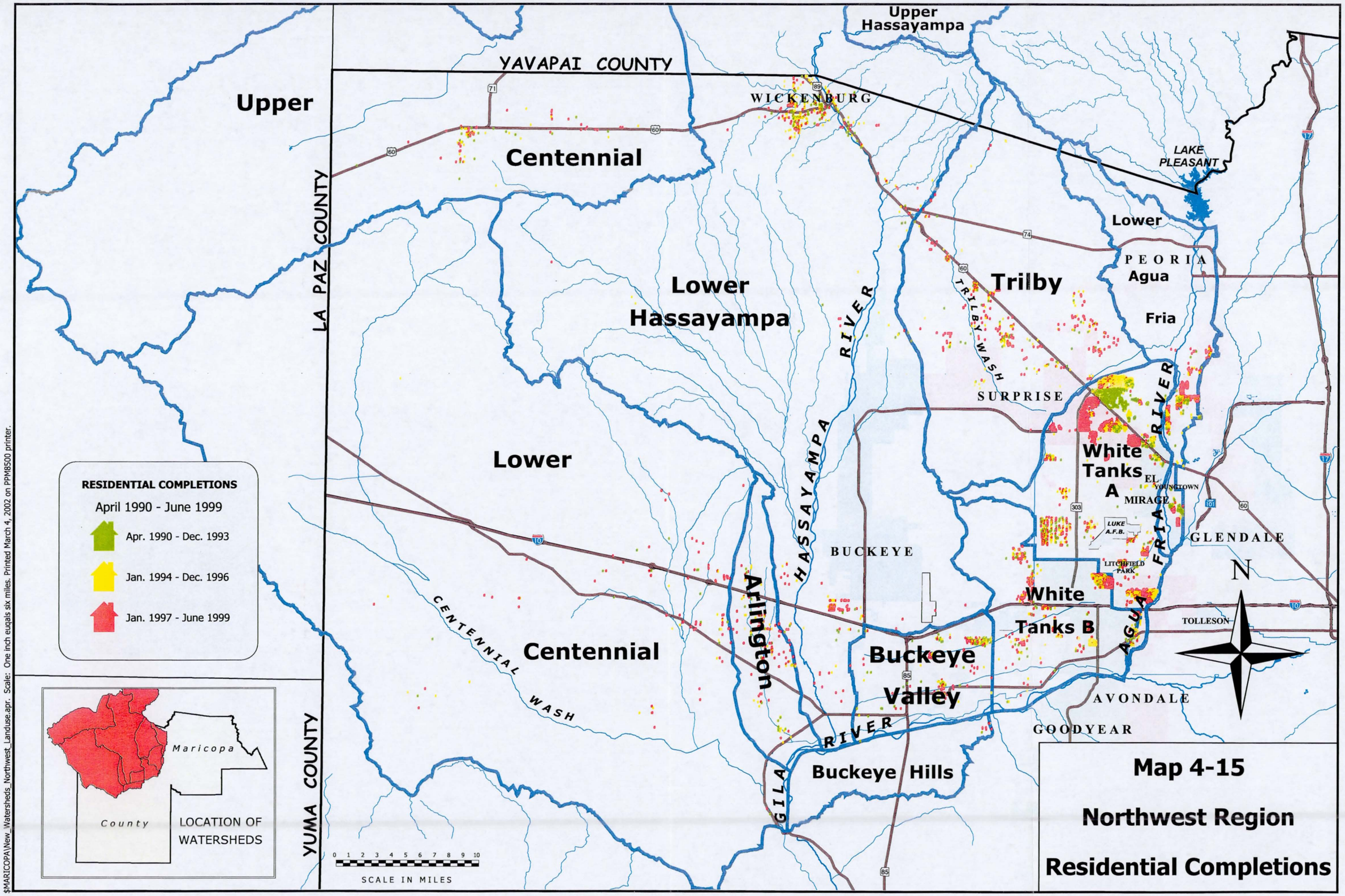

Map 4-14
Northwest Region
Land Ownership and
Population Projections
LAND OWNERSHIP
FEDERAL
PRIVATE
STATE
PARKS
MILITARY
COUNTY
2020
Population Projections
One dot (·) = 100 people
LOCATION OF WATERSHEDS
Maricopa
County
SCALE IN MILES
0 1 2 3 4 5 6 7 8 9 10
N
YAVAPAI COUNTY
LA PAZ COUNTY
YUMA COUNTY
Upper
Upper Hassayampa
Centennial
Lower Hassayampa
Lower
Centennial
Trilby
Lower
Agua Fria
White Tanks A
White Tanks B
Arlington
Buckeye Valley
Buckeye Hills
LAKE PLEASANT
LUKE A.F.B.
HASSAYAMPA RIVER
TRILBY WASH
CENTENNIAL WASH
GILA RIVER
AGUA FRIA RIVER
$MARICOPA\New_Watersheds_Northwest_Landownership.apr. Scale: One inch equals six miles. Printed March 4, 2002 on PPM8500 printer.



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or some variation.

Southwest Region

, 3355 square miles of which are within the County, or about 36 percent of the total area in the County.

Description

The Southwest Region covers 10 watersheds in the southwestern portion of Maricopa County. These watersheds are Ajo, Gila Bend, Gillespie, Lower Gila, Painted Rock, Santa Rosa, Sentinel, Theba, Vekol, and Waterman. The exact location is shown on Map 4-2. These watersheds contain 3,473 square miles ~~or nearly 38 percent of the total area in the County. Approximately 118 square miles are outside of Maricopa County~~. All but three of the watersheds have areas that extend outside the District's boundary. Lower Gila and Sentinel both extend into eastern Yuma County. Waterman and Vekol Watersheds both extend into western Pinal County. The Ajo Watershed extends into both southeastern Yuma County and western Pima County. The Theba Watershed is partly in western Pima County and the Santa Rosa Watershed extends into Pima County and southwestern Pinal County.

The Southwest Region is bounded on the west by Yuma County, on the south by Pima County, and on the east by Pinal County. The northern boundary is roughly formed by the Gila River in the northeast and Centennial Wash in the northwest. The Gila River runs through a number of the watersheds. Major washes in the area include Tenmile, Waterman, Rainbow, Sandtank, Vekol, Midway, Copper, Loudermilk, and Sauceda. The Enterprise and Gila Bend Canals run through the Painted Rock, Gila Bend, and Theba watersheds. Interstate 8, State Route 85, and Old U. S. 80 bisect the region dividing it in quarters. Signal Mountain, Painted Rock, Woolsey Peak, the Sierra Estrella, North Maricopa Mountains, and South Maricopa Mountains wilderness areas are scattered through this region. The southern portion of the region is the Barry M. Goldwater Gunnery Range, which contains the Sand Tank and Sauceda Mountains.

The Gila Bend Indian Community and portions of the Gila River and Tohono O'Odham Indian Communities are in this region. All or parts of the municipal boundaries of Avondale, Goodyear and Gila Bend are in this Region. Unincorporated communities include Agua Caliente, Sentinel, Palo Verde, Arlington, and Rainbow Valley. The District does the Floodplain Management for the Town of Gila Bend.

Physical Characteristics

The area in general is mountainous with slopes over 15 percent for more than fifty percent of the area with valleys between ranges. The majority of the land area that was classified in these watersheds falls into the B Hydrologic Groups for soils. A, C and D Hydrologic Groups are distributed through the Region. The Southern half of the Region is the Barry M. Goldwater Gunnery Range was not classified on the USDA/NRCS Digital Soil Survey. Map 4-16 shows areas of soil erodability by water and the flood hazards for this Region. The numerous watercourses and several canals in this area pose potential flooding hazards. Run-off from the irrigated farm land scattered through several of the watersheds may cause water quality problems. The majority of the land in the Region still retains its natural desert vegetation. River restoration along the Gila River is being planned which should help maintain or restore riparian areas along this corridor.

Land Status

Land ownership patterns are heavily weighted towards federal at 41.5 percent of the area and military at 36.8 percent of the area. Both of these figures are well above the overall Maricopa

these only total 99.5%

County average. Private and state ownership are less than the County averages with 11.1 percent and 5.7 percent respectively as compared to 29 percent and 11.2 percent.

Native American lands are nearly on the County average with 4.4 percent of the total versus 4.6 percent for Maricopa County. There is no national forest in this Region however, there are numerous conservation and preserve areas.

Land use patterns vary widely from Maricopa County averages in several categories. Open Space, in the Region, accounts for nearly 47 percent of the total versus 32.8 percent. Agriculture accounts for just three percent versus seven percent for the County. The most striking difference is in residential and commercial where less than a quarter of a percent of the land use occurs versus nearly seven percent for the County as a whole. Map 4-17 shows the land use patterns throughout the Region.

Socioeconomic Characteristics

The Southwest Region (Maricopa County portion only) had a population of 5,570 people in 1995. This was approximately one-quarter of one percent of the total population for Maricopa County in 1995. This Region is by far the least populated region in terms of numbers of people.

Population is projected to reach 61,831 people by 2025. This increase of 56,261 people is a percentage increase of over 1,000 percent for the 30-year period. This 33.7 percent growth rate on an annual basis far exceeds the projected growth rate of 3.2 percent for Maricopa County.

District Activities Completed

Structural

No structural projects have been completed by the District in the Southwest Region.

Non-Structural

156.0 linear miles of watercourse delineations have been completed in the Southwest Region out of ~~an estimated~~ 2,273.5 linear miles estimated from the100,000 USGS Hydrography. Delineations have been done in seven of the ten watersheds, with the most in the Waterman Watershed. About 1,180 drainage permits and 16 floodplain use permits were issued from 1990 to 1999.

Studies

The following studies have been done or are in process by the District for this Region:

- Gila Bend ADMP (1980's, 2001) for the Gila Bend, Theba, and Painted Rock Watersheds.
- Rainbow Valley/Waterman Wash ADMS (1980's) for the Waterman Watershed.
- The El Rio Watercourse Master Plans will be beginning in 2002.

Hazard and Problem Assessment

The Southwest Region has considerable acres of land under federal and military control with very few people living within its confines. The percentage rate of growth over the next 30 years will far exceed that for the County as a whole. However, by 2025, total population in this Region will still be just one-ninth of the next least populated region. Areas where development is projected include Goodyear and Avondale which are located in the far northeastern corner of the Region.

The population is expected to increase 56,261 over the 30-year period. There are 538.84 square miles of area still available for development to hold this population.

However, 2,118 linear miles of delineations out of 2,274 still remain to be done so that these new residents will not develop in flood and erosion hazard areas. There are 12 structures in the floodway and 148 structures in the delineated floodplains. Only 18 structures are also in a moderate or severe erosion hazard zone. In addition, there were 78 County road closures from 1996-2000 which were mostly in the Waterman Watershed. Reported flooding problems for each watershed are in the individual write-ups in Appendix B.

Table 4-3 shows the Southwest Region Watersheds that are inside the County's boundary in the bottom half for priority in need of a series of projects per the District's programs. The Waterman Watershed falls in the top 15. Problems that need to be addressed ~~are~~ include the following:

- A portion of the 2,118 linear miles of watercourses need to be delineated.
- A buy-out program needs to be presented to the property owners with their structures in the floodway, with priority given to residential homes in the highest hazard category.
- A more detailed look at the approximate 148 structures at risk in the floodplain needs to be done.

