Comprehensive Program Report

FY 2000/2001 – FY 2005/2006

Prepared for the Pima County Board of Supervisors
Sitting as the
Flood Control District Board of Directors

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1.0 INTRODUCTION

The Pima County Regional Flood Control District (District) was established by the state of Arizona as a special taxing authority responsible for regional flood control under the Arizona Revised Statutes (A.R.S.) Title 48 Special Taxing Districts, Chapter 21 County Flood Control Districts. The District is responsible for providing regional flood prevention programs and flood control services for incorporated and unincorporated areas in Pima County (see Figure 1).

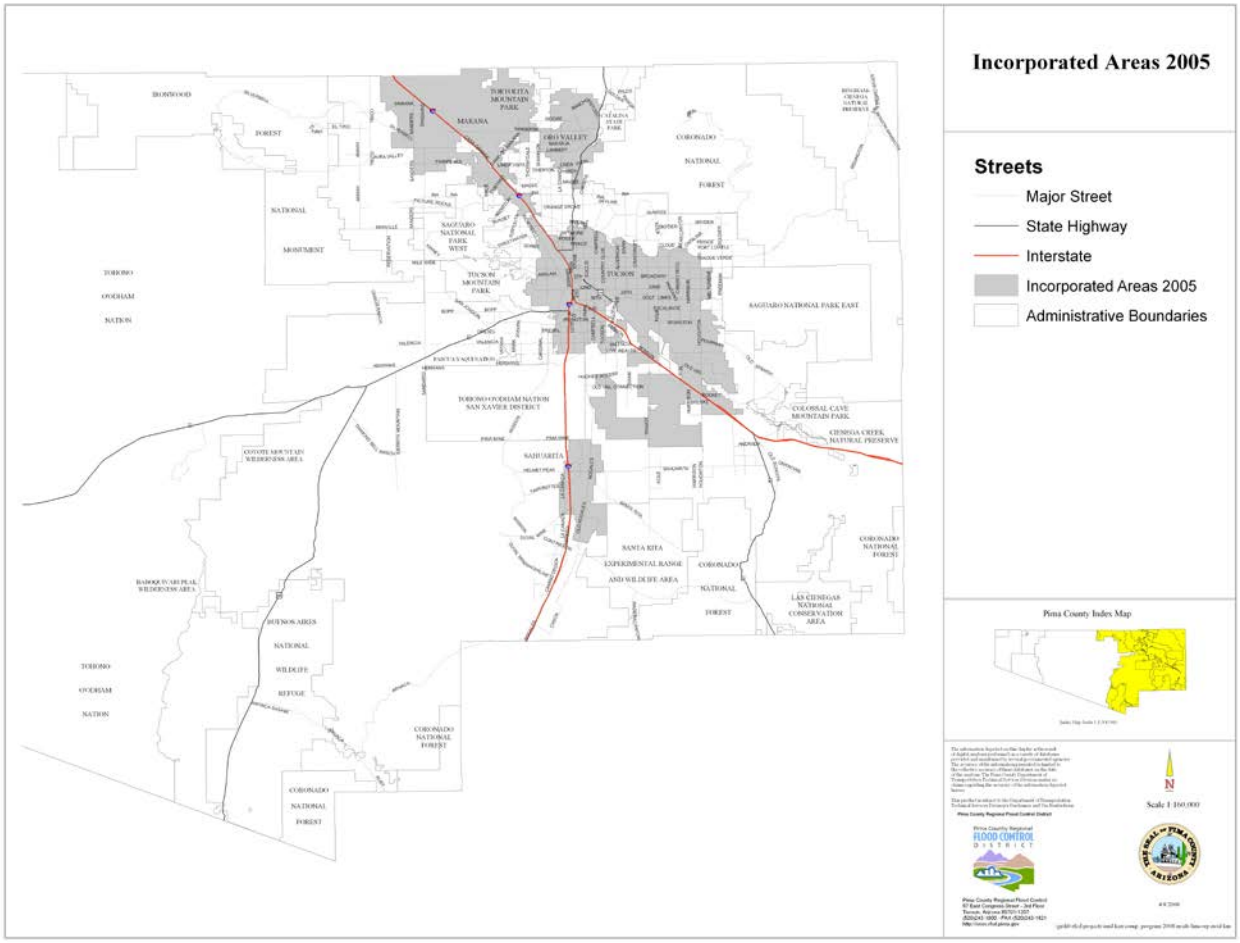


Figure 1
Pima County Jurisdictions

1.1 PURPOSE

This report describes current District programs, services and future plans to provide comprehensive flood and erosion control, protect and restore riparian habitat, and promote increased groundwater recharge along Pima County floodplains. Projects undertaken during FY 2001/02 through FY 2005/06 are emphasized. Information for prior years can be found in previous Comprehensive Program reports, as discussed below.

This report has been prepared to fulfill the requirements of A.R.S. 48-3616, which requires preparation of such a report at least every five years. In addition, it provides formal documentation of District activities over the past few years.

1.2 PREVIOUS DISTRICT COMPREHENSIVE PROGRAM REPORTS

The following three reports have been completed: *1979 Comprehensive Status Report; 1990 Comprehensive Program Report; Comprehensive Program Report for FY 1990/91 – FY 1995/96; and Comprehensive Program Report for FY 1995/96 – FY 2000/01*. The 1979 Comprehensive Status Report, completed one year after the District was formed, discussed the status of ongoing flood control projects and identified future needs. The 1990 Comprehensive Program Report was the first comprehensive documentation of District activities. It discussed all aspects of District programs from the District's inception in 1978 through 1990. The report for FY 1990/91 – FY 1995/96 was the second such comprehensive report, and focused on District activities for those six years. Likewise the *Comprehensive Program Report for FY 1995/96 – FY 2000/01* was the third Comprehensive Report, and focused on District activities for those six years.

1.3 KEY PROGRAM AREAS

District activities can be grouped into three key program areas:

1) Floodplain Management Program
2) Flood Control Program
3) Natural Resources Protection Program

A brief overview of each is presented below. Chapters 5, 6, and 7 of this report provide detailed descriptions of each program area for five fiscal years (FY 2001/02 through FY 2005/06).

<u>1) Floodplain Management Program</u>

This program consists of nonstructural activities intended to: a) prevent existing flooding and erosion problems from getting worse, and b) prevent the creation of new flooding and erosion problems by means other than constructing structural flood control improvements. Program elements include the National Flood Insurance Program (NFIP); Floodplain Regulations; Subdivision and Development Review; the Floodprone Land Acquisition Program; the Flood Warning Program; and Public Information/Education/Awareness activities.

<u>2) Flood Control Program</u>

This program consists of activities intended to reduce flooding and erosion by designing and constructing improvements that will safely convey floodwaters and protect channel banks from erosion. Structural projects are typically a solution in areas that have already been built out, or where there is important infrastructure that needs to be protected. Projects include bank stabilization, bridges, channelization, levees, regional detention basins, and river parks.

3) Natural Resources Protection Program

This program consists of activities to protect and/or enhance riparian habitat and promote groundwater recharge. In conjunction with the Sonoran Desert Conservation Plan (SDCP), Pima County promotes and supports regional riparian restoration with the intent to recover natural functions within riverine systems. Projects include riparian habitat protection, restoration, and enhancement; protection and mitigation measures implemented though the Floodplain Use Permit (FPUP) process; design and construction of groundwater recharge basins; and encouraging use of water harvesting techniques. During the previous five-year program period the District adopted new policies and procedures including a major revision of the Pima County Floodplain and Erosion Hazard Management Ordinance (Ordinance). This corresponded to and was linked with major public efforts by Pima County to adopt the Sonoran Desert Multi-Species Conservation Plan. The latter is a component of the SDCP that identifies specific habitat elements for protection. As part of the new Ordinance, the Pima County Board of Supervisors (Board) adopted a map of riparian areas and geologic floodplains that are protected via the Comprehensive Plan Amendment, Rezoning, Subdivision and Development Plan review processes.

These revisions further the District's goal of establishing and implementing regulations that go above and beyond the minimum requirements established by the NFIP. By adopting higher regulatory standards the residents of unincorporated Pima County are eligible for significant discounts on flood insurance (10-25%). Pima County remains in the top 95% of participating communities throughout the United States under the NFIP Community Rating System (CRS).

1.4 FLOODPLAIN MANAGEMENT

The U.S. had been experiencing escalating disaster assistance costs associated with major floods, prior to the enactment of federal floodplain management regulations in 1968. Most of the burden to respond to flood damage and loss was borne by the federal government, and ultimately the general public. In addition, flood insurance was not available to assist property owners who experienced flood damage.

Regulatory management of floodplains began when Congress passed the *National Flood Insurance Act of 1968*, which created the NFIP. The purpose of the NFIP is two-fold: 1) to reduce future flood damage by regulating development in floodplains; and 2) to enable those living in floodplains to purchase reasonably priced flood insurance. Creation of the NFIP raised the national awareness about flood hazards and reasonable measures that can be taken to reduce flood damage and loss.

Because most watercourses in the Tucson area are dry and flow only when it rains, flood hazards are not the foremost thought in the minds of most Tucson area residents. However, in July 1990 and again in January 1993, the President of the United States declared Pima County a flood disaster area. In 2003 a major wildfire denuded large portions of the Catalina Mountains. In the years that followed erosion associated with flooding increased and the damages were significant. Local government agencies such as the District and the incorporated municipalities strive to maintain awareness of flood hazards and work to minimize flood damage and loss of life.

1.5 CAPITAL IMPROVEMENTS

Flood control problems along the major watercourses and drainage areas are often regional in nature and require a uniform approach to achieve control of flooding and erosion hazards. In 1978, the state of Arizona recognized the need to establish county flood control districts to address regional flood control problems where:

- watercourses flow from one municipality into another,
- upstream tributaries affect downstream watercourses in another jurisdiction, or
- location of a flood control improvement provides benefits to more than one jurisdiction.

Due to the interconnectedness of the watercourse system in Pima County, it is often necessary to plan and coordinate the sequencing of major projects so that the benefit will be maximized and flood damage potential is reduced in a manner that does not follow jurisdictional boundaries.

Regional flood control improvements are tied to areas within flood hazard zones, which vary by jurisdiction. Factors influencing where capital flood control improvements are needed in jurisdictions include the community's flood damage potential, population, geographical location, total area and the ratio of undeveloped areas, newly developed areas, and older areas developed prior to floodplain management regulations.

In assessing needs and priorities for structural flood control improvements, the District considers repetitive flood damages and the potential for future flood damages. FEMA provides national flood insurance to residents and businesses nationwide. In Pima County, the number of flood insurance policies issued and the dollar value of the insurance provides an indication of potential flood damage costs (see Table1-1).

Table 1-1
Flood Insurance Coverage in Pima County, FEMA 2005

Jurisdiction	Coverage $ Value	Current # of Policies	Percent Policies	Percent $ Value
Town of Marana	$ 264,376,000	137	3%	24%
Town of Oro Valley	$ 16,148,000	60	1%	1%
Town of Sahuarita	$ 2,271,000	10	<1%	<1%
City of South Tucson	$ 594,000	3	<1%	<1%
City of Tucson	$ 385,370,000	2,536	50%	35%
Unincorporated	*$ 427,403,000*	*2,366*	*46%*	*39%*
Total	**$1,096,162,000**	**5,112**	**100%**	**100%**

The total value of property covered by federal flood insurance in all of Pima County is $1,096,162,000. The City of Tucson accounts for $385,370,000 in value of coverage or 35% of the total value and the unincorporated area accounts for *$427,403,000* in value of coverage or *39%* of the total value. The Town of Marana has the third highest potential for damage with a coverage value of $264,376,000 or 24%.

1.6 INCREASING EMPHASIS ON MANAGING NATURAL RESOURCES ELEMENTS OF FLOODPLAINS

Floodplain management practices have evolved over the past 30 years from a focused approach on controlling excess stormwater runoff to a more holistic approach. Current practices include managing hydrologic, hydraulic, and sediment transport elements, as well as the plant and animal life, and cultural/historic features of a drainage system.

In the late 1960s and 1970s, traditional floodplain management focused on confining inundation to relatively small areas, using channels, levees, and other structural means. In the early 1980s, use of stormwater detention became popular. Detention areas could be constructed for individual lots or building sites, as well as for larger areas. Parks with constructed play facilities, ball fields, and other recreational uses were soon incorporated into the design of larger (regional) detention basins. Increasingly smaller basins have recreational facilities associated with them within subdivisions as well.

In the mid-1980s and continuing today, increased attention has been focused on preserving natural, cultural, and historic resources associated with floodplains. The unique assemblage of plant and animal life found along undisturbed streambeds, as well as the natural recharge, promotes biological diversity helping to maintain the ecological character of the region. Similarly, historic and cultural features make an area unique whether there is a buried archaeological site or historical buildings along the banks of a stream.