Each of the above issues needs to now be prioritized through the various different District programs. The District is responsible for the Floodplain Management for the majority of this area and, as the lead agency, has done several studies to identify the hazards and solutions for these watersheds. The next section identifies the flood control projects in the current CIP to mitigate these flooding hazards for the watersheds in the Southwest Region.

Presently Identified Future Activities

Capital Improvement Program

The CIP for Fiscal Years 2001/2002 to 2005/2006 indicates that there are no projects planned for the Southwest Region.

Recommended Projects from On-going ADMPs

There are no projects currently recommended in recently completed studies for this report.

However, the District will utilize existing floodplain and drainage regulations to minimize and prevent damages from flooding problems. The Floodplain Delineation Branch will delineate an addition XX linear miles outside of the ADMP's being prepared. Operation and maintenance of existing structures will be ongoing to preserve the life of facilities and prevent flooding from occurring due to maintenance issues.

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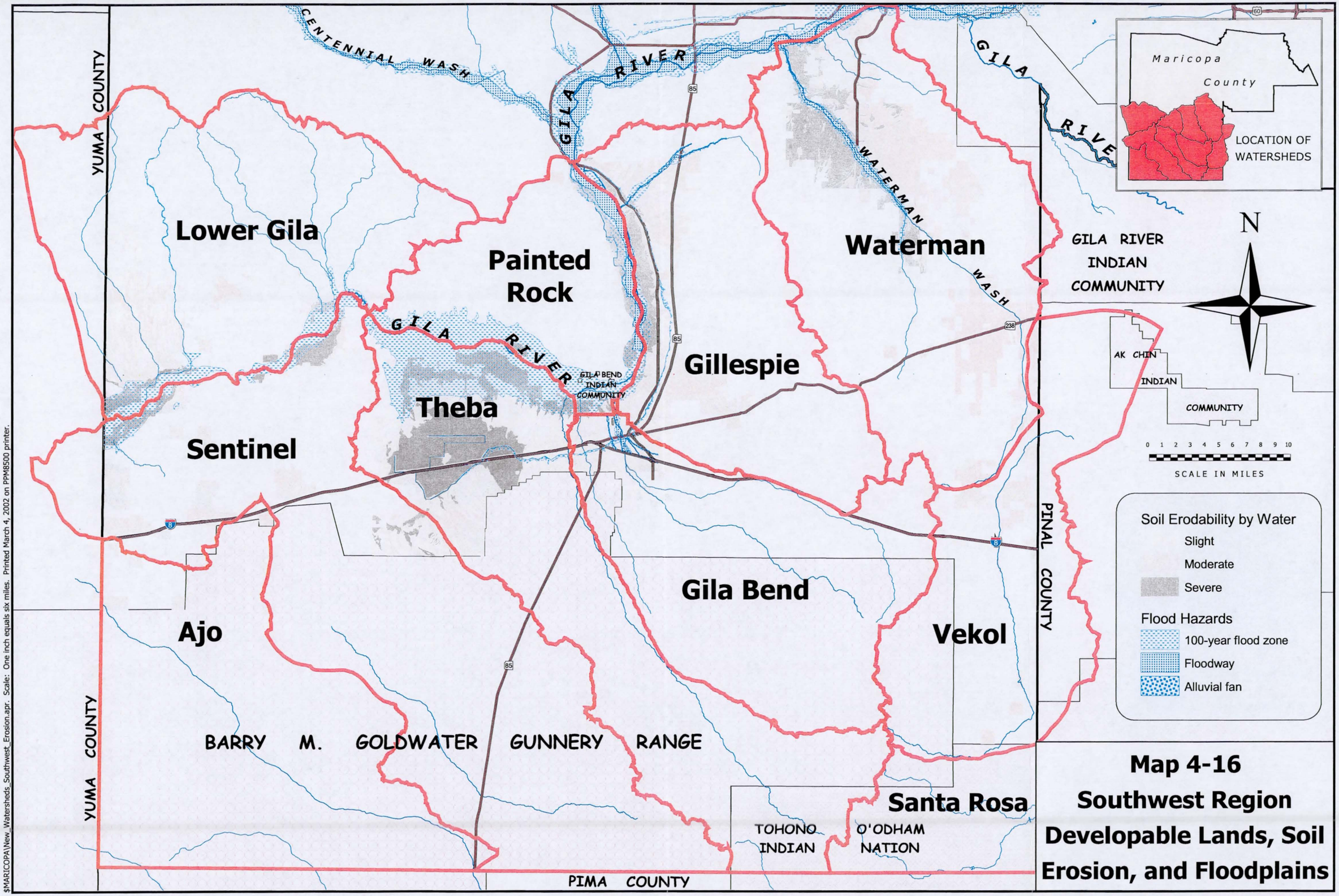
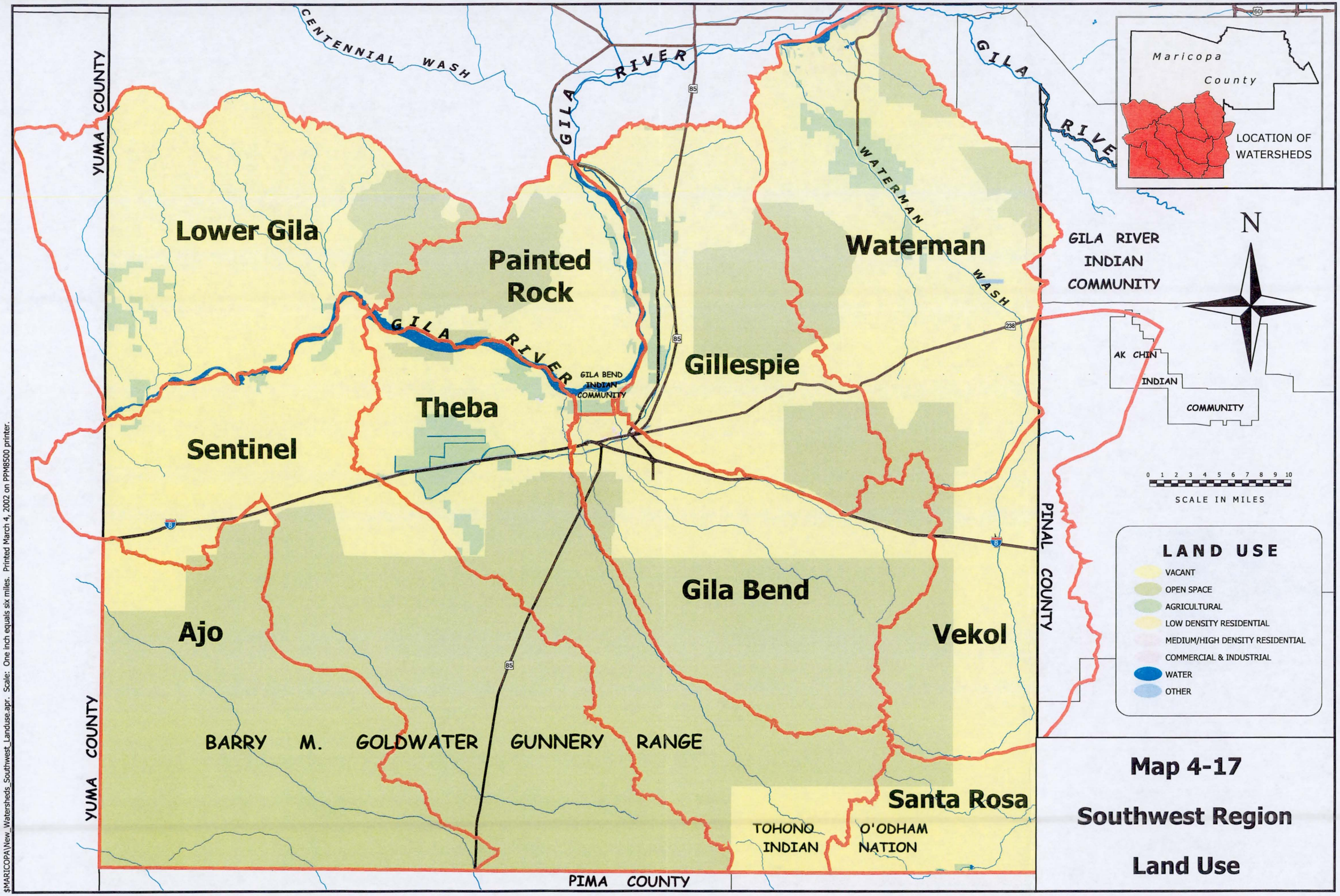


Map 4-16
Southwest Region
Developable Lands, Soil Erosion, and Floodplains

$MARICOPA\New_Watersheds_Southwest_Erosion.apr. Scale: One inch equals six miles. Printed March 4, 2002 on PPM8500 printer.



Map 4-17

Southwest Region

Land Use

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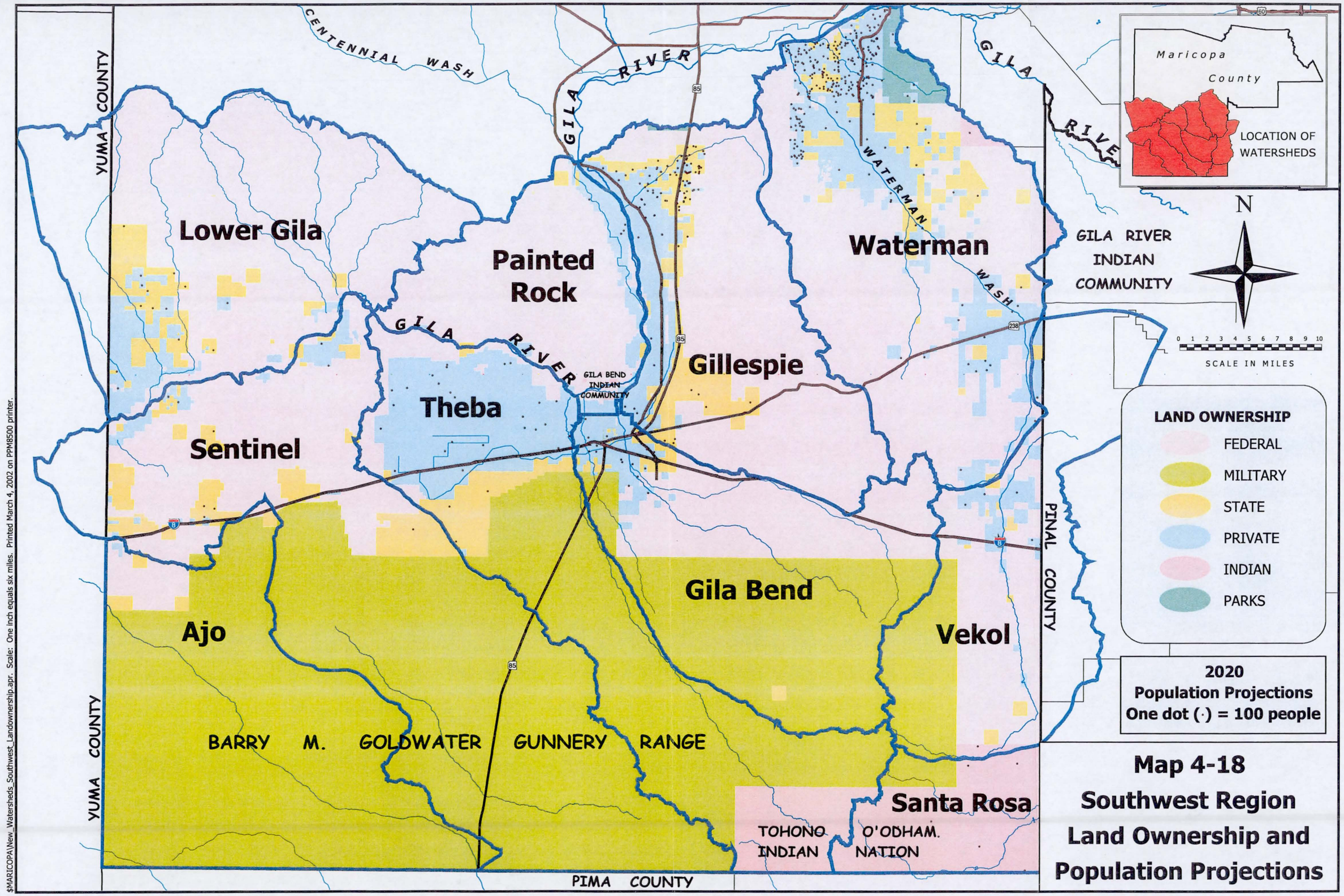
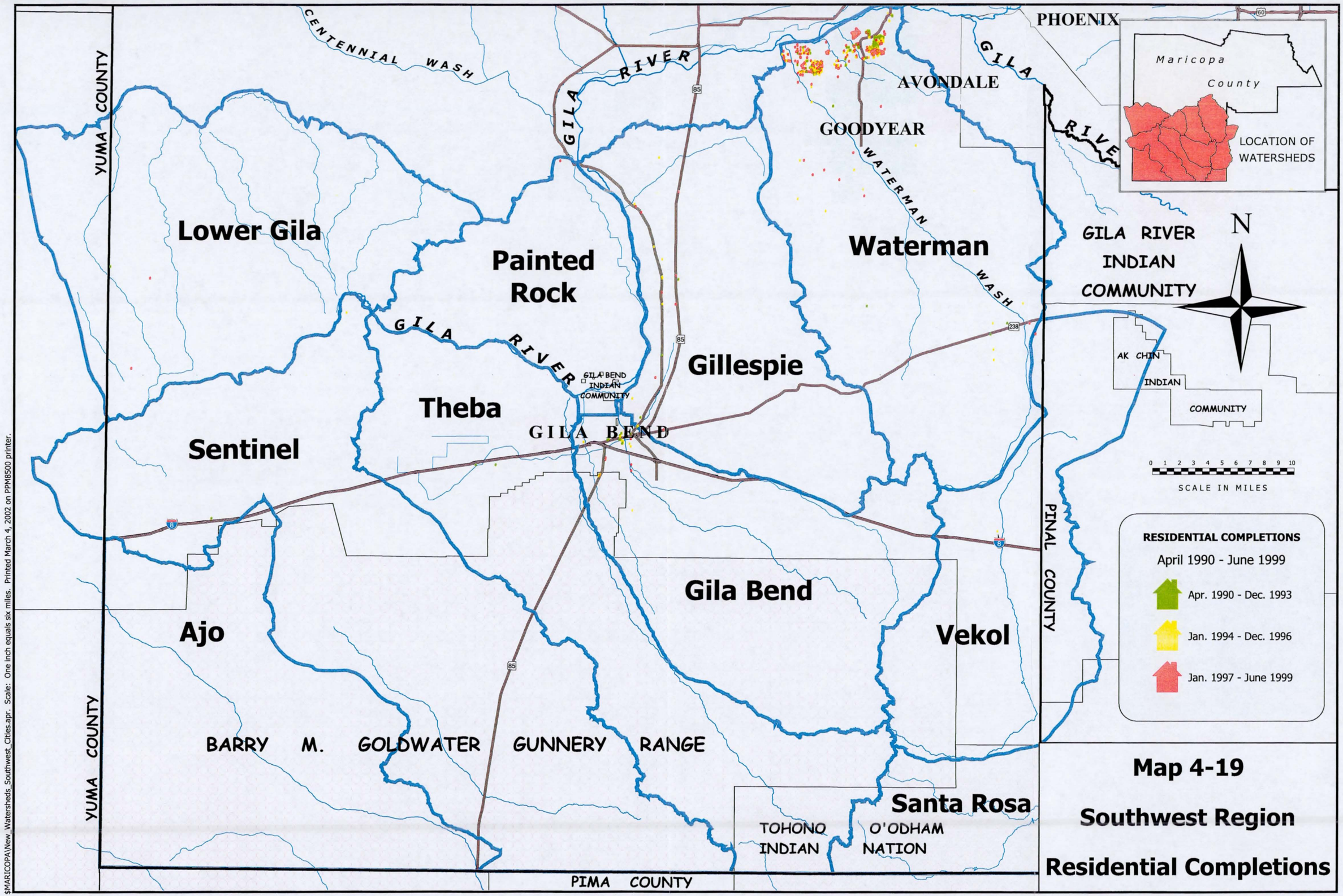


Map 4-18
Southwest Region
Land Ownership and
Population Projections

$MARICOPA\New_Watersheds_Southwest_Landownership.apr. Scale: One inch equals six miles. Printed March 4, 2002 on PPM8500 printer.



Map 4-19

Southwest Region

Residential Completions

$MARICOPA\New_Watersheds_Southwest_Cities.apr: Scale: One inch equals six miles. Printed March 4, 2002 on PPM8500 printer.

Summary

Considerable measures have been taken to minimize or eliminate flood control hazards throughout the County. But with the rapid and continuing growth Maricopa County has experienced in conjunction with funding limitations there is much left to do. The best approach is to first assess risk through a prioritization process for each watershed and then establish a schedule to complete needed projects over time. This has been done for the most part through the CIP process. Approximately 40 additional projects were done through the CIP program since the 1963 report. A good portion of the urban area problems have been addressed. There are still area of concern in the heavily developed portions of the Metropolitan Area, but the District now has the opportunity to get ahead of development to prevent similar situations from happening. The upcoming ADMP studies will look at implementation of the District's non-structural and low-impact programs. The recently completed North Peoria Area Drainage Master Plan for the Lower Agua Fria Watershed demonstrates the use of the non-structural principles using a "Rules of Development" approach. Future flood management for the District will employ a combination of these principles with structural fixes as needed.

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CHAPTER 5. COMPREHENSIVE FLOOD MANAGEMENT PLAN

Overview

Maricopa County is too vast to determine all of the flood hazard problems in a short time frame especially when areas remain unpopulated and lives and property have not been at risk on a constant basis. As indicated in the previous chapters approximately 30 percent of the County is still available for development. The approximate 64 percent that may not urbanize, such as the National Forest, Gunnery Range, and steep slopes, still contributes to the flood hazards and must be addressed. The population is expected to increase by about 2.4 million people by 2025 expanding further out in the County. It is likely that these people will locate in these outlying areas. There are still urbanized areas that have not been completely delineated or all proposed projects not yet completed. As noted in Chapter 4 there are numerous projects to still complete in the urbanized areas.

The District is required by State law to produce a report that describes existing facilities and programs for flood control mitigation as well as identify future flooding problems. In addition, a Floodplain Management Plan must be part of Maricopa County's application to the Insurance Services Office for the NFIP Community Rating System. This is required because Maricopa County is a Category **C** community (10 or more repetitive losses). Currently the County's rating is CRS Class 5. Credit for this program is provided for preparing, adopting, implementing, evaluating, and updating a comprehensive floodplain management plan (FPM). Up to 235 points are provided for a series of planning steps. Those steps are the following:

Subsection	Step	Max. Points
a.	Organize to prepare the plan	10
b.	Involve the public	48
c.	Coordinate with other agencies	18
d.	Assess the hazard	10
e.	Assess the problem	35
f.	Set goals	2
g.	Review possible activit1es	30
h.	Draft an action plan	60
i.	Adopt the plan	2
j.	Implement, evaluate, and revise	10
k.	Adopt a Habitat Conservation Plan (optional)	10

A number of the above items are addressed throughout this Comprehensive Plan. This chapter will recap those items and cover the remaining issues on the list.

Plan Organization

This Comprehensive Plan was prepared by a professional planner (AICP) with the assistance of a committee composed of staff from several of the branches that will be implementing the plan. The list of team members is noted on the inside cover sheet. This Team met weekly for close to two years to gather data, discuss the data, and develop the Comprehensive Plan. The Plan has then gone through an extensive internal review by District Division and Branch Managers and other staff who will be involved in the implementation of the District's flood management programs. In

addition, the County's Planning and Development, Parks and Recreation, Transportation, and Environmental Services Departments provided input on the Plan.

Public Involvement

This Plan went through numerous meetings where the public was invited to attend to review the Plan and offer input. The District also held an information meeting before the Flood Control Advisory Board in April 2002 as well as the required public hearings per Arizona Revised Statutes and the CRS Program. The affidavits of meeting notice publication and sign-in sheets are included in Appendix C. The District has a web page were this document was posted for public review beginning in April of 2002. Public information meetings on the Plan were held in each of the Board of Director's Districts.

The District uses an Area Drainage Master Plan program to assess the hazards and problems by watershed because of the County's vast area. These studies give a more localized view of issues and solutions to flooding problems for the citizens to participate in. There were X of these ADMP's prepared in the last five years where public meetings were held that gave additional information on specific areas that has been summarized in this Plan. The record of these public meetings is included in Appendix C.

Coordination with Other Agencies

As above, with the public input process, other agencies are offered the opportunity to participate in the Comprehensive Plan development on two levels. The first being the extensive external review period in April of 2002 for all municipalities and affected agencies to provide comment on this Plan which was distributed to them. In addition, throughout the year agency representatives sit on technical advisory teams for the various ADMP's that are prepared by the District in partnership with these agencies. This list of ADMP's prepared in the last five years and agencies that were involved in the planning process are noted in Appendix C.

Assessing the Hazards and Problems

In the 42 years the District has been in existence considerable progress has been made to study and resolve the flooding problems in Maricopa County. However, there is still much to be done. A general list of issues is as follows:

- 11 of the 37 watersheds within the District's boundary have not yet been studied,
- Of the remaining 26, approximately 12 of these studies are over ten years old,
- 6,950 of 8,730 linear miles of 100,000 USGS Hydrography remain to be done,
- An estimated 423 structures are in the floodway and 22,000 in the floodplain with 14,511 of these in moderate or severe erosion hazard zones,
- Development pressure to the tune of 2,500 – 3,600 new residential starts are expected per month spreading into areas not yet delineated or studied,
- Not all flood problems have been addressed in the existing urbanized areas.