The District continues to emphasize programs that reduce flood and erosion damage by traditional methods where these methods are needed and appropriate. Consistent with an increasing emphasis nationwide on the importance of natural floodplains to a healthy regional ecosystem, the District has increased its emphasis on and funding of the natural resources protection elements of the floodplain management program.

1.7 SUMMARY OF NEW DISTRICT ACTIVITIES - FY 2000/01 - FY 2005/06

Work continues to proceed on several of the 14 bond projects that were approved by the electorate in a Special Bond Election held on May 20, 1997. A total of $21.5 million in flood control bond projects was approved. Construction was initiated on a major structural project known as the Lower Santa Cruz River Flood Control Levee.

In February 1999, FEMA issued the first set of Digital Flood Insurance Rate Maps (D-FIRMs) for Pima County, the City of Tucson, and incorporated areas. The conversion from a hard paper to a digital format will enable more accurate processing of information related to federally-mapped Special Flood Hazard Areas (SFHA).

Increased emphasis has been placed on natural resources programs including riparian habitat restoration/enhancement and groundwater recharge. Five new riparian restoration projects are underway; four of the five are in the planning stages. Several studies related to riparian restoration have been completed, and others are underway as part of the Riparian Restoration Element of the SDCP.

The District has been expanding its role in promoting groundwater recharge projects along the major watercourses. Construction of four interconnected basins was completed along the Lower Santa Cruz River in May 2000; the basins began receiving Central Arizona Project (CAP)

water in June 2000. Design work continues on another recharge project along the Lower Santa Cruz River, which will recharge treated effluent.

PermitsPlus Implementation

In 2005, the District began working with the Pima County Development Services Department to improve the permit review process using the PermitsPlus system. PermitsPlus is a computer tracking program used by Development Services to manage Activity Permits (i.e., building permits, exterior wall permits, grading permits, etc.). This program will streamline the overall permitting process, which will allow the District to be more efficient and effective in serving our community.

Unified Hydrology Method

In January of 2005, the District began holding monthly meetings with all local jurisdictions to promote a Unified Hydrologic Model for eastern Pima County. The long-term goal is to produce a seamless county and municipal-wide drainage strategy that could be incorporated into each agency's Geographic Information System (GIS). The results will provide data to allow proper drainage infrastructure sizing that will meet any jurisdictions' requirements and eliminate the current practice of re-analyzing infrastructure design for each jurisdiction. The use of NOAA14 rainfall values as well as the HEC HMS hydrologic software will ultimately allow users to obtain watershed data via the District's website.

FEMA Map Technical Corrections

In fiscal year 2005/06, the District took aggressive steps to improve the flood hazard information on the Flood Insurance Rate Maps (FIRMs). In a cooperative effort with FEMA, the cities of Tucson, South Tucson and the towns of Marana, Oro Valley and Sahuarita, floodplain map corrections were made on 59 floodplains.

Floodplain and Erosion Hazard Management Ordinance Revisions

During FY 2004/05, the Ordinance was revised to strengthen both public safety elements as well as protection of Pima County's natural resources (Riparian Habitat Protection & Mitigation). Updated riparian classification maps were included in the amendment. The Flood Control District Advisory Committee (FCDAC) was instrumental in providing oversight and comment on staff efforts. Extensive public input was sought through a series of focus group meetings with members of the development and the conservation communities plus numerous public meetings. Public comment was incorporated into the final draft Ordinance amendment. The Ordinance amendment was presented to the Board for adoption during a public hearing held in August 2005, following a 30-day public notice period. They were approved and the amendments became effective on October 21, 2005 (Ordinance 2005- FC2).

The current Ordinance further strengthens riparian protection by incorporating the riparian elements of the Conservation Lands System (CLS). The CLS categorizes and identifies locations of priority biological resources within Pima County and provides policy guidelines for the conservation of these resources.

In developing the technical portion of the SDCP, detailed riparian classification maps were produced to provide precise habitat boundaries and classifications. The new maps incorporate

the riparian elements of the CLS and provide a framework for linkage and landscape connections via "Important Riparian Areas" (IRAs). IRAs protect the connectivity of habitat areas through protection of the natural functions of washes and flow patterns necessary for survival of riparian vegetation. IRA is a separate classification shown on the updated maps and requires the highest standard of protection.

CRS Audit

In March 2005, a representative of the CRS performed Pima County's 5-year audit. The audit is a routine part of the CRS voluntary incentive program, which rates communities participating in the NFIP. For CRS participating communities, flood insurance premium rates are discounted in increments of 5% (a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5% discount, where as a Class 10 is not participating in the CRS and receives no discount). The CRS classes for local communities are based on 18 creditable activities, organized under four categories: 1) Public Information, 2) Mapping and Regulations, 3) Flood Damage Reduction, and 4) Flood Preparedness.

During the reporting period Pima County was a Class 6 community, which is in the top 5% of all participating communities. With efforts being made to increase community awareness and education regarding flood hazards and regulations, Pima County will be upgraded to a Class 5 community, which would mean an additional 5% reduction in insurance rates for all property owners purchasing flood insurance. Currently, Pima County residents receive a 20% discount on flood insurance. Every year, Pima County seeks ways to improve its class rating.

2.0 ABOUT THE REGIONAL FLOOD CONTROL DISTRICT

2.1 FORMATION OF THE DISTRICT

The state of Arizona passed the Floodplain Management Act of 1973 to comply with federal law. This law authorized the formation of county flood control districts, and the adoption of floodplain areas. On June 5, 1978, the District was organized by the Pima County Board of Supervisors (Board), which also acts as the Board of Directors of the District.

Provisions of the enabling legislation allow incorporated cities and towns to assume responsibility for regulating floodplains within their respective jurisdictions. Accordingly, the City of Tucson and the towns of Oro Valley and Marana have assumed regulatory authority for floodplain management and regulation. The District is responsible for floodplain management throughout the rest of unincorporated Pima County, including the City of South Tucson and the Town of Sahuarita. Lands within the boundaries of national forests, parks and monuments, and Indian Nations are outside of the District's jurisdiction.

The brisk growth and development in eastern Pima County has rapidly changed the jurisdictional demographics. In 1978 when the District was first formed, the City of Tucson, the City of South Tucson and the Town of Oro Valley were the only incorporated areas (see Figure 1). Since then, the towns of Marana and Sahuarita have incorporated. In July 2007, PAG provided estimates agreed upon by the jurisdictions. Table 1-2 provides the current information on population and area with a comparison to 2000 census data.

Table 1-2
Population and Area Data for Jurisdictions in Pima County

Jurisdiction	Date of Incorporation	2000 Population	2005 Population	Percent Population	2007 Sq. Mi.
Town of Marana	1977	13,556	26,725	3%	118
Town of Oro Valley	1974	29,700	39,400	4%	35
Town of Sahuarita	1994	3,242	13,990	2%	30
City of South Tucson	1938	5,490	5,630	1%	1
City of Tucson	1877	486,699	529,770	55%	227
Unincorporated	NA	305,059	342,120	35%	8,789
TOTAL		**834,746**	**957,635**		**9,200**

2.2 ORGANIZATION

In 2005, the District became an independent regional organization with its separation from the Pima County Department of Transportation and transition to the Pima County *Regional* Flood Control District, and is budgeted separately as a special taxing district. The District remains part of the Public Works Department. The District Director is the Chief Engineer for Pima County.

Between FY 1996/97 and FY 2000/01, the District was composed of two divisions: 1) Flood Control Engineering Division, and 2) Floodplain Management and Planning Division. In June 2001, the Board of Directors approved the new Water Resources Division for riparian habitat and water resources preservation for the FY 2001/02 operating budget.

In FY 2005/06, the District expanded the base divisional structure from three divisions, consisting of the Floodplain Management Division, the Flood Control Engineering Division, and the Water Resources Division, to five divisions. In order to accomplish this expansion, which was to address burgeoning urban growth and development as well as expanding infrastructure inventory, the former functions of the Floodplain Management Division were divided into the following five divisions:

- The Engineering Division oversees the planning, design, and construction of flood control improvements including working with the U.S. Army Corps of Engineers (Corps) on federal flood control projects.

- The Planning and Development Review Division whose primary objectives are to progressively plan and ensure flood safety for developing areas throughout Pima County by conducting detailed studies of drainage basins to determine appropriate flood protection strategies and ensuring comprehensive review of all proposed land development projects.

- The Infrastructure Management Division whose primary objectives are to ensure regular inspections and proper maintenance of all District-owned flood control infrastructure and to lead the District's information management efforts so that all reports, permits and other data can be stored electronically and be readily accessible to all staff to improve efficiency.

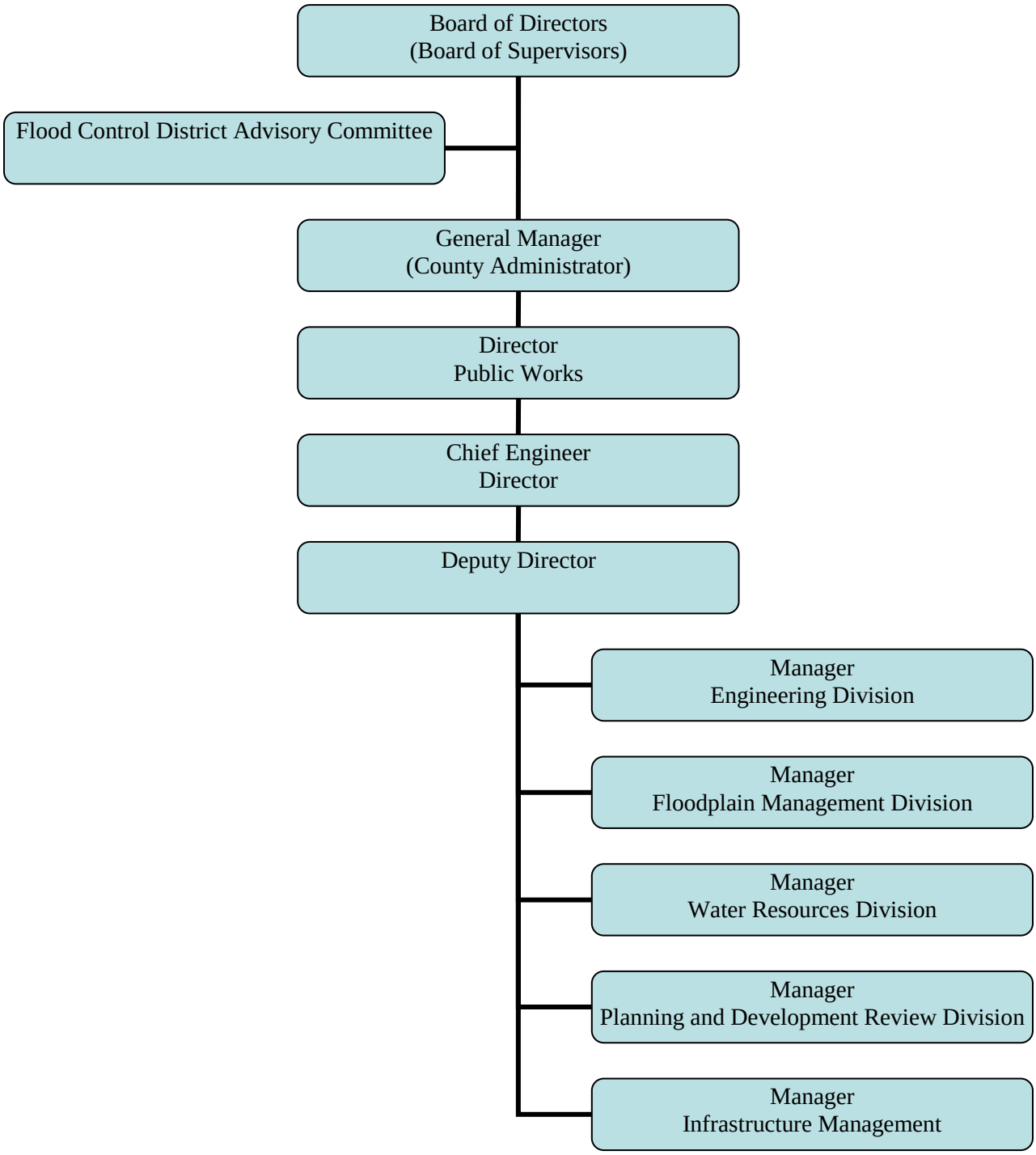
- The Floodplain Management Division's focus is on individual lot development and high quality customer service for flood protection, drainage complaint response, and overall enforcement of the Ordinance.

- The Water Resources Division is responsible for the regulation of riparian habitat, environmental restoration, monitoring of shallow groundwater areas, and operation of the Automated Local Evaluation in Real Time (ALERT) network of precipitation and stream gages.

The strategy behind this reorganization was to better focus on current and future needs of the District in order to enhance customer service and improve flood safety for residents of Pima County (Figure 2). The District receives substantial support from the Pima County Department of Transportation, which includes Administrative Support Services, Maintenance Operations, Field Engineering, Real Property, and Technical Services. Further assistance is received from other Pima County departments including Development Services, Environmental Quality, Graphic Services, and the Pima County Attorney's Office. The District pays for services rendered by Pima County departments through interdepartmental fund transfers from the District to Pima County.