Chapters 1 through 3 give a background on conditions that affect District activities and the programs that have been in progress to address the flood hazards and problems. Chapter 4 serve as the District's report to meet ARS § 48-3616 which gives a summary of existing structural and non-structural projects to mitigate flooding problems and identifies future projects and problems by watershed.

The New River WCMP is missing.

Sols Wash
Aguila
Upper Centennial
Wickenburg
Hassayampa WCMP
Tiger Wash
Jackrabbit Wash
Wittmann
North Peoria
Agua Fria WCMP
Lake Pleasant
Skunk Creek WCMP
Cave Creek WCMP
Carefree
Upper New River
Desert Hills
Skunk Crk / Adobe Dam
Cave Creek / Carefree
Rio Verde
Scottsdale Rd Corridor
Upper Indian Bend Wash
ACDC & Glendale / Peoria
E Fork Cave Crk
ACDC
Ftn Hills
Goldfield Ranch
Glendale / Peoria
Scottsdale / Paradise Valley
Granite Reef Wash
Buckeye / Sun Valley
Maryvale
Metro
E Phx
STP
Upper Emf
Spook Hill
Palo Verde
White Tanks / Agua Fria
Durango
S Phoenix
W Mesa / Tempe
Northwest Mesa
East Mesa
Luke Wash
Hohokam
S Phx / Laveen
Estrella
Laveen
Foothills
Gilbert / Chandler
Lower Centennial
Queen Creek
El Rio WCMP
East Maricopa Floodway
Queen Creek & Sanokai Wash
Painted Rock
Rainbow Valley / Waterman Wash
Gillespie
Sentinel
Theba
Gila Bend
Vekol
N
NOT TO SCALE - FOR LOCATION ONLY

Area Drainage Master Plan Studies (ADMS)
AND **Area Drainage Master Plans (ADMP)**

- Future Studies
- Completed Studies
- Continuing Studies / **Plans**
- New Studies / **Plans**

Watercourse Master Plans

- ***Completed WCMPs***
- ***Continuing WCMPs***
- ***New WCMPs***

Map 5-1

Status of Master Plans and Studies

FY 2001/02

February 7, 2001

Because of Maricopa County's vast size, assessment of the remaining hazards and problems is done by watershed through the ADMS/ADMP program. An ADMP may cover one or more watersheds. Eight of these studies were begun in the last two years with five of these studies just being completed. Anticipated projects from these studies are identified in Chapter 4 and detailed in the District's current CIP. Map 5-1 shows the location of studies and the six studies that are starting up. District studies include environmental hazards identification, environmental characteristics evaluation, multi-use opportunities, public involvement, development and evaluation of alternatives. When practical, studies will contain a "Rules of Development" section which applies non-structural and low-impact solutions to development while incorporating trails and other multi-use opportunities. The North Peoria ADMP, completed in February 2002, contains this element.

Floodplain Management Goals

One of the tools that the District uses to set a course for future direction and type of projects to be done is the annual Strategic Plan. This Strategic Plan is prepared by a Team made up of staff members from the District's Divisions. The Strategic Plan is adopted by the Board of Directors. The current strategic planning process for the District, Managing for Results, produced the following Floodplain Management Goals for FY 01-06:

1. The Flood Control District will conduct two studies per year for the next five years to identify flood prone areas, limit growth in those areas, and establish plans for the required drainage infrastructure.
2. The Flood Control District will study, each year for the next five years, two major areas of Maricopa County that are not yet under development, but are expected to be according to the Maricopa Association of Governments' projections.
3. Each year for the next five years, the Flood Control District will evaluate five existing flood control facilities' safety monitoring procedures, evaluate District-owned flood control facilities, and begin plans to mitigate, upgrade, or redesign these facilities to reduce the increased risk and liability associated with them, meet all regulatory requirements, and maintain or improve their flood control functions.
4. The Flood Control District will initiate at least one project each year for the next five years that uses innovative and resourceful operational and financial strategies.
5. The Flood Control District will evaluate five existing flood control facilities each year for the next five years to determine how they can be made more aesthetically pleasing or used as multi-use facilities.
6. The Flood Control District will plan and design future flood control projects to incorporate multi-use facilities where practical.

In addition, The Maricopa County Comprehensive Plan 2020 – Eye to the Future, adopted by the Board of Supervisors on October 20, 1997, identifies the following Goals, Objectives, and Policies that pertain to the District's programs and activities:

Land Use

Goal: Promote efficient land development that is compatible with adjacent land uses, is well integrated with the transportation system, and is sensitive to the natural environment.

Objective L1 Promote infill development.

Policy L1.2 *Explore financing mechanisms to pay the cost of capital improvements necessitated by new development.*

Objective L3 Encourage innovative and varied approaches to development.

Policy L3.2 *Encourage flexible standards to accommodate innovative and varied approaches to development.*

Policy L3.3 *Encourage the use of unit plans of development for residential with more than ten dwelling units.*

Objective L10 Promote the balance of conservation and development.

Policy L10.1 *Encourage the preservation of environmentally sensitive areas through the transfer of development rights, density transfers, or other suitable techniques.*

Policy L10.2 *Encourage building envelopes and localized grading, to reduce blading and cut and fill, in environmentally sensitive areas.*

Policy L10.3 *Encourage and provide incentives for clustered development patterns within Development Master Plans.*

Policy L10.4 *Encourage the development of critical area programs to preserve environmentally sensitive areas in a manner that protects private property rights.*

Policy L10.5 *Encourage development standards for hillsides and other environmentally sensitive lands that allow street standards and other infrastructure to respond in an innovative manner to topography and drainage.*

Policy L10.6 *Encourage the preservation of ridgelines, foothills, and mountainous land with slopes of 15% or greater.*

Objective L11 Promote an interconnected open space system.

Policy L11.1 *Support techniques for acquisition and maintenance of open space.*

Policy L11.2 *Preserve and respect private property rights in any future designation of open space areas.*

Policy L11.3 *Encourage the protection of ridgelines, foothills, significant mountainous areas, wildlife habitat, native vegetation, and riparian areas.*

Policy L11.4 *Discourage development within major 100-year floodplains.*

Environmental

Goal 1: Promote development that considers adverse environmental impacts on the natural and cultural environment, preserves highly valued open space, and remediates areas contaminated with hazardous materials.

Objective E1 **Encourage preservation of significant mountainous areas with slopes over 15% for parks, open space, and/or compatible recreation use.**

Policy E1.1 *Conduct site evaluations in the planning stage.*

Policy E1.2 *Explore incentives and options for preservation.*

Objective E2 **Promote development that is compatible with the visual character and quality of site.**

Policy E2.1 *Encourage guidelines for building construction, modification, and landscaping that reflect community or regional character.*

Policy E2.2 *Encourage preservation of scenic corridors and vistas.*

Objective E3 **Promote the appreciation and preservation of significant archeological and historic resources within the framework of state and federal laws, regulations, and guidelines.**

Policy E3.1 *Conduct surveys and evaluations for cultural resources as required by the Arizona Antiquities Act, the State Historic Preservation Act, the National Historic Preservation Act, and other applicable laws, regulations, and guidelines.*

Policy E3.2 *Implement mitigation measures for cultural resources as required by the Arizona Antiquities Act, the State Historic Preservation Act, the National Historic Preservation Act, and other applicable laws, regulations, and guidelines.*

Policy E3.3 *Consider alternative funding sources for impact avoidance or mitigation or impacts to significant cultural resources.*

Objective E4 **Encourage the protection of habitat within the framework of state and federal laws, regulations, and guidelines.**

Policy E4.1 *Identify priority habitat areas subject to development in compliance with Endangered Species Act and other applicable laws, regulations, and guidelines.*

Policy E4.2 *Participate in the inventory and classification of habitat for noted important species in priority areas if required by state or federal laws, regulations, and/or guidelines.*

Policy E4.3 *Develop habitat conservation plans for protected species if required by state or federal laws, regulations, and/or guidelines.*

Policy E4.4 *Explore incentives to preserve habitat.*

Policy E4.5 *Explore methods to acquire lands classified as priority habitat areas as part of an open space plan.*

Objective E5 **Promote the protection and preservation of riparian areas within the framework of state and federal laws, regulations, and guidelines.**

Policy E5.1 *Encourage site evaluation and classification of riparian-areas as required by the United States Army Corps of Engineers 404 permit program or by other state or federal laws, regulations, and/or guidelines.*

Policy E5.2 *Consider incentives and options for preservation.*

Objective E6 Encourage the reduction of pollutants in rivers and streams within the framework of state and federal laws, regulations, and guidelines.

Objective E7 Discourage new development in major 100-year floodplains.

Policy E7.1 *Ensure that local floodplain management regulations remain in conformance with state flood control statues and the National Flood Insurance Program (NFIP) rules and guidelines.*

Policy E7.2 *Review proposed floodplain uses and issue only appropriate permits and clearances.*

Policy E7.3 *Review existing 100-year floodplains as necessary against changed conditions and obtain revisions through Federal Emergency Management Agency (FEMA) where necessary.*

Policy E7.4 *Encourage flood identification studies in areas where development is imminent or ongoing to identify 100-year flood hazard areas.*

Policy E7.5 *Continue public education efforts pertaining to the judicious uses of flood-prone properties.*

The following are the goals, objectives, and policies for the Maricopa County Comprehensive Pan 2020 Open Space Element that was recently added to the County Plan:

Open Space

Goal: Maintain and, where necessary, encourage expanding the open space system for Maricopa County to address public access, connectivity, education, preservation, buffering, quantity, quality, and diversity for regionally significant open spaces.

Objective O1 Promote physical and visual public access to open space resources.

Policy O1.1 *Encourage efforts to protect and improve public access to open space resources.*

Policy O1.2 *Encourage protection of view corridors within new and established scenic corridors.*

Policy O1.3 *Encourage protection of public access around existing regional parks from urban encroachment.*

Objective O2 Establish regional open space connectivity and linkages for both recreation and wildlife purposes.

Policy O2.1 *Coordinate trail linkages in new developments with Maricopa County Flood Control projects and other open space projects and/or resources.*

Policy O2.2 *Encourage development of trails along rivers, washes, and canals to link existing open space resources throughout the region.*

Policy O2.3 *Design all road crossings to minimize disturbance to the natural environment, and to accommodate identified trail crossings and other open space.*

Policy O2.4 *Encourage preservation of Upper Sonoran Desert areas to serve as major links between regionally significant open space resources. In addition, encourage inclusion of smaller*

areas of foothills (bajadas), flatlands, and small valleys to provide connectivity and transition functions.

Policy O2.5 *Encourage completion of the Sun Circle Trail (Figure 2) through integration into the Maricopa County Regional Trail plan.*

Policy O2.7 *Encourage integration and consideration of the proposed Maricopa County Regional Trail into future development.*

Policy O2.8 *Support partnerships with public and private entities whenever possible to establish open space corridors and linkages.*

Objective O3 Promote the economic and quality of life benefits of open space.

Policy O3.1 *Encourage communication efforts with open space stakeholders to share information and discussion on current issues and/or projects.*

Policy O3.4 *Participate in multi-jurisdictional projects that promote open space protection.*

Objective O4 Protect and enhance environmentally sensitive areas, including mountains and steep slopes; rivers and washes; historic, cultural, and archeological resources; view corridors; sensitive desert; and significant wildlife habitat and ecosystems.

Policy O4.1 *Conserve mountainous areas that contain important wildlife habitats, cultural resources, and scenic areas.*

Policy O4.2 *Discourage development on ridge or crestlines and on steep slopes.*

Policy O4.3 *Encourage the use of native plant material for all types of landscaping.*

Policy O4.5 *Explore implementation of flexible zoning techniques that promote open space preservation.*

Policy O4.6 *Consider alternate funding sources and protection techniques for acquisition of priority open space areas.*

Policy O4.7 *Discourage development in areas that are environmentally sensitive.*

Objective O5 Encourage appropriate open space buffers between communities and land uses.

Policy O5.1 *Discourage development in those foothill areas that provide buffers around mountainous areas, open space linkages, and public access points.*

Policy O5.3 *Protect view corridors through buffering, screening, and other development standards.*

Prioritization (Review of Possible Activities)

The District cannot fund studies and projects for the entire County all at once, nor is there a need to do so. The five-year ADMP and CIP Programs allow the District to plan ahead and spread these projects out over a reasonable time frame based on highest need. Prioritization of District activities for flooding problem mitigation starts at a very broad level through the Planning and

Project Management (PPM) Division. A process has been established through a committee in the PPM Division to score all of the watersheds based on nine critical elements that are tied to the District's core programs and activities and area risk. This ranking of watersheds against each other is a preliminary look at where the greater problems appear to exist and therefore ADMS, ADMP, or WCMP's need to be done or updated. The critical element data used for each watershed and the summary of the scores is presented in Chapter 4 in Table 4-3 and 4-4. The individual prioritization sheets for each watershed are in Appendix B with the corresponding watershed write-up.

Even at this preliminary assessment level, to decide on what order areas should be evaluated there are two levels to consider: 1) addressing existing urban areas and people currently at risk where solutions have not yet been completed and 2) getting ahead of development to prevent current and costly problems that are being addressed in urbanized areas from occurring.

The process above needs to be refined even further to look at additional data that would affect risk which is called a phase II assessment. This phase would look at soil conditions, slope, type of future development expected (i.e.: infill, master planned communities, large lot), floodplain management responsibilities, and solutions already planned in the next five years. At the same time these assessments and prioritizations are in process, each watersheds needs to be looked at in terms of individual District programs. While the PPM division in coordination with the other Divisions identifies future problems, each Division is also moving forward with activities under their programs. Examples of this would be as follows:

- A study may not be scheduled for several years for a watershed, however development is occurring. The Regulatory Branch would continue to provide floodplain management through its activities which are detailed in Chapter 3. The District staff can anticipate issuing approximately 20,000 drainage clearance permits each year.

- Again, studies may not be scheduled yet, but the Delineations Branch would still move forward on A Zones or detailed delineations for water courses where there are identified risks and floodplain management is needed. The Floodplain Delineation Branch has XXX miles of new delineations planned for the next xxx years.

- Flood Hazard Education is an ongoing process in conjunction with all other District programs and activities. Location of flood warning and data collection devises continues to grow and are prioritized on risk assessment adding to the District's floodplain management efforts either as a recommended solution to a study or to prevent possible lost lives or flood damages prior to solutions being developed through a study.

Prioritization will be affected by other projects that can reduce costs, timing, development pressure in an area, and a number of other factors. Chapter 3 emphasizes the multitude of programs that have evolved over time at the District to allow floodplain management to take places on numerous levels. Figure 5-1 shows the complexity of the layers of program activity and prioritization that takes place to schedule what projects will get done when.

Figure 5-1 Prioritization Diagram
(in process)

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This sentence is too long. Break it up and expand so what you are trying to save comes through clearly.

Under "Preventive" on Next Page:

- Action: Updating of the "Drainage Design Manual for Maricopa County" and the "Uniform Drainage Policies and Standards for Maricopa County"

Budget: Staff Time, Intergovernmental Agreement with the COP
Responsible Party: Special Projects Branch of the Engineering Division of the Drainage Design Manual

The goal is to promote adoption by all communities within the County. This will promote consistency in technical methodology and reduce future losses related to flooding.

This section needs a lead-in paragraph.

Action Plan
Short-Term FY2001-2002 to FY2005-2006

1. Preventive

- *Action*: The District is currently working with County Planning and Development on a cooperative effort to notify developers of ADMP's and floodplain regulations early on in the development process. Expecting the Board of Supervisors to also adopt the District's Area Plans.

  the District is

  Budget: Staff time (District budget)

  Responsible Party: Planning Branch of Planning & Project Management Division

- *Action*: Maricopa County has recently adopted an Open Space Element for the Comprehensive Plan 2020 – Eye to the Future. See Floodplain Management Goals above.

  Budget: Staff time (County General Fund)

  Responsible Party: Maricopa County Planning & Development

- **Action**: Bold? The District's Floodplain Regulations were updated in 1999 and the Drainage Regulations are currently being updated in-house.

  Budget: Staff time (District Budget)

  Responsible Party: District Regulatory & Engineering Divisions

- *Action*: Stormwater Management .....

  Budget:

  Responsible Party:

- *Action*: Drainage System Maintenance .....

  Budget:

  Responsible Party:

see previous page

2. Property Protection

- *Action*: The District staff is finalizing a Floodprone Properties Acquisition policy that better defines our existing programs for acquisition and relocation especially in situation where a few structures need to be removed from the floodway and floodplain. Floodproofing is included in this policy. This policy is described in Chapter 6.

  Budget:

  Responsible Party:

- *Action*: Building Elevation .....

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Budget:

Responsible Party:

- *Action*: Insurance

Budget:

Responsible Party:

3. Natural Resource Protection

- *Action*: Erosion and Sediment control … New Policy, 54+ erosion hazard zones recently delineated in the following studies: Skunk Creek Watercourse Master Plan (2001), Agua Fria Watercourse Master Plan (2002), North Peoria ADMP (2002),

Budget:

Responsible Party:

- *Action*: Wetlands protection and mitigation sites, best management practices

Budget:

Responsible Party:

4. Emergency Services

- *Action*: Flood warning and response

Budget:

Responsible Party:

5. Structural Projects

- *Action*: A series of levees, channels, storm drains diversions, retention basins, and FRS have been built over the years in the County for flood protection, usually in already urbanized areas as a retrofit, or prior to urbanization ~~previously~~ by federal agencies to protect farmland. There are currently 35 structural projects identified in the FY 2001-2002 to 2005-2006 CIP. The projects are listed in Chapter 4 by watershed and region.

Budget:

Responsible Party:

- *Action*: Phase I and II of a Structures Retrofit Program have been completed. There will be two more phases to this process. The intent of this program is to look at incorporating multi-use opportunities into existing structures, make them more aesthetically pleasing, and blend with the environment. The City of Peoria is in the process, under an IGA with the District, of developing a trail and park along existing District fee-held property. This project is along the New River and confluence of the New River with Skunk Creek. Much of the trail will be on the existing maintenance/access road along the river. The

Cities of Avondale and Glendale are currently working with the District on similar projects. Avondale's project will be on the Agua Fria River and Glendale's on the New River.

Budget:

Responsible Party:

- *Action*: Analysis for low-impact structural alternatives are being incorporated into District ADMP studies.

  Budget:

  Responsible Party: District Planning Branch

6. Public Information

- *Action*: Map information

  Budget:

  Responsible Party:

- *Action*: Outreach projects

  Budget:

  Responsible Party:

- *Action*: Real estate disclosures

  Budget:

  Responsible Party:

- *Action*: Library

  Budget:

  Responsible Party:

- *Action*: Technical assistance

  Budget:

  Responsible Party:

- *Action*: Environmental education

  Budget:

  Responsible Party:

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Plan Adoption and Implementation

This Comprehensive Plan was recommended for approval by the Flood Control Advisory Board on May XX, 2002. The Board of Directors adopted this Plan on July xx, 2002 by Resolution FCD 2002 RXXX. Implementation of all activities identified in this Plan is underway. This Plan will be updated and revised annually in conjunction with the District's Strategic Plan, Capital Improvement Program, and budget process. The District staff will analyze the success of its programs through the measurement process established by the County-wide Managing for Results program.

The District staff will further evaluate both the plan and the level of reduction in flood related problems through records and public feedback. The District staff will also look at its programs and revise them as needed to meet the demands and changes of the County.

Summary

With over two-thirds of the County still in need of assessment and planning for future floodplain management the District and the public face a challenging few years ahead. A partnership with the residents of the County through education and other programs is essential for a successful Plan. Citizens have had more opportunity to participate in the planning process over the last ten years and through continued education by the District will be able to help implement the flood management programs. The simple steps of having access to a floodplain map or the District's library (which is available on the internet) to review a study can accomplish the task of keeping structures out of harms way. In order for the District staff to keep the floodplain management program effective, annual review and revision as needed of the Strategic Plan is crucial. Chapter 6 summarizes elements of the current Strategic Plan and profiles several of the newer initiatives for non-structural activities the District is developing.

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CHAPTER 6. STRATEGIC DIRECTION

Introduction

The District employs a number of "tools" that collectively make up the comprehensive flood management plan in order to plan for future flood hazard mitigation. The beginning chapters of this Plan address some of these, such as State Statutes and the Capital Improvement Program. However, the District faces many outside forces that drive decision making. These other issues must be integrated into the decision making and prioritization processes. The District must also constantly evaluate its programs and funding available to develop projects that meet the safety needs for the citizens as well as incorporate the desires of the Board of Directors and public into future designs.

In addition to this Comprehensive Plan and the Capital Improvement Program, the District prepares a Strategic Plan, a Business Plan, and a Financial Plan. The Financial Plan sets goals and addresses the District's funding issues. The Business Plan breaks the District's work functions into programs and activities which then have measurements established. This is done to better track performance and public benefit. Each activity has goals and objectives that will be updated annually. The Strategic Plan sets the direction for the District which affects what programs and goals will be accomplished. The Strategic Plan is summarized in this chapter.

The District is also moving forward on several new initiatives that are shifting from the study or strategy identification stage into implementation. These activities are not addressed in detail in chapter 3 with the existing programs as they are not fully implemented as yet. An introduction to these new efforts are provided in this chapter.

Strategic Plan

Overview

The ***purpose*** of the strategic plan is to identify the basis for the ~~Flood Control~~ District and current and future actions necessary to maintain the ~~Flood Control~~ Districts capability to provide mandated responsibilities. The ***goal*** is to provide a collective vision of the short, near and long-term direction of the ~~Flood Control~~ District.

The ***vision*** of the Flood Control District of Maricopa County is that the people of Maricopa County and future generations will have the maximum amount of protection from the effects of flooding through fiscally responsible flood control actions and multiple-use facilities that complement or enhance the beauty of our desert environment.

The ***mission*** of the Flood Control District of Maricopa County is to provide ***flood hazard identification, regulation, remediation, and education*** to the people in Maricopa County so that they can reduce their risks of injury, death, and property damage due to flooding while enjoying the natural and beneficial values served by floodplains.