Although District employees are part of the Public Works Department their positions are funded entirely by District revenues. In FY 2005/06, 60.8 full-time equivalent staff positions were funded. Due to vacancies there are 54 fulltime equivalent positions which is a decrease from 56 at the last report. As noted, the Board, sitting as the District's Board of Directors, governs the District. The Board also hears requests for variances and appeals to the Ordinance. In 1988, the Board formed a 12-member advisory group, the FCDAC, to advise the Board on flood and erosion matters, and to increase public participation in the decision-making process. Five members are appointed by the Board (one for each Board member), three are appointed by the City of Tucson, and one each is appointed by the City of South Tucson, and the towns of Oro Valley, Marana and Sahuarita.

Figure 2
DISTRICT ORGANIZATION



2.3 MISSION AND GOALS

Mission

The District's mission is to protect the health, safety and welfare of Pima County residents by providing comprehensive flood protection programs and floodplain management services. These services emphasize fiscal responsibility, protection of natural resources, and a balanced, multi-objective approach to managing regional watercourses, floodplains and stormwater runoff.

Goals

The District's goals are to:

- Meet or exceed federal and state requirements for floodplain management including those mandated for participation in the NFIP;
- Minimize flood and erosion damage by regulating development within areas subject to flooding or erosion;
- Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, and streets located in regulatory flood and erosion hazard areas;
- Encourage the most effective expenditures of public monies for flood protection;
- Maintain flood control facilities;
- Inform the public of floodplain and erosion hazards;
- Encourage the preservation of natural washes, and enhance riparian habitat;
- Protect, preserve and enhance groundwater recharge and water quality; and
- Minimize the need for rescue and relief efforts associated with large floods.

2.4 REGULATORY METHODS

Several regulatory tools are used to manage activities in flood and erosion hazard areas. These include the Pima County Code, county ordinances and policies, and department procedures including technical policies and design standards manuals. Ordinances and policies adopted by the Board have the highest regulatory authority. Procedures, technical policies and design standards manuals approved by the Chief Engineer (Director) have the next highest level of authority. Finally, the District has completed several river and basin management studies that contain guidelines and recommendations for areas that experience or are expected to experience flood and/or erosion problems.

The main regulatory tool used by the District is Ordinance No. 2005-FC2, which is also named Title 16 of the Pima County Code. The Ordinance was developed largely to satisfy minimum federal and state standards governing flood hazard areas.

Enforcement of the Ordinance enables Pima County to participate in the NFIP. Establishment of the NFIP was the main driving force behind the development of floodplain management programs across the nation. Programs and activities that go above and beyond the minimum requirements enable the District to participate in the NFIP's CRS, which rewards communities by discounting the cost of flood insurance premiums.

Revisions to the Ordinance occur periodically. A decision by the District's Board of Directors is required for adoption of any amendments to the Ordinance. On July 14, 1998, revisions were adopted into Ordinance No. 1998-FC1. Article X was adopted for the purpose of enhancing wildlife values by preserving riparian vegetation along watercourses and floodplains. Also adopted were maps indicating the location of existing riparian habitat that meets specific criteria. The Ordinance affords protection to these mapped habitat areas and requires specific actions when sites containing certain vegetation are developed or subdivided.

Ordinance No. 1999-FC1, adopted June 1, 1999, codified the Ordinance and its various amendments as Title 16 of the Pima County Code.

In 2005, the riparian habitat provisions were expanded to require Board approval of riparian mitigation plans and expanding the mapped habitats (from 26,250 acres to 87,270 acres). Additional requirements included maintenance of private detention basins and extending applicability of sheet flood zones including FEMA Shaded Zone X floodplains.

3.0 STORMS AND FLOOD DAMAGE

3.1 FLOOD HAZARD SEASONALITY: TWO RAINY SEASONS

In southeast Arizona, rainfall generally occurs during two rainy seasons known as the monsoons and the winter rainy season. Precipitation patterns during each season are distinct.

Summer Storms

Early July typically marks the official start of the monsoons, which constitutes the first three consecutive days when the dew point averages 54 or higher. In the spring of 2000, the Tucson office of the National Weather Service (NWS) declared that the monsoons would occur from June 15th through September 30th. However, the actual start date of the monsoons occurs only when the dew point criterion is satisfied.

Summer convective rain occurs when there is an influx of moisture from the Gulf of Mexico, areas to the south in Mexico, the Gulf of California, or the Pacific Ocean. When this moist air is exposed to intense surface heating it rises resulting in cloud formation and rainfall. Summer storms tend to be short and intense, giving rise to the terms "flashy" and flash flooding.

Winter Storms

Winter storms occur when large-scale fronts from the Pacific Ocean pass through. These can be warmer, subtropical systems, which result in rainfall across the area. They can also be cold fronts, which are shifted further south than usual causing snow over the mountains and rain in lower elevations. Winter storms are of longer duration and lower intensity than summer storms.

(Reference: Hydroclimatological and Paleohydrological Context of Extreme Winter Flooding in Arizona, 1993, Arizona Geological Survey Open-File Report 95-12, House and Hirschboeck, October 1995).

3.2 EL NIÑO/LA NIÑA EPISODES

(Information in this section was obtained from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) website, http://www.ogp.noaa.gov/enso, and the NWS, Tucson website, http://nimbo.wrh.noaa.gov/Tucson/twc.html.

- In the early 1990s, El Niño became a household word across the U.S. El Niño is typically viewed as the warm phase of the El Niño–Southern Oscillation (ENSO) System. It is characterized by a weakening of the western trade winds, a warming of sea surface temperatures in the eastern and central equatorial Pacific Ocean, high atmospheric sea level pressures in the western tropical Pacific and Indian Oceans, and low sea level pressures in the southeast tropical Pacific Ocean.

- El Niño episodes are accompanied by swings in the Southern Oscillation, which is an inter-annual seesaw in tropical sea level pressures in the southeast tropical Pacific Ocean. El Niño episodes, which occur at intervals of 2-7 years and may last 12-18 months, have global consequences. They result in shifts in tropical rainfall, which affect wind patterns worldwide. This affects the position of monsoons, the jet stream, and storm tracks, which separate warm and cold regions of the earth. The result is unseasonable weather over many areas. Increased understanding of ENSO patterns enables more accurate global and regional climate predictions.

- In Arizona, a strong El Niño episode may result in increased frequency of above-normal precipitation over the state during December through March. It also may result in cooler than normal temperatures during February through April.

- The strong El Niño episode lasting from November 1997 through April 1998 was similar to the conditions in the episode of 1982/83, which was the strongest El Niño of the century. Locally, stories on television and in the newspapers publicized the strength of the El Niño, and raised the possibility of heavy rains and flooding. Although no major flooding occurred, there were several significant storms during that winter rainy season, and the public's awareness of its effects was heightened.

- La Niña is thought of as the cold phase of the ENSO swings. It is characterized by conditions opposite those of El Niño in the U.S. and its impacts are more clearly seen in winter. In southeast Arizona, effects of La Niña include dryer than normal winters, and above average temperatures.

3.3 BRIEF OVERVIEW OF HISTORICAL FLOODING

Historical records of flooding in the Tucson area date back to the late 1800s. As one would expect the frequency of reports of flood damage and loss increased over time as the population of the metropolitan area grew. By the late 1970s, the population in Pima County had grown to almost 500,000; by 2000, that number had risen to nearly 850,000.

When the District was formed in June 1978, the greater Tucson area had recently experienced two presidentially-declared flood disasters, with a third about to take place. It was a busy time for a fledgling flood control agency. During the 16-year period from July 1, 1977 to July 1, 1993; the Tucson area experienced six presidentially-declared flood disasters: October 1977, March 1978, December 1978, October 1983, July 1990, and January 1993. A disaster was also declared during the Aspen Fire in 2003.

October 1983 Flood

The October 1983 flood was the largest flood of record in the Tucson area. In an unusual occurrence, between 6½ to 7½ inches of rain fell across the Tucson basin over a five-day period. Flood and erosion damage was greatest along the Santa Cruz River with extensive damage incurred on Rillito Creek, Tanque Verde Creek, and Pantano Wash. Damage to public infrastructure was estimated at $105.7 million, and four people died in flood related incidents. Due to the magnitude and extent of flooding and related damage, this flood is the one to which subsequent floods have been compared.

January 1993 Flood

During a 14-day period in 1993, January 5th through the 19th, significant rain fell over most of central and southeast Arizona resulting in flooding along most major watercourses. This flooding was noteworthy for three reasons: 1) although these were the most damaging floods to occur in almost 10 years, no lives were lost and no residential and commercial structures were destroyed with the exception of some horse barns associated with a business along Rillito Creek; 2) the high water levels in the streams lasted almost two weeks rather than the typical few days; and 3) according to the U.S. Geological Survey, record-setting volumes of floodwater were discharged along Rillito Creek.

Estimates of damage to public transportation and drainage infrastructure for unincorporated Pima County, the City of Tucson, and the Town of Marana included $3.4 million in emergency repairs and $13.9 million for long-term improvements. This compares to an estimate of $105.7 million in repairs and improvements after the 1983 flood.

By the end of calendar year 1996, flood repairs and improvements initiated in response to the 1993 flood were largely completed. A detailed description of the January 1993 flooding can be found in the *January 1993 Floods, Pima County, Arizona, Summary Report* (Pima County Flood Control District, July 1993).

RECENT STORMS AND FLOODING

Between July 1, 1996 and July 1, 2000, one large flood on September 3, 1996, one small but noteworthy flood on August 18, 1998, and one major flood on July 15, 1999 occurred in the greater Tucson area. A brief description of these floods follows.

September 3, 1996 Flood

In the early morning hours between 5 a.m. and 8 a.m., an unusually strong thunderstorm with high winds battered the greater Tucson area resulting in three to five inches of rain in some locations. The highest rainfall depths were reported in the foothills of the Santa Catalina

Mountains northeast of Craycroft Road and Sunrise Drive. Lesser amounts of rainfall, but still over one inch, were reported across the Tucson Valley.

Although this storm occurred during part of the morning rush hour, there were no fatalities reported. A woman and her daughter were rescued after spending more than one hour in their car, which was swept off the River Road crossing at Tanuri Wash (east of Craycroft Road), and carried downstream toward Tanque Verde Creek. A five-year old boy and his mother were rescued from a car stalled in six feet of water in the flooded downtown Stone Avenue underpass.

In addition to street flooding and closures throughout the metropolitan area, residential flooding was reported near River Road and Craycroft Road, and near Dodge Boulevard and River Road where the Finger Rock Wash drains into Rillito Creek. Scattered power outages were reported throughout the metropolitan area, and a few water mains broke. Almost 250 storm-related emergencies were called in to city and rural fire departments. Large flows were reported on the lower Tanque Verde Creek and its tributaries, Rillito Creek and tributaries east of Country Club Road, and the Santa Cruz River and Brawley Wash.

August 18, 1998

A highly localized, but intense storm occurred in central Tucson around 8 p.m. A 39-year old man was swept away in the Arcadia Wash at-grade crossing of Fairmount Street near Rosemont Boulevard. When the floodwaters receded, his overturned vehicle was found in the Arcadia Wash. His body was recovered approximately eight miles downstream in Rillito Creek near Stone Avenue.

July 14 and 15, 1999

In the summer of 1999, a wet tropical air mass combined with daytime heating resulted in light to moderate rainfall over much of the Tucson area between July 12th and July 15th. Several streets were flooded at various times. On the evening of July 14th, three people were rescued after their van was swept into floodwaters of the Alamo Wash near Broadway Boulevard and Wilmot Road. Two adults were pulled from the van, and in a dramatic rescue, a child was plucked from the water after being swept through the box culvert at Wilmot Road.

On July 14th, light rain began falling on the upper Sabino Canyon watershed early in the day, and continued throughout the night. The early morning hours of July 15th marked the beginning of flooding in Sabino Creek that would rival the October 1983 and January 1993 floods, the largest in recent history. On the 15th, between 2:30 a.m. and 4:30 a.m., 1.3 inches of rain was recorded near the top of the watershed. During the next two hours, a torrential downpour dropped another 4.6 inches on the upper watershed, for a four-hour storm total of 5.9 inches, which exceeds a 100-year, 24-hour storm.

This storm was atypical in that the rainfall intensity was unusually high, and the storm was centered over the Sabino Canyon watershed. Significantly less rain fell on adjacent watersheds. The storm was, however, typical in its “flashiness.” Flow depths increased rapidly, resulting in the need for several rescues.

Sixteen people were airlifted out of the Sabino Canyon Recreation Area at about 7:30 a.m. and several horses, pigs and chickens were moved out of the Hidden Valley Ranch area a few hours

later. Two residents who stayed with the horses during the worst of the flooding and sought refuge on the rooftop of a barn were brought out with the horses. Approximately six residences located within the creek bed received flood damage, as did the animal corrals and horse barns in the Hidden Valley area.