The ***environment*** in which we currently exist within Maricopa County is influenced by the increase in projected population - Population growth in Maricopa County is pushing people to build in higher flood risk areas such as agricultural lands, deserts, washes, and in areas beyond those that

are protected by existing dams. This increases the risks to life and property, and the demand for flood control. The combination of physical characteristics plus a large and continuing growth in population has made Maricopa County susceptible to flooding and/or erosion and sediment damages. Further the current environment reflects that County residents are requesting wildlife habitats, recreational facilities, and aesthetically pleasing open areas and are reluctant to accept concrete flood control structures resulting in the design and installation of more costly and complex multi-use facilities. An additional aspect of the environment are all the rules and regulations that influence the decision making process. This information is divided into federal, state, county, and local.

Federal

- 29CFR Ch XVII (7-1-88). Occupational Safety and Health Act (OSHA).
- 33CFR Title 33 Title 2, Chapter II-Corps of Engineers, Department of the Army, Part 208, Flood Control Maintenance & Operations of Flood Control Works.
- 40CFR Part 122, 123, 124. National Pollutant Discharge Elimination System (NPDES). 33USC Section 1344 (a), (b), and (e). Wetlands or Dredge and Fill Program (a.k.a. Section 404 of the Clean Water Act). 42USC 9601(35)(A)(B) and 9607(a). Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).
- National Flood Insurance Act of 1968 (PL 90-448, Title XIII). Flood Disaster Protection Act of 1973.

State

- A.R.S. §33-1324. Requires the District to maintain owned facilities that are rented in a clean and safe condition in full compliance with the applicable building codes.
- A.R.S. §45-1212. Requires the State to inspect dams in order to ensure proper maintenance.
- 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.
- A.R.S. §48-3609. Directs the Board of Directors to "...adopt and enforce regulations governing floodplains and floodplain management in its area of jurisdiction...."
- A.R.S. §48-3610. Requires the District to perform floodplain responsibilities for all jurisdictions within the District boundaries unless an incorporated city or town declares by resolution that it will manage its own floodplain.
- A.R.S. §48-3613. Requires the District to evaluate and when appropriate grant written authorization to construct within the floodplain.
- A.R.S. §48-3616. Directs the Board of Directors to require the Chief Engineer and General Manager to present "...recommendations and a preliminary plan for the construction or other acquisition of facilities to carry out the purpose of the district...."
- A.R.S. §48-3616. Requires the preparation of and approval by the Flood Control Advisory Board and the Board of Directors of a comprehensive plan to "...eliminate or minimize flood control problems." It would logically follow that these structures must be maintained.
- 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 carrying out is responsibilities...."

County

The Drainage Regulation for the Unincorporated Area of Maricopa County, adopted September 26, 1988. Provides for the regulation, and drainage review for Unincorporated Areas of Maricopa County and defines requirements for drainage retention and grading plans.

Local

Local statutes or ordinances require the District to maintain property to certain minimum standards (no weeds, debris, etc.).

Fundamental Programs

Specified Tasks

Specified tasks are those specifically described in the mandate as functions that the District must do and represent core functions. As noted in earlier chapters, the District's core functions fall into the following four main programs:

- Flood Hazard Regulation Program
- Flood Hazard Identification Program
- Flood Hazard Remediation Program
- Flood Hazard Education Program

Implied Tasks

Implied tasks are those not core to the Flood Control District mandates but are required to be able to conduct the business of Flood Control. Those tasks are the following:

- Employee Program – The Employee Program develops the required staff with the appropriate training and skills to support the fundamental obligations of the District recognizing that qualified, experienced, customer oriented staff provide our shareholders the best service. This program includes human resources management and information technology support. It is managed and staffed by the Human Resources branch of the Administrative Division and the Information Technology Division.

- Customer Service Program – The Customer Service Program provides service to our client municipalities and the general public so that they can take advantage of employee knowledge so that they can live with acceptable risk of loss of life or property due to flooding. This program includes responses to individual, and group, public and private party requests. It is managed by the Office of the Chief Engineer with support from all Flood Control District Divisions and staff.

- Financial Management Program – The Financial Management Program provides financial services including program budget, financial resources and financial management of revenues and expenses to support the organization to achieve success of the District's programs. This program includes financial services including budget, procurement, financial resources management, risk management and property management. It is managed and staffed by the Financial Services Branch of the Administration Division, and the Property Management

Branch of the Land Division with support of by the CIP/Policy Branch of the Planning and Project Management Division.

Program Assessment

A SWOT (strengths, weaknesses, opportunities, and threats) analysis is done for each of the programs listed above as part of the District's Strategic Plan. Trends are also examined. A summary of the analysis is presented in this report.

Flood Hazard Regulation Program

The Flood Hazard Regulation Program primarily involves the regulatory the primary responsibilities to manage, review and approve impacts to floodplains and drainage within Maricopa County. This program is very much influenced by the fast paced growth environment of Maricopa County and a trend for new development to be moving towards foothill areas.

Strength lies in an experienced regulatory management team and adopted floodplain and drainage regulations. Floodplain and drainage, field and office reviews continue to rebound from staff shortfalls resulting in more timely reviews and permitting.

Significant challenges however exist to being able to adequately manage development. Shortfalls in the availability of technical information beyond "A" zone delineations, shortfall in the integration of Title 11 drainage provisions and the inability to implement possible remediation measures due to the inability to influence or control land use affects the ability to provide comprehensive flood mitigation measures. Further weaknesses in the ability to regulate above dams structures and in the undeveloped foothills of the County further challenge flood hazard regulation efforts. Comprehensive policy for management and integration of sand and gravel operations has need of attention. Finally, there is a shortfall within internal District staff in the integration of floodplain delineation, planning and regulatory development review issues.

There are opportunities to mitigate shortfalls through the possible use of Title 11 special zoning districts and/or regulation based on historic flow paths to manage flood hazards particularly with respect to new development. Continued emphasis to develop stronger links to County Planning & Development would further help to mitigate shortfalls.

The most significant threat to the District is the ability to assume the responsibility of floodplain management and water quality management if these responsibilities shift from municipal jurisdiction to county jurisdiction.

Flood Hazard Identification Program

The Flood Hazard Information Program primarily provides information in the form of engineering and planning analysis of current conditions and opportunities for mitigation of flooding impacts through structural and non-structural improvements.

The most significant strength is the volume of planning studies now available to be used as tools to mitigate existing and/or future floods out in front of development. An advantage that the District has in providing informational efforts is a single focus to flood control.

Shortfalls in the ~~information~~ identification program reflect the comprehensiveness and particularly the implementation of the information determined. The shortfall identified under the Flood Hazard Regulation Program pertaining to the interrelationship between the District's regulatory, floodplain and planning arms affects the information program. Planning focus has been to develop CIP mitigation measures rather than a broader flood management plan taking advantage of all possible alternatives for public protection. Absent from the master planning process is linkage to the CRS program and that features are not linked to Title 11 drainage regulations nor to historic flow paths. With the effort to identify flood protection measures in front of development, existing, developed area have had a lesser focus as has the identification of regional or individual flooding impacts.

The two major shortfalls however in the Flood Hazard ~~information~~ Identification program is the lack of a cradle to grave, comprehensive risk/benefit prioritization methodology such that areas of the County determined to have the greatest risk and/or potential for mitigation are conducted first. The second major shortfall is the low implementation potential of identified mitigation measures due to insufficient funds, lack of municipal cost share, property implications of delineations or the challenges to implement institutional measures.

The Flood Hazard ~~Information~~ Identification Program will continue to be challenged with the outward movement of growth, and the inability to implement. Although recent trends looked for quantity of information versus quality of information this trend is shifting.

Opportunities can be maximized however by pursing identification of potential infrastructure on zoning maps, pursuit of alternative funding mechanisms available to the District and expanding determination of benefits to include both public protection but also economic benefit.

Flood Hazard Remediation Program

The Flood Hazard Remediation Program is centered upon the actual implementation and sustainment of flood mitigation measures and primarily includes the design, construction, land acquisition, operation and maintenance of flood control infrastructure.

The greatest strength of the Remediation Program is the development of mitigation infrastructure, which bridges multi-jurisdictional boundaries providing regional flood control. With the community desire for open space, and active and passive recreation opportunities, mitigation infrastructure through physical structures such as flood control channels and basins have been successful at providing incidental public use opportunities and landscape and aesthetics enhancements to communities. Focus ~~to~~ on building flood control facilities under this "kinder & gentler" philosophy has ~~provided~~ resulted in community benefits by providing flooding mitigation and community multi-use opportunities at a cost less than the sum of the elements if implemented separately.

This statement says positive things are weaknesses.

Alignment, diversity of solutions and implementation through cost share with project partners appears to encompass the greatest weaknesses of the Remediation Program. Over the last 5-years there has been a focus ~~to~~ on expenditure of capital improvement dollars and reduction of budget carryover. As a result, District remediation efforts focused ~~to~~ on the larger, structural alternatives for flood hazard remediation rather than a balance of structural, non-structural and buyout alternatives. The challenge to implementation of remediation measures is two fold. First is the inability to exercise any land use controls to force development to partner implementation and

I think you mean that problems with alignment between partners, the financial aspects of multi-use solutions, and lack of funding available from project partners encompass the greatest weaknesses.

second are the challenges of cost share partnering with municipal interests. In many cases the District dominates leadership of projects at the expense of City commitment to cost share only to find that City staff is not as aligned as it could be with the District's perception of importance. This also results in a ~~shortfall~~ problem that watershed-to-watershed features identified in the master planning process are implemented sometimes piecemeal.

The most significant opportunity within the Remediation program is to leverage private development funds to support the implementation of flood control infrastructure. Opportunity exists in new development, and where private entities can facilitate construction of flood control measures with commercial gain such as controlled sand and gravel excavation in river channels ~~that provide containment opportunities.~~ resulting in a designed conveyance corridor instead of a large excavation with no practical use.
As the District meets the needs of the public with flood control projects that provide multi-use opportunities, the potential increase in liability from public use can become a threat.

Flood Hazard Education Program

The Flood Hazard Education Program provides the public with information regarding public protection from flooding events and the implementation of measures to mitigate loss of life and property from storm water runoff.

The Education Program has strength in that over the last 5-years the awareness of the presence of the District within the community has significantly increased. With this increased ~~presence~~ awareness the roles, functions and responsibilities are better understood by the communities. This is particularily true with respect to carrying the message of flood control and hazards to children. Additionally, the District has strength in its emergency management response to forecasting rainfall events and the impacts of rainfall events to the community.

The public safety program however is not fully engaged as it currently focuses ~~to~~ on winter storm periods and summer monsoon periods as the time for public education rather than being a yearlong continuous program. Education on flood control infrastructure planning, design and construction is not fully engaged, nor do our customers understand where their contributed tax money is going, particularly as ~~it~~ applied to floodplain and drainage regulation enforcement, Water quality responsibilities and emergency management. Project specific education needs tend to be focused ~~to~~ on defending flooding activities, roles and solutions versus a more proactive program defining why project specific facilities are important to public protection.

Opportunities made available by the Internet and advanced communications technologies could provide the District a significant increase in our abilities to bring about increase public awareness and response to flood control measures.

Generally however the most significant threat to the District is ~~without a~~ the public involvement effort public understanding of the services provided and value of the District, the public will continue to be at odds with the District due to individual property right implications.

Employee Development Program

In order to conduct the flood hazard mitigation obligations defined by the Remediation, Regulation, Education and ~~Information~~ identification programs, the District must have a quality, skilled workforce. The

employee program speaks to the management of critical human resources and those tools provided to the employee, particularly information technology, that allows employees to perform their duties in the most efficient and effective manner.

Without a doubt the greatest asset of the District is a quality, diverse workforce who have the trust of our customers and agents. These employees have developed strong technical networks and relationships both locally and nationally. There is significant institutional knowledge of the District and its history and the employees have enjoyed the benefits of market based salaries over the last 5-years. In addition to the human resources, the District has managed very well its information technology and facility assets.

Weakness within the Employee Program primarily includes career progression opportunities, employee development and employee cohesion. Although career progressions exist for the engineering disciplines, limited opportunities exist for others. Career development measures including training, seminars and continuing education opportunities are under funded and under utilized. Further, with increase production focus, cohesion between individuals, and departments both laterally and up and down the chain of command are a shortfall. Employees identified a lack of sense of friendship, camaraderie and cohesiveness. Understanding of individual and departmental roles and functions were also identified as a shortfall.

The most significant threat to the District staff is the aging work force particularly within upper management and the impact to future business and institutional knowledge possessed by employees soon to retire.

Opportunities for increased employee efficiency and effectiveness can be realized if employees can be managed to maximize strengths and minimize weaknesses.

Unfortunately, with tightening of budgets within the District, the positive trend of market based salary adjustments could change direction.

Customer Service Program

The Customer Service Program provides response to requests by the general public, residents, agencies and municipalities such that they can live with the risk and implications of flooding.

The strength of the District's customer service program is the professional treatment and flexibility that the organization provides to its customers. Employees generally maintain an attitude and recognition that without satisfied customers, the need for the District's services is threatened.

Shortfalls however exist in that in some cases information provided may not be uniform or consistent between departments. Further, with increased visibility within the public arena, staff may not be prepared for a larger scale public need to know. There is also a shortfall in developing understanding within the political, elected official arena where opportunities to network and build relationships are not pursued as aggressively as possible. Staffing constraints and workload have resulted in a slightly lower level of customer service and reduced interagency coordination. Finally, interdepartmental communication is lacking.

There are opportunities for the District and development to partner ~~and establish relationships for~~ to implement flood control measures, new development who must deal with drainage issues as an obligation to development, so partnering can be beneficial to both parties.

The District must be able to respond to an increasing trend that the general public wants to know more about what is happening within the community and what value they receive for their tax dollars. Further, municipalities also need to understand the value of flood control to the citizens they represent.

Financial Management Program

The Financial Management Program is an implied task providing the appropriate financial resources ~~to the resources and the~~ means to conduct mandated flood control measures.

Financially the District is fiscally responsible and responsive and has one of the tightest budgets within the County. Further current property tax revenue sources make available significant financial resources to implement flood hazard mitigation measures.

Externally the major weakness of the program is constraints placed upon the District by the County and the inability to leverage development funds to pay for flood mitigation measures for new development. Further, cost share issues have challenged the ability to implement flood control infrastructure within the County. Internally, with a current focus ~~to~~ on expenditure of CIP dollars for major projects, allocation of dollars to flood mitigation programs might be misaligned nor is the CIP program diverse in methods to mitigate flooding.

The greatest opportunities lie in the ability to leverage development dollars to pay for necessary infrastructure ~~necessary~~. Leveraging lesser-cost non-structural methods would also provide greater financial resources to protect the public. Further opportunities to leverage federal dollars for associated programs should be considered.

Threats to the District operation are predominately associated with differing priorities for the County and the District and the challenges as the urban areas pay property taxes for rural area infrastructure. Changes in BOD leadership also influence changes in the abilities for flood mitigation.

Finally, trends that affect the District has shown that smaller communities find it increasing difficult to participate in cost sharing infrastructure necessary for protection of their communities.

Newer District Initiatives

As noted in Chapter 3, the District realizes the need to continuously evaluate the success of existing programs and activities, and revise as needed. Also, the District needs to consider new activities ~~9~~ and Services ~~)~~ that reflect the changes and needs within the County. The following sections describe some of these initiatives in process that add to the set of tools for mitigating or eliminating flood and erosion hazards.

Erosion Hazard Ordinance

Under ARS § 48-3605 the Arizona Department of Water Resources has established criteria and standards for determining flood and erosion hazard areas. The District has not included delineation of erosion hazard areas in past studies but has now added that element to many of its

recently completed ADMP's and will continue to analyze these areas in future studies. In conjunction with identify and mapping the erosion hazard areas, the District will be looking at its current regulations and need for additional policy or action items.

Floodprone Properties Acquisition *or Floodproofing*

The *Alternative Flood Control Works Program* (Resolution FCD 95-01) was developed to provide another mechanism through which the District could achieve it's mission of protecting the public from hazards due to flooding. Through implementation of the Program, the District will allow limited funding for the use of voluntary, non-structural flood mitigation measures, such as property acquisition or floodproofing, to assist residents of flood or erosion prone properties where large-scale structural or non-structural CIP projects are determined to be unfeasible.

The District, however, did not have a specific pool of money set aside annually to floodproof or acquire properties in flood or erosion prone areas to protect the public from flooding hazards. There was clearly a need for a consistent, proactive program for addressing properties in these flood and erosion prone areas.

To reduce the occurrence of repetitive loss properties and to protect the public, the District desires to work with property owners to remove them from harm's way. To achieve these objectives, the District developed the proactive *Alternative Flood Control Works Program* to provide limited District funding for voluntary non-structural mitigation measures. A voluntary floodproofing or acquisition and relocation program with uniform guidelines and annual funding is being implemented to address properties in high-hazard flood or erosion prone areas. Acquired properties may serve a dual purpose as community open space in addition to ~~handling~~ providing a conveyance for floodwaters.

The goals of the *Alternative Flood Control Works Program* are the following:

- To reduce the risk of injury, death, and property damage due to flooding by providing flood or erosion hazard remediation in the form of acquisition or floodproofing.
- To establish a program and funding source to acquire or floodproof properties in flood or erosion prone areas including delineated floodplains, erosion hazard zones, and local areas of repetitive flooding.
- To maximize the use of federally-sponsored programs for flood or erosion remediation while avoiding conflicts with existing floodplain regulations.
- To identify all properties in flood or erosion prone areas in Maricopa County that pose a threat to personal and public safety, and to identify similar properties in all future District studies.
- To encourage local jurisdictions to consider alternative flood control programs, and to provide a mechanism through which they might remove or floodproof properties in flood or erosion prone areas.

This policy is intended as a voluntary program, with limited exceptions, that would increase the District's and its client communities' economic, technical and administrative flexibility while improving beneficial floodplain characteristics. The Program is not intended to facilitate urban renewal or Community Development Block Grant projects or to allow non-structural, stand-alone CIP projects to bypass the requirements of the *Procedure for Identifying and Prioritizing Potential 5-Year CIP Projects.*

Efforts will be made to maximize access to federally-sponsored programs such as the floodproofing/relocation/acquisition assistance program available through the National Flood Mitigation Fund (Sections 553-554 of the *Riegle Community Development and Regulatory Improvement Act of 1994*). This fund replaces Section 1362 (Acquisition of Storm Damaged Property) of the National Flood Insurance Program (NFIP). For some of the District's client communities, potential reductions in flood insurance premiums may also be available through the NFIP's Community Rating System (CRS) program, which credits the acquisition or floodproofing of structures as a sound floodplain management method. Additionally, newer Federal programs; such as the Challenge 21 Project (Cooperating Technical Partners), Flood Hazard Mitigation, and Riverine Ecosystem Restoration; will be looked to for assistance.

The Program will also avoid conflicts with existing regulatory programs. For example, A.R.S. Section 48-3609 requires that nonconforming buildings or structures in a regulatory floodplain that are not used for 12 months or more or are destroyed to the extend of 50 percent of its value, as determined by a competent appraiser, must come into compliance with the floodplain regulations before further use is authorized. Structures falling under this regulation would not be eligible for acquisition or floodproofing by the District, but they may be eligible for funding through provisions of the NFIP.

Benefits

- Direct public safety benefit by ~~proving~~ providing flood mitigation for people living in flood or erosion prone areas.
- Direct and indirect economic benefits from reduced flood or erosion losses.
- Avoidance of costs of structural flood control projects.
- Reduced public costs of disaster assistance and emergency relief.
- Reduced public costs of emergency operations during flood disasters.
- Moderation of flood flows by allowing floodplains to function more naturally (reducing flow velocities, flow depths, and flood peaks).
- Protection of flora and fauna by providing and preserving natural open space and maintaining and preserving natural floodplain habitats.
- Providing multiple-use recreational opportunities (developed and facilitated by others).
- Water quality enhancement by reducing downstream turbidity.
- Increasing infiltration in the natural channels enhancing groundwater recharge.

Funding

Funding for the *Alternative Flood Control Works Program* is capped at an amount not to exceed five percent (5%) of the District's annual CIP expenditures. The funding level is based on an assessment of requests received, funding availability, and relative priority of other CIP projects. The relative priority of alternative projects to standard structural or non-structural CIP projects is based on the individual, weighted scores of the projects.

Qualifying Criteria

The following list describes the Program's qualifying criteria. A property must meet one or more of the following descriptions to be further evaluated using the established prioritization criteria.

- Property with an inhabited residential structure located in a 100-year floodplain and/or erosion hazard zone and built prior to such designation.
- Property with an inhabited residential structure that has been flood damaged or has significant unrepaired structural damage.
- Property with an inhabited residential structure built prior to local drainage regulations that is recommended by District staff because of unique drainage considerations.

Proposals for projects within incorporated areas must be requested through the appropriate jurisdiction and submittal must be made through the annual CIP Prioritization Procedure process. In addition, any property or structure that will benefit from a future CIP drainage or flood control project is not eligible for this Program. Nonconforming residences in a regulatory floodplain that have not been used for 12 months or more or are destroyed to the extent of 50 percent or more of their value will not be eligible for acquisition or floodproofing by the District.

A set of Program Guidelines has been developed to establish Evaluation Methodology, Prioritization, Property Management, Land Costs and Relocation, and Public Information and Education.

Public Information/Education

It is essential to have individuals and special interests groups involved in the development of the policy and guidelines. These groups will be different throughout the County. Groups such as homeowners associations, the Sierra Club, neighborhood advocate groups, trails clubs, equestrians, and other special interests groups can serve as spokesman for an FCDMC Floodprone Property Acquisition of Floodproofing program and projects. In some cases the groups must be cultivated as they will be a strong influence against the removal of structures from harm's way when a structural fix is still available.