Flows from Sabino Creek and other foothills washes drained into Tanque Verde Creek and Rillito Creek resulting in significant flows on these watercourses as well. A 12-year old boy had fallen into Rillito Creek and was rescued near La Cañada Drive.

The greatest amount of flood damage occurred along the Catalina Highway (a.k.a., the General Hitchcock Highway), which experienced catastrophic failure in three locations north of Molino Basin. Severe erosion and undermining of the roadway, as well as several rockslides, resulted in the closure of the highway for several weeks. This left up to 800 residents of the Mount Lemmon community stranded. Although an alternate access route was available from the north (the Oracle Control Road), it is an unimproved dirt road that can only be traversed with a four-wheel drive vehicle which takes several hours. Permanent repairs were completed as part of a Federal Highway Administration project that began in March 2000. This project was planned prior to the occurrence of the July 15, 1999 storm.

July 26, 1999

A very small, but highly intense monsoon thunderstorm positioned itself over the Earp Wash Watershed near Valencia and Alvernon roads shortly after 2:00 p.m. One rain gauge volunteer reported that 1.5 inches of rain fell in approximately one hour. Runoff inundated the residential properties along Alvord, Palo Verde, and Milton roads. The American Red Cross provided assistance to those residents whose properties were flooded. The storm also impacted a Tucson Electric Power substation, which caused power outages impacting 1,912 customers.

July 29, 2003

Ajo, Arizona, is an unincorporated community located within Pima County, Arizona, and lies approximately 160 miles west of Tucson. On July 29, 2003, the community of Ajo experienced a severe thunderstorm producing significant rainfall—approximately 1.3 inches of rain in just over one hour. Flooding occurred primarily along the Gibson Arroyo and tributaries located south of the arroyo.

The District quickly responded by providing immediate assistance with cleanup and maintenance of streets, bridges, and portions of the Gibson Arroyo. In addition, the District immediately requested and received approval to enter a portion of the Gibson Arroyo owned by Phelps Dodge in order to dredge along an extensive stretch of the channel to provide increased hydraulic capacity.

As part of the District's response, a consultant was hired to provide an emergency evaluation and report on the flooding including new aerial-topographic mapping, a field review of the flooding, data collection, and preparation of preliminary hydrologic and hydraulic analyses. Accordingly, a Master Drainage Plan was developed to recommend specific approaches to address these floodprone areas including the Second Avenue Bridge and southern tributary flooding.

Second Avenue Bridge Replacement

Eyewitness accounts of the July 29, 2003 flood provide ample evidence that debris and sediment effectively blocked the conveyance area of the bridge and increased flooding conditions during the flood event. The bridge is a three-cell structure with a relatively low profile with two pier walls between the cells, which restrict the amount of debris and sediment that can freely pass downstream. Hydraulic modeling of the existing bridge reveals that if the opening were not clogged by debris and sediment, the 100-year flow depth at the bridge would be reduced by about 1.3 feet. A new bridge can be designed to accommodate debris and sediment, thereby reducing flooding.

Curley School Site Detention Basin

The southern portion of Ajo contains several tributaries to the Gibson Arroyo. This area maintains poor drainage infrastructure such as private culvert systems that run under residential structures. The most effective way to alleviate the flooding problem is to reduce the peak discharge by storing the flood volume in a flood control basin. The former football field at Curley School is a prime location for the detention basin as this is a sizeable piece of property capable of supporting a detention basin.

Aspen Fire – Summer 2003

The Aspen Fire consumed 85,000 acres of land and 335 structures between June 17, 2003 and July 17, 2003. The incendiary point was located near Marshall Peak on the Aspen Trail. By nightfall of June 19th, the community of Summerhaven was engulfed in flames.

One of the principal dangers resulting from significant fires is increased flooding including erosion and debris flow due to the destruction of large quantities of vegetation. A mountain fire, such as the Aspen Fire, increases the magnitude of this danger due to large topographic relief and flow concentration into more urbanized areas. Early estimates from the United States Forest Service indicated that watersheds in areas severely burned could produce up to five times the quantity of runoff from a given area.

In order to address these dangers and other related issues, District staff launched a comprehensive and multifaceted program to provide an enhanced early flood warning system, mitigate the newly developed hazards, and to better characterize the nature of the hazards.

As a first step, the Pima County ALERT system that was damaged by the fire was quickly repaired and supplemented with additional weather and stream gauge monitoring sites in order to provide enhanced early warning. This system was critical when potential post-fire flood dangers became imminent threats to urbanized areas downstream. ALERT system repairs and enhancements costs were $47,000. Second, Pima County worked with the Natural Resources Conservation Service (NRCS) to quickly develop and implement a multi-phased program under the Emergency Watershed Protection Program to reduce the potential damages that could be caused by increased flood and debris flows through containment of ash from burned structures, revegetation and structural erosion control efforts. Third, the District launched a total of four hydrologic studies to evaluate in more detail the hydrologic conditions within the different watersheds in the post-fire era. The Emergency Watershed Protection Revegetation and Erosion Control Program costs were $727,061. Several emergency contracts and agreements were required to implement the elements of this District program. The total contract amount to

successfully complete this three-tiered effort was approximately $944,000. Hydrologic studies were estimated at $170,000 to study the front-range watersheds of Ventana, Sabino, Molino, and the Upper Cañada del Oro watersheds. An agreement with the Corps to study Carter Canyon was also implemented.

The only waste materials generated during the implementation of the post-fire flood control program were from activities associated with the removal of debris from major drainage channels within the Summerhaven area. This activity was necessary to prevent the formation of large and potentially hazardous debris dams (mostly vegetative waste) within the watercourses. A breach in these unstable debris dams due to hydrostatic and hydrodynamic forces could have exacerbated downstream flash flooding. These removal activities are one of the most significant efforts in the Revegetation and Erosion Control Program requiring repeated efforts to remove debris from vegetation and felled trees that continued to appear within the drainage courses. Vegetative debris measuring less than 12 inches in diameter was chipped and taken to the landfill to be used as daily cover, whereas larger debris was cut up and removed from the channels.

The District worked closely with the United States Forest Service to secure access, as necessary, for the installation of additional monitoring stations, as well as the staging areas required for aerial revegetation.

The District also worked closely with the NRCS and local conservation districts throughout the course of the Revegetation and Erosion Control Program including co-staffing the “yellow tent” located within Summerhaven for the first six weeks after resident reentry in order to answer questions pertaining to erosion hazards and revegetation methods among others during the post-fire healing process.

Hydrologic work was coordinated with the Corps for the Carter Canyon watershed. The program was implemented by the District and successfully addressed the immediate needs such as providing enhanced warning for downstream residents alerting them to the potential for increased flood flows; providing erosion protection and flow attenuation through revegetation processes and other constructed measures, and providing protection to the remaining facilities and water quality. Additionally, the hydrologic studies provided information necessary to determine the design criteria needed to provide appropriate future protective measures.

It is expected that most of the structural treatments completed under this project will remain viable and functional for several years until the natural recovery processes returns the hydrologic conditions back to pre-fire conditions.

August 25, 2003 - Cañada del Oro Watershed – Catalina, Arizona

The Aspen Fire changed the hydrologic characteristics within the Cañada del Oro watershed. Moderate to high burn severity through much of the watershed denuded the drainage basin, greatly increasing the chances of flooding during the summer monsoon season.

On August 25, 2003, a significant rainfall event occurred resulting in flows of approximately 7,000 cfs—a 25-year flow. Sheriff’s deputies evacuated the area and most of the homes within low-lying areas both east and west of the channel. Immediately following the flood, the District began efforts to assist the residents by accepting applications to the Floodprone Land

Acquisition Program (FLAP) from residents who wanted Pima County to appraise their properties for possible acquisition.

The acreage evaluated consisted of 75 parcels totaling almost 200 acres of land. As of July 2004, 151 acres of land or approximately three-quarters of the total acreage within the Cañada del Oro floodplain was acquired.

The cost to the District has been substantial—$7,880,641 for real property and $1,120,524 paid out for relocation benefits to displaced property owners. The District, however, garnered a federal grant of $3,000,000 to contribute to the enormous costs generated by this project.

The acquisition of contiguous parcels of property containing rural characteristics created an interest, particularly with the Pima County Natural Resources, Parks and Recreation Department. The community of Catalina, Oro Valley, and area residents welcomed an opportunity to create a rustic, equestrian-oriented recreational space for this northwest cluster of communities, which could evolve into a well-planned, multi-use facility for area residents as well as for surrounding developments.

August 14, 2005

On the morning of August 14, 2005, a large storm system moved from east to west over the Sierrita Mountains south of Tucson. Brawley Wash (located west of Tucson downstream of Three Points) and many small washes in the Diamond Bell area exceeded their capacity resulting in flooding of residential areas and roads throughout Avra Valley. Many families were stranded for days due to high water and damaged roads. Rain gauges and Doppler radar indicated a large area of the Brawley Wash watershed received between two and four inches of rainfall during a six-hour period; the highest rainfall intensity measured by an ALERT gauge was 2.32 inches in one hour. Stream flow on the Brawley Wash at Highway 286 was the highest flow measured at this location since 1984. The maximum depth was approximately 10 feet with a discharge of 11,800 cubic feet per second.

During these storm events, information provided by the ALERT system aided the NWS and emergency teams with their decisions to warn the public of potential flooding and their response to emergency situations where people and infrastructure were in danger from the rising floodwaters.

August 2005

In late August 2005, a heavy rainstorm produced two to six inches of precipitation impacting the area near Old Nogales Highway south of the Tucson International Airport also known as the Old Nogales Highway Colonia. This area predominately contains older mobile homes on one-acre lots that do not have the benefit of infrastructure such as sewer lines, streets, sidewalks, street lights, etc. Many of these one-acre parcels were the result of lot splitting in early 2000— most were not financed by traditional lenders who would have required flood insurance.

This storm, estimated to be a 25 to 50-year event, left many residents with extensive flood damage to their homes. Using FLAP funds, the District purchased one parcel in this area. Additionally, in an effort to improve existing living conditions for other damaged properties, the District made a contribution of $200,000 to assist the Pima County Community Development and Neighborhood Conservation Department with rehabilitation efforts. The District also

replaced five mobile homes using mobile homes acquired from other FLAP acquisitions, replaced damaged roofs, provided new doors, windows, electrical appliances, and new cooling and heating systems. Overall, 40 families benefited from these outreach and flood protection assistance activities.

4.0 DISTRICT FUNDING

Several methods are used to fund the operation and administration of the District. Revenue sources include a secondary tax levy on real property, General Obligation Bonds (GO Bonds), District bonds, federal and state assistance, developer participation, earned interest income, and miscellaneous revenues. Expenditures include the operating budget (including maintenance activities), the District's Capital Improvement Program (CIP), and debt service on the bond programs.

This chapter focuses primarily on the District's finances for FY 2001/02 through 2005/2006. Summary data for previous years is presented. Detailed information for previous years can be found in the *Flood Control District Comprehensive Program, December 1990,* the *Pima County Comprehensive Program Report, FY 1990-91-FY 1995-96,* and the *Pima County Regional*

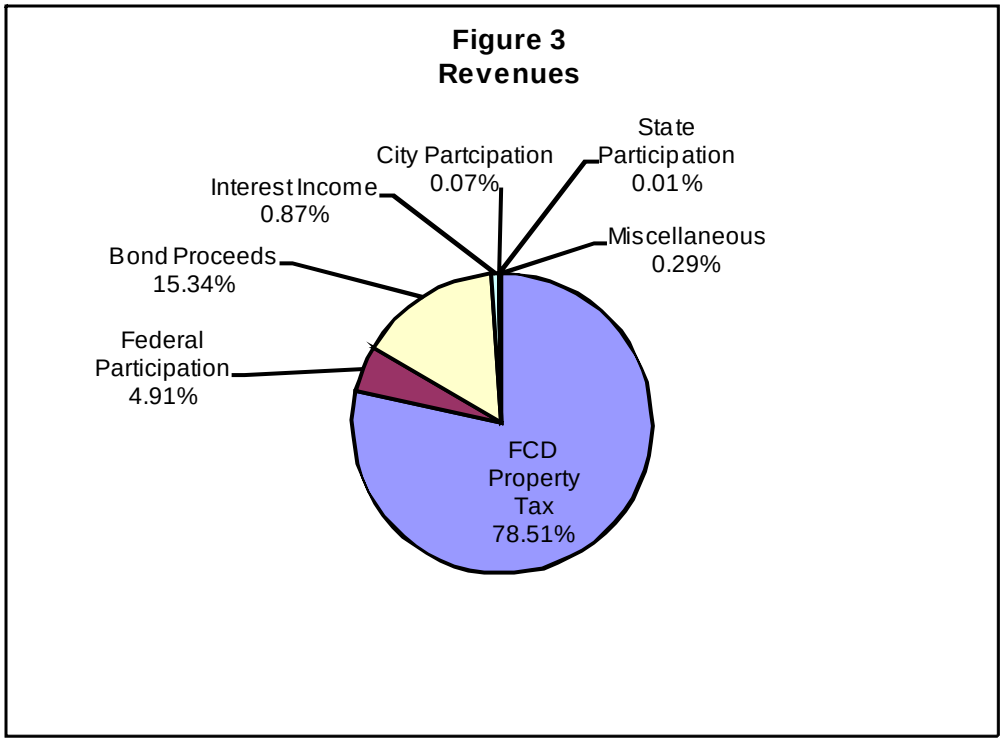
Revenues	***01/02***	***02/03***	***03/04***	***04/05***	***05/06***	***Total***
FCD Property Tax	13,700,000	14,500,000	16,500,000	17,400,000	19,800,000	81,900,000
Federal Participation	3,200,000		455,159	19,415	1,450,000	5,124,574
Bond Proceeds	6,700,000	1,200,000	300,000	2,100,000	5,700,000	16,000,000
Interest Income	151,954	200,000	106,492	121,950	327,053	907,449
City Participation			68,210	2,227	0	70,437
State Participation			(281,219)	21,012	271,519	11,312
Miscellaneous	2,008	8,000	15,616	117,238	162,772	305,634
Total Revenues	23,753,962	15,908,000	17,164,258	19,781,842	27,711,344	**104,319,406**
Expenditures						
Capital Improvements	13,800,000	7,100,000	8,200,000	8,100,000	13,900,000	51,100,000
Operating Budget	5,100,000	5,800,000	7,200,000	6,700,000	9,000,000	33,800,000
PAG	31,700	35,000	35,000	30,266	30,266	162,232
GL Adjustment						
Debt Services	900,000	1,000,000	1,008,552	1,000,000	1,000,000	4,908,552
Total Expenditures	19,831,700	13,935,000	16,443,552	15,830,266	23,930,266	**89,970,784**

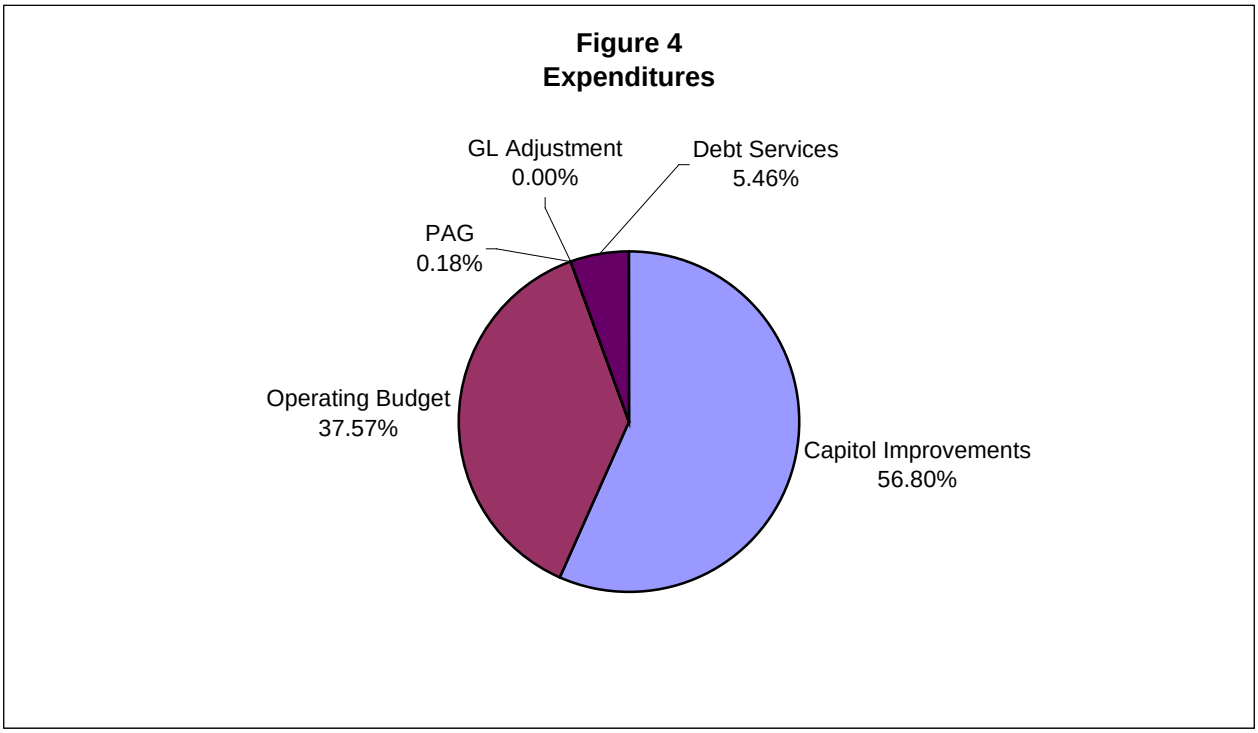
Flood Control District Comprehensive Program Report FY 1995/96 – FY 2000/2001.

Table 4-1
Revenues and Expenditures

(All data from Annual Reports)

Table 4-1 and Figures 3 & 4 summarize revenues and expenditures for the 5-year reporting period.





4.1 TAX LEVY

In April 1978, state legislation authorized the formation of county flood control districts, and provided districts with the authority to levy taxes on real property to pay for administering, constructing and maintaining flood control systems within each district. The District became operational on July 1, 1978 with the adoption of the first budget for FY 1978/79 and assessment of the Districts tax levy.

Table 4-2 shows the annual valuation, tax rate, tax levy and proceeds for the period FY 2001/02 through FY 2005/06.

Table 4-2
District Tax Levy Rate FY 2001/02 through FY 2005/06

Fiscal Year	Levy Rate*	Tax Revenue**
2001/2002	0.35460	$13.7
2002/2003	0.35460	$14.5
2003/2004	0.35460	$16.5
2004/2005	0.35460	$17.4
2005/2006	0.37456	$19.8

*Per $100 assessed valuation ** Un-audited dollar amount in millions

Five incorporated municipalities contribute to the tax revenue. The following table shows the data and percentage figures for FY 2005/06, broken down by contributor.

Table 4-3
District Tax Contributions by Jurisdiction

Jurisdiction	FY 2005/06	
	FCD Tax $ Due	Percent
Unincorporated Pima County	$ 8,381,066	42.03%
City of Tucson	$ 8,868,768	44.47%
City of South Tucson	$ 54,987	0.28%
Town of Oro Valley	$ 1,488,669	7.47%
Town of Marana	$ 845,006	4.24%
Town of Sahuarita	$ 303,084	1.52%
Total	**$19,941,580**	**100%**

4.2 BONDS

On May 20, 1997, Pima County held a Special Bond Election that included funding for specific flood control projects. Its passage enabled the issuance and sale of GO Bonds, in an amount not to exceed $21.5 million, to be used for flood control improvements. The 1997 Bond projects and funding amount are shown in Table 4-4. On May 6, 2004 additional flood control bonds were approved and are shown in table 4-5.

Table 4-4
May 20, 1997 Bond Projects resulting from Special Bond Election

Project	Bond Funding
Santa Cruz Riverbank Stabilization - Grant Road. to Ft. Lowell Alignment	$ 3,500,000
Santa Cruz Riverbank Stabilization- Valencia Road to Irvington Road	$ 4,000,000
Lower Santa Cruz River Levee - I-10 to Sanders Road	$ 6,000,000
Detention/Retention Basin - Mission View Wash	$ 1,000,000
Urban Drainage Improvements - City of Tucson	$ 2,000,000
Urban Drainage Improvements, City of South Tucson	$900,000
Urban Drainage Improvements - Town of Sahuarita	$ 500,000
Urban Drainage Improvements - Town of Oro Valley	$ 350,000
Drainageway Improvements - Green Valley Drainageway #9	$ 1,000,000
Drainageway Improvements - Continental Vistas, Green Valley	$ 250,000
Fourth Avenue Drainage - Improvements City of South Tucson	$ 500,000
Urban Drainage Improvements - Fairview Ave. and Limberlost Drive	$ 500,000
Drainage Improvements - Holladay Street and Forrest Avenue	$ 500,000
Drainage Improvements - Tucson Diversion Channel	$ 500,000
TOTAL	**$21,500,000**

Table 4-5
2004 Bond Projects resulting from Special Bond Election

Project	Bond Funding
Floodprone Land Acquisition Program	$ 5,000,000
Urban Drainage:	
Pima County Urban Drainage Infrastructure Program	$ 8,281,000
City of South Tucson Projects	$ 1,719,000
Tohono O'odham Nation Urban Drainage	$ 1,500,000
Pascua Yaqui Tribe Black Wash Flood Control	$ 1,000,000
River Parks & Flood Control	
Santa Cruz River, Ajo to 29th Street	$14,000,000
Santa Cruz River, Grant to Fort Lowell	$ 2,700,000
Rillito River Linear Park Completion	$ 3,000,000
Santa Cruz River in vicinity of Continental Ranch	$ 4,000,000
Cañada del Oro River Park, Thornydale to Magee	$ 5,000,000
TOTAL	**$46,200,000**

4.3 FEDERAL ASSISTANCE

The District aggressively seeks partnerships with other local, state and federal agencies such as the Corps to provide funding for capital flood control infrastructure. Between FY 1995-96 and 2000-01, the District received $1,185,000 in state funding from the Arizona Department of Water Resources (ADWR) and the Arizona Water Protection Fund (AWPF). More recently, the District secured $4,500,000 in federal funding from the NRCS for the construction of bond project FC-01: Santa Cruz Riverbank Stabilization, Grant Road to Ft. Lowell Road. Table 4-6 on the following page provides a summary of federal assistance received by the District.

Table 4-6
Federal Assistance for Construction Projects FY 2001/02 - FY 2005/06

Project	District & Federal Agency	Amount Received (in millions)	Total (in millions)
Arroyo Chico	District Corps	2.50 5.00	7.50
Santa Cruz River Watershed Study	District Corps	1.20 1.20	2.40
Agua Caliente Park	District Corps	1.75 3.00	4.75
Lower Rillito Flood Control Environmental Restoration	District Corps	7.0 10.6	17.60
Paseo de las Iglesias	District Corps	16.0 24.9	40.90
Rillito Creek Environmental Restoration	District Corps	7.20 10.80	18.00
Rillito/Swan Wetlands	District Corps	2.60 4.00	6.60
Tres Rios del Norte	District Corps	8.00 11.8	19.80
Tanque Verde Creek	District Corps	0.3 0.3	0.60

5.0 FLOODPLAIN MANAGEMENT PROGRAM

5.1 OVERVIEW OF NONSTRUCTURAL PROGRAM ACTIVITIES

This program consists of activities intended to: a) prevent existing flooding and erosion problems from getting worse, and b) prevent the creation of new flooding and erosion problems by means other than constructing structural flood control improvements. To accomplish these goals, the District administers several floodplain management programs that reduce the amount of flood and erosion loss in the community through nonstructural methods. The most important of these is FEMA's NFIP. FEMA designates specific areas as SFHAs. In order to participate in the NFIP, a community must at a minimum enforce FEMA regulations governing activities permitted in SFHAs. Section 5.2 provides more information about the NFIP.

The District also regulates activities in flood and erosion hazard areas identified in accordance with the most current Ordinance No. 2005-FC2. Although some of these areas have not been mapped by FEMA, they are at risk of flooding and/or erosion. Activities undertaken in any identified flood or erosion hazard area must satisfy the provisions of the Ordinance (see Section 5.3).

In addition to the above, other nonstructural floodplain management program activities include providing flood hazard status information to the public; administering the FPUP program; investigating and responding to drainage complaints; issuing floodplain violation notices; generating reports and studies for specific floodprone areas; administering the FLAP; operating the flood warning system; participating in emergency response and flood preparedness activities; upgrading photographic and topographic mapping; and developing educational programs for the general public, including maintaining and upgrading the District's website. These activities are discussed in more detail in Sections 5.3 through 5.9.

5.2 NATIONAL FLOOD INSURANCE PROGRAM

5.2.1 Purpose of the National Flood Insurance Program

Congress established the NFIP in 1968, to provide an insurance alternative to disaster assistance. In exchange for communities assuming responsibility for managing floodplains in accordance with the NFIP, the federal government acting through FEMA makes flood insurance available and provides disaster assistance following presidential-declared floods.

Establishing the NFIP transferred floodplain management responsibility from the federal to the local level, and the cost of flood loss from the general taxpayer to the floodplain occupant (FEMA, 1986; Bond, 1987).

The community benefits of participating in the NFIP include the availability of: 1) federally-sponsored flood insurance programs; 2) disaster assistance, including monies for the permanent repair or reconstruction of insurable buildings in SFHAs, and relocation monies; and 3) federally-insured loans, such as FHA, VA, and SBA. Flood insurance is required to finance the purchase of an inhabitable structure located in a flood hazard area with a federally insured loan. It is recommended in all other areas and is available to owners and occupants.