Public involvement will require different strategies with these various groups. Public workshops, where staff can present educational material and discuss options, are an effective approach when multiple individual landowners are involved. One-on-one meetings will be more effective with some. Handouts fully explaining the process are essential and will be developed and updated as needed. In addition to the informal meetings and education process, formal meetings will be held before the Flood Control Advisory Board and Board of Directors to inform them on the Floodprone Property Acquisition of Floodproofing policy and guidelines.

Structure Rehabilitation

The District owns and operates 22 flood control dams, which provide highly beneficial flood protection for significant portions of Maricopa County. If the extensive flood protection function provided by these dams is to be maintained for the future, significant issues of aging infrastructure and increasing urbanization must be addressed. These issues are the following:

- Changing Standards for Dams – More than half of the District dams were constructed over 25-years ago, three of which, including the 10-mile long McMicken Dam were constructed nearly 50-years ago. Dam design standards today are significantly more stringent than the standards of 50-years ago or even 10-years ago. In many cases, the more stringent standards, implemented by both state and federal agencies, are based on lessons learned

from catastrophic dam failures. The Arizona Department of Water Resources, jurisdictional agency for all District dams revised its dam safety standards and procedures in June 2000.

- Urbanization - Many of the District dams were originally built to protect small watersheds and agricultural farmlands from flooding. Today, these same dams are providing significant flood control benefits to an increasingly urbanized environment. Land rights for many of these dams were not acquired for downstream areas subject to inundation from emergency spillway discharges. In addition, land rights were generally acquired for these projects only up to design flood pool levels in the reservoir areas, resulting in potential inundation to existing and future developed properties upstream of the dams. from floods of greater magnitude.

- Aging Infrastructure - Earth Embankment Dam Structural Integrity Issues – All 22 District dams, totaling 64 miles in length, are earthfill flood control dams. Because of the infrequent nature of large flood events, these dams rarely impound significant amounts of water and are thus called "dry dams". However, these dams must be ready at all times to operate safely and properly in a flood event.

- Embankment Cracking - A significant structural integrity issue at many of the dams is cracking that has occurred of the earth embankment that has occurred over time due to several causes. Many of the dams have been modified by the installation of a zone of material within the earth embankment that acts as a defensive mechanism against failure of the dam due to certain types of cracking. The adequacy of these modifications are being evaluated under the Structures Assessment Program.

- Subsidence Due to Groundwater Pumping – Land subsidence is the lowering of a region of land surface caused by settlement of the underlying soil zone in areas where the groundwater table has been significantly lowered due to groundwater pumping. Subsidence fissures are narrow cracks in the earth surface that run very deep (up to 300 feet and greater) which develop as a direct result of groundwater pumping. Subsidence fissures can have serious impacts on the safe operation of an earth dam. When a subsidence fissure develops in the vicinity of an earth dam, as is the case with the McMicken Dam and Powerline FRS, it must be investigated, monitored and if needed treated or mitigated to assure the safety the dam. In certain other areas land subsidence results in the loss of the flood storage volume the dam was designed for, as is the case for White Tanks FRS#3.

Other primary dam safety and dam function issues specific to the dams and related features which must be evaluated and addressed include:

- Flood Protection Flood Event – Flood control dams are designed to protect downstream areas from floods of a certain frequency or recurrence interval. For District dams, these flood events range from a 100-year flood to about a 250-year flood event, depending on which federal agency designed and constructed the dam. Upstream development and other factors can change the ability of a dam to provide the level of flood protection for which it was designed. Such changes have and continue to impact certain District Dams.

- Design Flood (Inflow Design Flood – IDF) – Since a very large flood can occur that is much larger than the ability of the dam and associated reservoir to store the flood, dams are

designed with emergency spillways which pass the floodwaters from extreme flood events around the dam so that these floodwaters do not overtop and fail the dam. In certain cases revised methods and standards to establish the magnitude of such extreme flood events calls into question the ability of the existing dam to safely pass such a flood.

The existing District programs for the dams were presented in Chapter 3.

- Dam Safety Program
- Operation and Maintenance
- Structures Assessment Program

The District is addressing the more immediate issues of dam safety with the ongoing implementation of the three programs. The primary focus of these efforts is to assure that the dams as they exist are well maintained and kept in a safe and proper operating condition. Site specific dam safety issues and potential dam safety issues are being identified, investigated and repaired or corrected as needed. The District is funding 100% of this important ongoing effort.

Long term solutions to these issues are needed so that flood protection currently provided by the existing District dams can be maintained or improved upon while at the same time assuring safe flood control projects. The District's ongoing programs cannot solve the important and dynamic issues of changing standards, urbanization and aging infrastructure. Resolution of these issues goes well beyond the District's ongoing operation and maintenance activities and dam safety program. The District simply does not have the financial resources to address these issues which are currently estimated to cost in excess of $200 million over the next 20 to 25 years. Therefore, the District is seeking federal funding assistance for the long-term solutions.

The long-term solution will be both structural and non-structural. Structural solution will involve large scale projects to rehabilitate existing dams or to remove and replace the dams with large regional flood control basins or flood conveyance features which maintain or improve the flood protection provided by the existing dam. Community multi-use opportunities will be an important aspect of these projects. Non-structural solutions involve actions such as upgrading and implementing emergency action plans. Non-structural solution may also involve acquisition of additional land rights to prevent future construction of inhabited structures in areas subject to emergency spillway discharges or reservoir impoundment. The feasibility of such options may be limited however, based on the large-scale nature of potential inundation areas and cost of land rights.

The Natural Resource Conservation Service was the federal sponsor for 16 District dams. There are several programs under which NRCS has the authority to rehabilitate dams it constructed. For the most part the issue is not one of federal authority but rather one of federal funding appropriations. These dam safety issues are both local and nationwide in scope. Over the last 50 years, NRCS constructed over 10,000 flood control dams across the nation. A recent survey of 22 states indicated that more than 2,200 of these dams require dam safety rehabilitation. While the national scope of these rehabilitation needs raises awareness of the issues, it also means that many dam owners are competing for limited federal dollars to implement long-term dam safety solutions.

The District's highest priority project to address long-term dam safety issues is White Tanks FRS#3. White Tanks FRS#3 is a District-owned dam that has dam safety deficiencies which require correction. To address the more immediate dam safety issues for this dam, the District will be constructing interim dam safety corrective measures in the fall of 2001. The District is seeking federal funding assistance from NRCS for the recommended permanent solution of a large regional flood control project to replace the dam while maintaining its flood protection function.

The Flood Control District of Maricopa County is meeting its maintenance and dam safety responsibilities as the owner and operator of 22 flood control dams, which provide flood protection to significant portions of Maricopa County. However, in order to address the important public safety issues of aging infrastructure and urbanization, full-scale dam rehabilitation or dam replacement projects as well as non-structural solutions are needed. The District will require financial assistance in order to implement these solutions to assure that the level of flood protection provided by the dams to the citizens of Maricopa County is secured well into the future.

Watercourse Master Plans – Riparian Conservation

For many years groups have been meeting to evaluate river restoration opportunities in the southwest. District staff has been actively participating in this effort. This new dynamic has expanded the potential for river management and restoration to now link the urban, urban/rural fringe with the rural rivers of the region. The rapidly growing urban areas provide significant opportunity to either prevent the destruction of vital river resources, or will provide the opportunity to restore or enhance resources that have already been degraded.

The District staff is working with the Corps of Engineers, Cities, sand and gravel operations and private non-profits corporations to pursue, within its authority, managing the river resources for restoration opportunities through the watercourse master plans. District staff attend monthly meetings of the River Management and Restoration Task Force which was jointly formed by the Arizona Riparian Council (ARC) and the Arizona Floodplain Management Association (AFMA). Part of this effort is to develop tools that help to quantify the risk associated with the problems restoring vegetation poses and to establish maintenance guidelines that allow for better risk management.

Multi-Use and Recreation / Structures Retrofit

Growing public concern for preserving the visual beauty of the urban, rural and natural settings in Maricopa County prompted the Board of Directors to adopt an Aesthetic Treatment and Landscaping Policy May 3, 1999 (Resolution 93-03). This policy provides general guidance and direction for the integration of landscape aesthetic features and recreation multi-use opportunities in all phases of planning, design, construction and operation of flood control facilities by the District. The policy applies to the design of new structures and to existing structures that do not include aesthetic features. This Policy was recently updated in 2000.

A second step to this initiative is the preparation of the Flood Control Structures Analysis. Providing flood protection facilities that preserve natural desert open space, enhance local community image, and provide opportunities for desert greenbelts and new parklands makes sense for the District. It provides increased public benefits, promotes increased public support for District programs, and enhances/expands multi-agency partnering opportunities which can lead to reduced District operating expenses. Responding to growing urbanization, increased scarcity of open space, and rising land costs in the County, the District is exploring utilization of existing flood

control facilities for local, community, and regional open space. The District has had two phases of this structures analysis completed to date. Several more phases are underway.

The purpose of the this analysis is to provide a preliminary assessment of opportunities for retrofitting existing facilities to integrate landscape aesthetic features and enhance recreation open space opportunities. The objectives of this assessment are to:

1. Assess the consistency of existing facilities with the District's 1992 Aesthetic Treatment and Landscaping Policy;
   '9 — or use 2000?
2. Assess the potential of existing facilities to provide regional, community and local open space amenities;
3. Identify possible treatment measures to correct or reduce inconsistencies with the District's 1992 Aesthetic Treatment and Landscaping Policy and enhance the open space potential of existing facilities;
4. Provide preliminary cost estimates for the identified possible treatment measures;
5. Link researched alternate funding sources developed for the West Valley Recreation Corridor study to projects for retrofitting facilities.

Funding Assessment (to be written)

Secondary tax levy on real property, rentals, licenses and permit fees currently pay for basic flood control services

i.e. ALERT system
A-zones
Info & education
Studies & plans
Maintenance
Plan review

Excess Land Sales and Leases

Interest earned on Fund Balance

Future Revenue Sources

Grants & Federal funds pay for special circumstances
i.e. trails
mitigation

Partners – 2 types (cost –sharing)
Public agency cost share – future benefits
Private development reimbursements – large scale construction

Development Impact Fees

Voluntary Exactions

Improvement Districts

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Summary

This Plan has described existing flood control projects and structures and identified future opportunities for flood hazard mitigation. A prioritization system has been established to determine greatest need for upcoming projects. It is important to now establish a plan for implementation of planned flood control works or floodprone land acquisition. The five-year Capital Improvement Program sets the progress for larger capital investment projects but does not identify a strategy for regulatory solutions or partnerships that result in multi-use projects.

Issues - Tentative priority, time schedule, and estimated cost for implementation of the various projects or project elements required to mitigate the County's flooding problems

This Plan will be updated annually in conjunction with the budget and CIP cycles (December to March) by the District's Planning Branch.

The District's area of jurisdiction is vast but mitigation or elimination of flood hazards has continued to meet the needs of the County residents. This first part of this report gives a broad overview of the challenges and constraints the District faces in floodplain management. More detail followed in Chapters 4 and 5 to present problems and address them. The bottom line is there is considerable work to still be completed. A reasonable comprehensive strategy has been presented herein to achieve public safety from flood hazards.

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