5.2.2 Flood Insurance Studies and Rate Maps

The District works in conjunction with FEMA under the Flood Insurance Study Program (FIS) to identify floodprone areas. A key work product of this effort is a set of official maps called FIRMs. These maps, also known as FIRM panels, show SFHAs and other relevant hydrological information. Federal, state, and local floodplain management regulations apply to development and other activities that take place in designated SFHAs.

FIRMs have been prepared for most of the major watercourses and many of the smaller watercourses within Pima County. These panels are updated periodically when structural improvements are implemented or when floodplain characteristics are altered due to modifications to channel geometry or by other new characteristics. The Floodplain Management Division is the local repository for the FIRMs.

Traditionally, these FIRM panels have been produced on paper (25” x 29” wide at 1” = 1000’ scale). In FY 1995/96, taking advantage of available digital technology, Pima County Technical Services Division developed a customized ArcView application utilizing a GIS for use by the Floodplain Management Section. The GIS layer consisted of FIRM SFHA information, hand digitized by Technical Services staff. Labeled *The Parcel Query System*, it was used by Floodplain Management to promptly confirm the regulatory floodplain status of specific parcels. Once a parcel was located, a paper map of the parcel containing the selected information was generated. Due to the potential error within the hand-digitized FIRM panels, an overlay of the computer-generated map onto the official paper FIRM panel was required in order to verify the regulatory FEMA floodplain limits.

A significant milestone occurred in FY 1998/99 when the FEMA re-mapping of Pima County was completed and the information was made available to the Pima County Technical Services Division in the form of D-FIRMs. Pima County is one of the first jurisdictions to utilize D-FIRMs, which now constitutes the official FEMA information for Pima County. The D-FIRM data has

been integrated into Pima County's GIS and is used by District staff in such tasks as providing flood status determinations, performing site reviews, and issuing FPUPs.

5.2.3 Revisions to Flood Insurance Rate Maps

The FIRMs necessitate periodic revision, either due to the availability of more accurate data, new development that has occurred construction of structural flood control projects, or occurrence of floods that cause dramatic changes in floodplain topography. Changes to the effective FIRMs can be accomplished as a physical map revision whereby the affected map panels are republished, or a Letter of Map Revision (LOMR) whereby a letter is issued with an attached figure showing the changes.

Changes can also be requested on a parcel basis if a parcel or structure was incorrectly included in an SFHA (i.e., if a small topographic high point didn't show up and the parcel is actually elevated above the 100-year water surface elevation). In this case, a Letter of Map Amendment (LOMA) may be issued to officially amend the effective NFIP map panel.

The District typically funds the cost of LOMRs for District flood control improvement projects. The private sector is responsible for completing the necessary paperwork to obtain LOMRs for private improvement projects that result in changes to FEMA SFHAs. At the request of property owners, the District generally files LOMAs (see Table 5-1 for a listing of LOMR and LOMA activity within unincorporated Pima County over the past five fiscal years).

Table 5-1
Approved LOMR and LOMA lists for FY 2001/02 – FY 2005/06

LOMR No.	LOMR Date	Panel Number(s)	Affected Wash and/or Floodplain
05-09-A090P	06-Jul-06	1663K	Pantano Wash - approx. 1000' upstream to approx. 3700' upstream of Craycroft Rd. -**AND**- Tanque Verde Wash - approx. 1700' upstream to approx. 5900' upstream of Craycroft Rd.
06-09-B665P	26-Jun-06	2200K	Unnamed Tributaries to Black Wash - just upstream to approx. 2500' upstream of Valencia Rd. (Sonoran Ranch Estates)
05-09-A160P	25-May-06	1643K, 1644K	Rillito Creek - approx. 250' upstream to approx. 3200' upstream of Dodge Blvd. **-AND-** Alvernon Wash - its confluence w/Rillito Creek to just upstream of Lowell Rd.
06-09-B741P	23-May-06	2225K, 2825K	Unnamed Tributaries to Black Wash - just upstream to approx. 3400' upstream of Victor Dr. (Star Valley)
05-09-A426P	31-Jan-06	2880K, 2890K	Pantano Wash near Colossal Cave Road Bridge Re-delineation
05-09-0185P	27-Jan-06	2254K, 2262K, 2270K, 2855K, 2875K, 2880K	Atterbury Wash Tributaries at various confluence locations - approx. 26,000' downstream of Valencia Rd. to the confluences w/Pantano Wash **-AND-** Unnamed Julian Wash Tributaries - just upstream to approx. 3500' upstream of Houghton Rd.
06-09-B019X	17-Jan-06	2225K	Unnamed Tributary to Black Wash - approx. 4000' downstream of Sunset Blvd. to approx. 500' upstream of Camino Verde Blvd. (Camino Verde Estates II)
06-09-B020X	11-Jan-06	2245K	Unnamed Wash - approx. 5500' downstream to approx. 100' upstream of Valencia Rd.
06-09-B069X	21-Dec-05	2200K	Unnamed Tributary to Black Wash - approx. 1200' upstream to approx. 5000' upstream of Tucson Ajo Highway (Eagle Point Estates)
05-09-0847P	28-Nov-05	**SUPERCEDED BY 06-09-B069X (12/21/2005)**	Unnamed Tributary to Black Wash - approx. 1200' upstream to approx. 5000' upstream of Tucson Ajo Highway (Eagle Point Estates)
05-09-0118P	25-Oct-05	1015K, 1020K, 1025K	Cañada Agua West Alluvial Fan - approx. 2300' upstream of Tortolita Rd. to approx. 200' downstream of Moore Rd.
05-09-2100324P	29-Sep-05	**SUPERCEDED BY 06-09-B019X (01/17/2006)**	Unnamed Tributary to Black Wash - approx. 4000' downstream of Sunset Blvd. to approx. 500' upstream of Camino Verde Blvd.
05-09-2100326P	26-Sep-05	**SUPERCEDED BY 06-09-B020X (01/11/2006)**	Unnamed Wash - approx. 5500' downstream to approx. 100' upstream of Valencia Rd.
03-09-1149P	04-Aug-05	1015K, 1020K, 1605K	Cañada Agua East Fan - approx 5300' downstream of Blue Bonnet Rd. to approx 300' upstream of Camino Del Norte
04-09-0547P	28-Jul-05	1644K, 2232K	Columbus Wash/Midway Wash - just downstream of Grant Rd. to just downstream of 5th St. **-AND-** Columbus Wash Overflow - its convergence w/Columbus Wash to just downstream of Seneca St.
04-09-0958P	15-Jul-05	1030K, 1040K	Big Wash - just upstream to approx. 8900' upstream of Tangerine Rd
04-09-1150P	18-Apr-05	**SUPERCEDED BY 06-09-B741P (05/23/2006)**	Unnamed Tributaries to Black Wash - just upstream to approx. 3400' upstream of Victor Dr. (Star Valley)
04-09-0697P	23-Mar-05	1025K	Ruelas Wash - approx. 7200' downstream to just downstream of Dove Mountain Blvd
03-09-1071P	10-Mar-05	0955K, 0960K, 0970K,	Santa Cruz River - approx. 6900' downstream of

LOMR No.	LOMR Date	Panel Number(s)	Affected Wash and/or Floodplain
		0980K, 0990K	Trico Rd. to approx 1600' downstream of Sanders Rd.
04-09-1576P	14-Jan-05	1025K	North Ranch Basin - approx. 2800' downstream to approx 2900' upstream of W. Cessna Way
04-09-0917P	17-Nov-04	**SUPERCEDED BY 05-09-2100326P (9/26/2005)**	Unnamed Tributary to Rodeo Wash - approx. 4000' downstream to just downstream of I-10
04-09-0621P	04-Nov-04	1644K	Rillito Creek - approx. 1200' downstream to approx. 1500' upstream of Swan Rd.
03-09-1300P	26-Oct-04	**SUPERCEDED BY 05-09-2100324P (09/29/2005)**	Unnamed Tributary to Black Wash - approx. 4000' downstream of Sunset Blvd. to approx. 500' upstream of Camino Verde Blvd.
02-09-1039P	16-Sep-04	0960K, 0970K, 0980K, 0985K, 0990K, 0995K, 1015K	Santa Cruz River - approx. 8600' downstream of Sanders Rd. to approx. 11,800' upstream of Avra Valley Rd.
04-09-0380P	29-Aug-04	1635K	Finger Rock Wash - approx. 300' downstream of E. Ina Rd to approx 100' upstream of E. Playa de Coronado -AND- Finger Rock Wash Tributary - the confluence with Finger Rock Wash to approx. 400' upstream of E. Playa de Coronado
04-09-0308P	12-Aug-04	1015K	Prospect Wash - approx. 1500' downstream to approx 400' upstream of Tortolita Rd
03-09-1711P	15-Jul-04	2233K	Naylor Wash - approx. 900' downstream to approx. 1450' upstream of 22nd St.
03-09-0698P	01-Jul-04	1025K	Ruelas Wash - alluvial fan flooding approx 7400' downstream to approx 1000' upstream of Dove Mountain Blvd; placement of fill; channelization; erosion wall approx 6200' downstream to approx 2600' downstream of Dove Mountain Blvd; 10'x24' con arch culvert at Dove Mountain Blvd
04-09-0750P	22-Apr-04	1610K	Between I-10 and the railroad, north of the Rillito Creek due to soil cement bank protection on the north bank of the Rillito
04-09-0465X	22-Apr-04	1610K, 1616K, 1617K, 1636K, 1637K, 1639K, 1643K, 1644K, 1645K, 1663K	Rillito Creek - its confluence w/the Santa Cruz River to the confluences of Pantano Wash and Tanque Verde Wash **-AND-** Pegler Wash - just upstream to approx. 4500' upstream of its confluence w/Rillito Creek
04-09-0474P	19-Apr-04	1025K	Prospect Canyon - approx. 1800' downstream to approx 2300' upstream of Unnamed Rd
04-09-0427P	18-Mar-04	2210K	Anklam Wash - approx. 1400' downstream to approx. 900' upstream of W. Anklam Road
02-09-829P	18-Mar-04	**SUPERCEDED BY 04-09-0465X (04/22/2004)**	Rillito Creek - its confluence w/the Santa Cruz River to the confluences of Pantano Wash and Tanque Verde Wash **-AND-** Pegler Wash - just upstream to approx. 4500' upstream of its confluence w/Rillito Creek
03-09-0141P	01-Mar-04	2810K	Mission Wash - just upstream of Cardinal Ave to just downstream of Sorrel Ln.
02-09-873P	23-Oct-03	2258K, 2270K	Pantano Wash - just upstream to approx. 5350' upstream of Golf Links Rd.
03-09-0541P	25-Sep-03	**SUPERCEDED BY 05-09-A426P (01/31/2006)**	Soil Cement bank protection Pantano Wash - approx. 350' downstream to approx. 5150' downstream of Vail Rd. crossing -AND- berm around a manmade pond located along the right bank (looking downstream) of Pantano Wash - approx. 500' downstream to approx. 800' downstream of the Vail Rd. crossing

LOMR No.	LOMR Date	Panel Number(s)	Affected Wash and/or Floodplain
03-09-0493P	18-Sep-03	2220K	Unnamed tributary to Black Wash - effects of a retention basin approx 100' wide and approx 1000' long located approx 100' E and approx 100' S of the intersection of Avenida Paisano and Calle Don Miguel to approx 1000' S of that intersection; 3-24" culverts approx 40' N of the intersection of Calle Don Miguel and Camino de Oeste; 3-48" culverts at the intersection of Avenida Paisano and Calle Don Miguel; a retention basin located approx 100' N and approx 50' E of that intersection; compacted fill for the Mountain Village Estates and Mountain Village Estates East subdivisions
03-09-0430P	14-Jul-03	2225K	Earthen channel along the eastern edge of Victor Dr from approx. 600' S to approx. 2600' S of Valencia Rd; installation of 3-3'x8' RC box culverts under Victor Dr; four drainage swales that are tributaries to Black Wash that cross Lots 1-76 and Block A of the West Star Estates subdivision
01-09-407P	30-Jun-03	**SUPERCEDED BY 04-09-1150P (04/18/2005)**	Unnamed tributaries to Black Wash
02-09-1386P	23-May-03	0980K	Derrio & Cottonwood Washes that reflect the presence of the CAP Canal from approx. the CAP Canal Overshoot located in T11 R11 S15 and from the CAP Canal Overshoot located approx. 2500' NE of Adonis Rd, extending SW to an irregular line that runs approx. 500' NE of I-10 Frontage Rd.
02-09-1252P	12-Feb-03	1643K, 2231K	Alvernon Wash - approx. 100' upstream of Flower St. to approx. 220' upstream of Grant Rd.
02-09-1197P	07-Nov-02	1020K, 1025K	Upper Cañada Agua West Alluvial Fan - approx. 800' downstream of Moore Rd to the hydrographic apex that is located approx. 6000' upstream of Moore Rd.
02-09-1113P	15-Oct-02	**SUPERCEDED BY 05-09-2100326P (9/26/2005)**	Unnamed tributary to Earp Wash - approx. 3800' downstream to just downstream of I-10
02-09-1050P	11-Sep-02	2220K	West Branch Santa Cruz River - approx. 1400' upstream to approx. 2500' upstream of Valencia Rd.
02-09-1007P	09-Sep-02	**SUPERCEDED BY 05-09-2100324P (09/29/2005)**	Camino Verde Estates Phase II and III
02-09-746X	25-Jul-02	1617K, 1636K	Rollercoaster Wash - just upstream to approx. 900' upstream of Oracle Jaynes Station Rd; Rollercoaster Wash South Drainage just upstream of its confluence with Rollercoaster Wash to just downstream of Oracle Jaynes Station Rd; unnamed tributary to Rollercoaster Wash from just upstream of its confluence w/Rollercoaster Wash to approx. 1100' upstream of Hudson Dr; Citrus Wash just upstream to approx. 2500' upstream of Oracle Jaynes Station Rd
01-09-685P	29-Mar-02	**SUPERCEDED BY 02-09-746X (07/25/2002)**	Rollercoaster Wash - just upstream to approx. 900' upstream of Oracle Jaynes Station Rd; Rollercoaster Wash South Drainage just upstream of its confluence with Rollercoaster Wash to just downstream of Oracle Jaynes Station Rd; unnamed tributary to Rollercoaster Wash from just upstream of its confluence w/Rollercoaster Wash to approx. 1100' upstream of Hudson Dr; Citrus Wash just upstream to approx. 2500' upstream of Oracle

LOMR No.	LOMR Date	Panel Number(s)	Affected Wash and/or Floodplain
			Jaynes Station Rd
01-09-1059P	25-Mar-02	1015K	Cañada Agua Wash - East (unnamed tributary) - just upstream of Linda Vista Blvd to just downstream of Blue Bonnet Rd.
02-09-220P	04-Jan-02	2227K	Arroyo Chico - approx. 50' downstream to approx. 300' upstream of Euclid Ave.
00-09-051P	02-Nov-01	2226K, 2227K	Tucson Arroyo - just upstream of I-10 to approx. 200' downstream of 5th Ave. **-AND-** Arroyo Chico - approx. 200' downstream of 5th Ave. to approx. 600' downstream of Miles St.
01-09-994P	04-Oct-01	2259K	Este Wash - intersection of 22nd St. and Houghton Rd. to approx. 3000' downstream of 22nd St.
01-09-914P	28-Aug-01	2210K	correct location of Linden St. east of Silvercroft Wash and approx. 400' south of Riverview Blvd.
01-09-430P	07-Aug-01	**SUPERCEDED BY 08-09-0051P (10/29/2007)**	Unnamed tributaries to Black Wash -AND- trapezoidal collector channel approx. 1000' downstream to approx. 300' upstream of Iberia Ave.; 2-36" concrete pipe culverts at Iberia Ave.

LOMA No.	Date	Type of LOMC	Address	Panel No.
03-09-0671A	04/11/2003	LOMR-FW	10661 E. Sundance Circle	1670K
04-09-1068A	07/14/2004	LOMA	11367 E. Edison Street	2280K
01-09-782A	07/02/2001	LOMA - OAS	11631 E. Calle de Samuel	1690K
04-09-0532A	03/01/2004	LOMA	11710 E. Thunderbird Trail (Guest Bldg)	1690K
04-09-0532A	03/01/2004	LOMA	11710 E. Thunderbird Trail (Main Bldg)	1690K
04-09-0267A	12/16/2003	LOMA	11852 E. Wagon Trail Road	2280K
02-09-189A	12/19/2001	LOMA	12200 E. Barbary Coast Road	2280K
03-09-1641A	11/19/2003	LOMR-FW	12320 E. Barbary Coast Road	2280K
03-09-0213A	12/26/2002	LOMA - OAS	13605 N. Como Drive	1025K
02-09-821A	05/15/2002	LOMA - OAS	13825 N. Como Drive	1025K
04-09-0782A	04/28/2004	LOMA	1475 E. Canyon Spring Court	1630K
01-09-993A	10/24/2001	LOMA	155 E. Yvon Drive	1636K
07-09-0414A	12/07/2006	LOMR-F	1598 W. Gentle Brook Trail	1636K
07-09-0414A	12/07/2006	LOMR-F	1624 W. Gentle Brook Trail	1617K
07-09-0414A	12/07/2006	LOMR-F	1624 W. Gentle Brook Trail	1636K
07-09-0414A	12/07/2006	LOMR-F	1626 W. Gentle Brook Trail	1617K
07-09-0414A	12/07/2006	LOMR-F	1626 W. Gentle Brook Trail	1636K
07-09-0414A	12/07/2006	LOMR-F	1628 W. Gentle Brook Trail	1617K
07-09-0414A	12/07/2006	LOMR-F	1630 W. Gentle Brook Trail	1617K
07-09-0414A	12/07/2006	LOMR-F	1644 W. Gentle Brook Trail	1617K
07-09-0414A	12/07/2006	LOMR-F	1650 W. Gentle Brook Trail	1617K
06-09-BB46A	07/12/2006	LOMA	1820 W. Placita del Lobo	1610K
06-09-BB47A	07/14/2006	LOMA	1830 W. Placita del Lobo	1610K
06-09-BB49A	07/14/2006	LOMA	1831 W. Placita del Lobo	1610K
06-09-BB48A	07/14/2006	LOMA	1840 W. Placita del Lobo	1610K
01-09-1077A	09/20/2001	LOMA	222 E. Yvon Drive	1636K
05-09-0822A	05/20/2005	LOMA	2417 W. Placita de Ramo	1617K
05-09-0506A	03/16/2005	LOMA	2433 W. Placita de Ramo	1617K
05-09-0694A	04/28/2005	LOMA	2449 W. Placita de Ramo	1617K
05-09-0468A	04/01/2005	LOMA	2465 W. Placita de Ramo	1617K
06-09-0029A	10/25/2005	LOMA	2481 W. Placita de Ramo	1617K
02-09-1229A	08/15/2002	LOMA	2601 W. Partridge Street	2810K
01-09-816A	07/11/2001	LOMA - OAS	2991 N. Melpomene Way	1670K
04-09-0828A	05/06/2004	LOMA - OAS	308 W. 31st Street	2228K
03-09-0525A	04/03/2003	LOMR-FW	325 E. Deone Lane	1630K
04-09-0978A	04/28/2004	LOMA - OAS	3301 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3311 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3321 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3331 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3431 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3441 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3451 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3461 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3471 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3481 W. Avenida de San Candido	2810K

LOMA No.	Date	Type of LOMC	Address	Panel No.
04-09-0978A	04/28/2004	LOMA - OAS	3491 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3501 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3515 W. Avenida de San Candido	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3665 W. Ostler Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3670 W. Ostler Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3675 W. Ostler Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3680 W. Ostler Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3685 W. Ostler Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3685 W. Tybolt Drive	2810K
00-09-010A	03/24/2000	LOMA	3687 W. Lost Horizon Drive	1616K
04-09-0978A	04/28/2004	LOMA - OAS	3690 W. Ostler Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3695 W. Tybolt Drive	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3705 W. Tybolt Drive	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3715 W. Tybolt Drive	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3725 W. Tybolt Drive	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3735 W. Tybolt Drive	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3755 W. Tybolt Drive	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3765 W. Tybolt Drive	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3775 W. Tybolt Drive	2810K
04-09-0978A	04/28/2004	LOMA - OAS	3785 W. Tybolt Drive	2810K
03-09-0176A	01/08/2003	LOMA	3915 N. Bear Canyon Road	1670K
05-09-1119A	06/09/2005	LOMA - OAS	3920 N. Tanuri Drive	1663K
02-09-067A	11/07/2001	LOMA - OAS	4000 N. Flaming Sky Place	1665K
07-09-1535A	08/28/2007	LOMA - OAS	4000 W. Tetakusim Road	2810K
02-09-067A	11/07/2001	LOMA - OAS	4009 N. Flaming Sky Place	1665K
02-09-067A	11/07/2001	LOMA - OAS	4017 N. Flaming Sky Place	1665K
02-09-067A	11/07/2001	LOMA - OAS	4020 N. Flaming Sky Place	1665K
02-09-067A	11/07/2001	LOMA - OAS	4025 N. Flaming Sky Place	1665K
02-09-067A	11/07/2001	LOMA - OAS	4033 N. Flaming Sky Place	1665K
03-09-1628A	10/29/2003	LOMA	4041 E. Bujia Primera	1645K
03-09-0288A	01/27/2003	LOMA	4231 E. Havasu Road	1635K
02-09-500A	03/12/2002	LOMA - OAS	4231 W. Elvado Road	2810K
02-09-1372A	09/18/2002	LOMA	4410 N. Pontatoc Road	1645K
00-09-010A	03/24/2000	LOMA	4617 W. Lost Horizon Drive	1616K
06-09-B935A	07/21/2006	LOMR-FW	4625 N. Palisade Drive	1670K
04-09-0222A	01/23/2004	LOMA	4759 W. Nebraska Street	2225K
01-09-836A	08/17/2001	LOMA	4850 N. Campbell Avenue	1637K
04-09-1649A	10/20/2004	LOMR-F	501 W. Royal Troon Place	3905K
04-09-1649A	10/20/2004	LOMR-F	507 W. Royal Troon Place	3905K
06-09-B429A	02/28/2006	LOMR-F	5073 W. Tillery Street	2225K
03-09-1154A	08/05/2003	LOMA	5111 S. Joseph Avenue	2225K
07-09-0414A	12/07/2006	LOMR-F	5143 N. Cliffed River Drive	1617K
07-09-0414A	12/07/2006	LOMR-F	5151 N. Cliffed River Drive	1617K
05-09-1650A	11/01/2005	LOMA	5164 N. Pontatoc Road	1645K
04-09-1046A	06/18/2004	LOMA	522 E. Placita Cerro Amistoso	1637K
07-09-0638A	02/08/2007	LOMA	5330 N. Maria Drive	1637K

LOMA No.	Date	Type of LOMC	Address	Panel No.
00-09-1050A	10/04/2000	LOMA	5505 N. Via Arroyo Amistoso	1637K
06-09-B233A	03/09/2006	LOMA	5555 N. Via Arroyo Amistoso	1637K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 11157 (Bldg 11)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 11158 (Bldg 11)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 11159 (Bldg 11)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 11160 (Bldg 11)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 11161 (Bldg 11)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 11258 (Bldg 11)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 11259 (Bldg 11)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 11260 (Bldg 11)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 11261 (Bldg 11)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 12162 (Bldg 12)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 12163 (Bldg 12)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 12164 (Bldg 12)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 12165 (Bldg 12)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 12166 (Bldg 12)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 12263 (Bldg 12)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 12264 (Bldg 12)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 12265 (Bldg 12)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 12266 (Bldg 12)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13167 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13168 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13169 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13170 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13171 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13267 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13268 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13269 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13270 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 13271 (Bldg 13)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 14172 (Bldg 14)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 14173 (Bldg 14)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 14174 (Bldg 14)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 14175 (Bldg 14)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 14176 (Bldg 14)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 14273 (Bldg 14)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 14274 (Bldg 14)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 14275 (Bldg 14)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 14276 (Bldg 14)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 4119 (Bldg 4)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 4120 (Bldg 4)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 4121 (Bldg 4)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 4122 (Bldg 4)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 4123 (Bldg 4)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 4219 (Bldg 4)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 4220 (Bldg 4)	1655K

LOMA No.	Date	Type of LOMC	Address	Panel No.
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 4221 (Bldg 4)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 4222 (Bldg 4)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5124 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5125 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5126 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5127 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5128 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5129 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5225 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5226 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5227 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 5228 (Bldg 5)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 6130 (Bldg 6)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 6131 (Bldg 6)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 6132 (Bldg 6)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 6133 (Bldg 6)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 6134 (Bldg 6)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 6230 (Bldg 6)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 6231 (Bldg 6)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 6232 (Bldg 6)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 6233 (Bldg 6)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 8141 (Bldg 8)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 8142 (Bldg 8)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 8143 (Bldg 8)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 8144 (Bldg 8)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 8145 (Bldg 8)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 8242 (Bldg 8)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 8243 (Bldg 8)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 8244 (Bldg 8)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 8245 (Bldg 8)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 9146 (Bldg 9)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 9147 (Bldg 9)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 9148 (Bldg 9)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 9149 (Bldg 9)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 9150 (Bldg 9)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 9246 (Bldg 9)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 9247 (Bldg 9)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 9248 (Bldg 9)	1655K
06-09-0243A	12/19/2005	LOMA	5800 N. Kolb Road Unit 9249 (Bldg 9)	1655K
04-09-1658A	01/12/2005	LOMA	5870 N. Piedra Seca	1635K
03-09-1102A	07/18/2003	LOMA	6129 N. Via Jaspeada	1635K
03-09-1102A	07/18/2003	LOMA	6137 N. Via Jaspeada	1635K
03-09-1102A	07/18/2003	LOMA	6161 N. Via Jaspeada	1635K
03-09-1102A	07/18/2003	LOMA	6169 N. Via Jaspeada	1635K
03-09-1102A	07/18/2003	LOMA	6177 N. Via Jaspeada	1635K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/207)	1655K

LOMA No.	Date	Type of LOMC	Address	Panel No.
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/208)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/209)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/210)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/211)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/212)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/213)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/214)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/215)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/216)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/217)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/218)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/219)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (21/220)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (22/221)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (22/222)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (22/223)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (22/224)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (22/225)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (22/226)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (22/227)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (22/228)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (23/229)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (23/230)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (23/231)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (23/232)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (23/233)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (23/234)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (23/235)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (23/236)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (24/237)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (24/238)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (24/239)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (24/240)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (24/241)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (24/242)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (24/243)	1655K
02-09-826A	06/05/2002	LOMA	6655 N. Canyon Crest Drive (24/244)	1655K
04-09-0162A	12/16/2003	LOMA	6901 N. Bobcat Ridge Trail	1605K
06-09-BG34A	10/24/2006	LOMR-F	6915 E. Cloud Road	1663K
04-09-0273A	12/19/2003	LOMA	7000 N. Bobcat Ridge Trail	1605K
04-09-0978A	04/28/2004	LOMA - OAS	7590 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7592 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7598 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7601 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7601 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7602 S. Bosworth Field Way	2810K

LOMA No.	Date	Type of LOMC	Address	Panel No.
04-09-0978A	04/28/2004	LOMA - OAS	7602 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7606 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7609 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7610 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7610 S. Cordelia Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7611 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7611 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7614 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7618 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7620 S. Cobham Drive	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7620 S. Cordelia Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7620 S. Malcolm Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7621 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7621 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7622 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7623 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7625 S. Cordelia Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7625 S. Malcolm Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7626 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7626 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7630 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7630 S. Cordelia Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7631 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7631 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7633 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7634 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7636 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7638 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7641 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7642 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7642 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7645 S. Cressida Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7646 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7646 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7647 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7649 S. Derby Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7650 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7650 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7650 S. Derby Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7650 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7651 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7653 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7654 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7655 S. Cressida Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7656 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7656 S. Dorset Court	2810K

LOMA No.	Date	Type of LOMC	Address	Panel No.
04-09-0978A	04/28/2004	LOMA - OAS	7658 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7658 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7659 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7659 S. Derby Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7660 S. Derby Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7661 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7661 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7662 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7662 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7664 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7665 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7665 S. Cressida Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7666 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7666 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7668 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7669 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7669 S. Derby Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7670 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7670 S. Derby Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7671 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7672 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7673 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7673 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7674 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7674 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7674 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7675 S. Cressida Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7677 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7677 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7678 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7679 S. Derby Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7680 S. Derby Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7680 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7681 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7681 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7682 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7682 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7683 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7685 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7685 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7686 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7686 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7689 S. Carlisle Avenue	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7689 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7690 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7690 S. Carlisle Avenue	2810K

LOMA No.	Date	Type of LOMC	Address	Panel No.
04-09-0978A	04/28/2004	LOMA - OAS	7691 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7692 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7693 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7693 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7694 S. Bosworth Field Way	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7698 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7698 S. Dorset Court	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7699 S. Coleville Street	2810K
04-09-0978A	04/28/2004	LOMA - OAS	7699 S. Dorset Court	2810K

5.2.4 Community Rating System Program

In 1990, to provide added incentive for communities to reduce flood loss and to encourage individuals in SFHAs to purchase flood insurance, FEMA introduced the CRS. Although the NFIP regulates new construction in flood hazard areas, there was little incentive to reduce flood damage to existing buildings located in flood hazard areas, manage development in flood hazard areas not mapped by the NFIP, protect new development to a level greater than the minimum NFIP standards, or promote the purchase of flood insurance.

The CRS enables communities to earn points for undertaking various flood control and floodplain management activities that are above and beyond the minimum NFIP requirements. Several Pima County divisions undertake the various activities that must be documented and are coordinated by the District. Annual re-certification is required. If sufficient points are earned, residents of the submitting jurisdiction are eligible for discounts in flood insurance premiums.

Since the CRS's inception in 1990, the District's involvement has resulted in reduced insurance premiums paid by Pima County residents each year. Every community participating in the nationwide program starts as a Class 10, and then gains CRS activity points to improve their class designation to Class 1. Each designation improvement amounts to a 5% reduction in flood insurance rates. Pima County is currently rated a Class 6 resulting in a 20% annual reduction in insurance rates within SFHAs and 10% in other areas; however, Pima County will be upgraded to a Class 5.

5.2.5 Repetitive Loss Area Plan

RLA1 – Tanque Verde Creek at Forty Niner Country Club

Certain properties within the Forty Niners Country Club Estates subdivision located along the north bank of the Tanque Verde Creek in the northeastern portion of the Tucson metropolitan area, as described below. The Tanque Verde Creek and local tributaries are the source of flooding in this area.

This subdivision was the subject of extensive study by the Corps in cooperation with the District during the past 10 years. The results of the Corps study was the recommendation that a levee be constructed along the north bank of the Tanque Verde Creek between the creek and the homes within the subdivision to eliminate flooding from the Tanque Verde Creek. The plan also

included improvements to local interior drainage within the subdivision. After public meetings were held with the residents of the area, the proposed plan was determined to be unacceptable to the public due to aesthetic considerations and the plan was discontinued due to public pressure against it. However, improvements to the local interior drainage of the subdivision were made which reduced flooding potential from those sources.

12150 East Barbary Coast

This property had losses due to flooding on October 1, 1983 and July 23, 1990. In each case flooding was due to local drainage and overbank flooding from the Tanque Verde Creek associated with monsoon weather patterns. This home is located within FEMA SFHA Zone AE and the floodway. Solutions to the prior flooding identified by the District and Corps have been rejected by the Forty Niner Country Club Estates Homeowners Association.

12140 East Barbary Coast

This property had losses due to flooding on October 1, 1983 and August 17, 1984. In each case flooding was due to local drainage and overbank flooding from the Tanque Verde Creek associated with monsoon weather patterns. This home is located within FEMA SFHA Zone AE and the floodway. Solutions to the prior flooding identified by the District and Corps have been rejected by the Forty Niner Country Club Estates Homeowners Association.

RLA2 – 3720 North Camino Seco

This home was constructed prior to local adoption of floodplain requirements and is therefore uniquely situated. This property had losses due to flooding on July 14, 1990 and January 8, 1993. In 1990, flooding was due to local drainage from Bear Canyon Wash associated with monsoon weather patterns. In 1993, flooding was due to unusually heavy winter rains over a period of several days. This home is located within FEMA SFHA Zone AE and is immediately adjacent to or partly within the floodway. FLAP acquisition is available should this property owner wish to sell. Local requirements limit further development of this property.

5.3 FLOODPLAIN MANAGEMENT REGULATIONS

5.3.1 Floodplain and Erosion Hazard Management Ordinance

Floodplain management activities are regulated in accordance with the Floodplain and Erosion Hazard Management Ordinance (Ordinance) within unincorporated Pima County. The Ordinance defines regulatory floodplains; assigns responsibility for maintaining updated floodplain maps to the District; specifies uses allowed in floodways and floodplains, building setbacks in erosion hazard areas, when and what type of mitigation is required for disturbing riparian habitat, and standards for manufactured home park and subdivision development. The ordinance also provides a formalized process for appealing decisions made regarding floodplain matters, and obtaining a variance from the Ordinance.

Administering the Ordinance accomplishes two goals: 1) satisfies FEMA FIS requirements governing activities in federally-mapped flood hazard areas; and 2) addresses local issues by

regulating activities in locally-designated regulatory flood and erosion hazard areas. Provisions of the Ordinance are more restrictive than the minimum required by the NFIP.

5.3.2 Floodplain Use Permit Program

As specified in the Ordinance, an FPUP must be obtained prior to development in a designated flood or erosion hazard area. "Development" is defined as "any manmade change to improved or unimproved real estates including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, fencing, excavating or drilling. The Ordinance further states that, "…no person shall be exempted from obtaining a FPUP…for any use which diverts, retards or obstructs the flow of water and creates a danger or hazard to life or property in the area." In essence, the Ordinance restricts uses in the regulatory flood and erosion hazard areas.

Allowable *floodway* uses are those that do not "…create a danger or hazard to life or property." These include agricultural, recreational, and accessory residential uses. Sand and gravel excavations are allowed subject to the conditions stated in the Ordinance. FPUPs for sand and gravel operations must be renewed annually.

Much greater leeway is provided for *floodplain* uses. Most uses are allowed in regulatory floodplains including constructing buildings as long as FPUP conditions are satisfied. For any structure designed for human habitation, the quantity (dv^2), or depth times the square of the velocity, must not exceed the value of 18 for greater than 30 minutes, and the depth of the surrounding 100-year floodwater must not exceed three feet. In addition, the finished floor elevation must be at least one foot above the 100-year water surface elevation. Other regulations govern the amount and type of fill used, and measures for protecting the fill; anchoring structures to prevent flotation; locating or flood proofing service facilities such as electrical and heating; and aligning structures relative to the direction of flow.

The Ordinance also specifies building setbacks where approved bank stabilization is not provided. The setback marks the edge of the erosion hazard area; it is measured from the top edge of the highest channel bank or the edge of the base floodwater surface elevation, whichever is closer to the channel centerline. Setback distances area based on the magnitude of the 100-year discharge. Provisions are made for considering reduced setbacks on a case-by-case basis as warranted.

5.3.3 Appeals and Variances

In addition to specifying what types of activities are allowed in flood and erosion hazard areas, the Ordinance provides a mechanism for appealing any interpretation of the Ordinance, and a process for obtaining a variance from the Ordinance. The majority of variances sought are to place residential structures, typically manufactured homes, in a designated floodway. The majority of appeals sought are to gain a reduction in the required finished floor elevation. Although granting appeals allows for a loosening of the Ordinance requirements, rarely do the decisions result in a violation of the provisions of the NFIP because the elevation provisions in the Ordinance are stricter than NFIP requirements.

The County Engineer first hears requests for appeals. If the request is not granted, the appeal is heard by the FCDAC Appeals Subcommittee, which then makes a recommendation to the Board sitting as the Floodplain Management Board. All requests for variances are heard and decided by the Floodplain Management Board.

The above is a brief summary of the provisions of the Ordinance. The reader is referred to the Ordinance for more detailed information. The Ordinance can be found on the District's website.

5.3.4 Other Regulatory Activities

In addition to issuing FPUPs, District staff provides information to the general public about permissible activities in flood hazard areas, and provides information about the flood hazard status of specific properties. Requests for information can be made via letter, fax or on a walk-in basis. The public information counter, also located on the 3rd Floor at 97 E. Congress Street, is open weekdays from 8:00 a.m. to 4:30 p.m.

Staff also investigates drainage complaints filed by the general public. If the complaint involves a violation of the Ordinance, the property owner is notified and corrective action is requested. When violations of the Ordinance are not corrected to the District's satisfaction, staff issues a violation notice and the case may be referred to the Pima County Attorney's Office for action. Staff often provides technical support to the attorney working on the case and may testify on behalf of the District.

In summary, Floodplain Management staff is perpetually engaged in issuing permits and providing floodplain information to the public. Table 5.3 provides data on floodplain management services provided by the District over the past six years.

Table 5.2
Floodplain Management Workload

	FY 00/01	FY 01/02	FY 02/03	FY 03/04	FY 04/05	FY 05/06
FPUPs (Received/Issued)	796/542	721/526	874/588	867/653	955/833	755/503
Drainage Complaints Received	391	262	588	241	289	394
Floodplain Status Letters Written	8,534	7,370	6,735	5,633	5,208	5,107
Counter Service	5,904	5,611	5,791	5,706	6,037	6,725
Site Reviews	76	85	72	109	175	173

5.4 STUDIES

The District initiates river and basin management plans and other key studies to identify present and future flood control needs and to implement related land use planning activities on major watercourses and tributary watersheds. The management plans allow the District to move away from reactive "spot" improvements and toward larger-scale, long-range improvements.

5.4.1 Watershed Planning Study

This internal planning document examined characteristics of watersheds within Pima County to provide input on basin study scoping and scheduling.

5.4.2 Lee Moore Wash Basin Management Study

This major basin study was initiated in 2006 to provide hydrology and rules of development for several large (213 square miles) predominately undeveloped watersheds located east of the Santa Cruz River, south of I-10, and northwest of the Santa Rita Mountains. This area includes alluvial fans and the Santa Cruz River geologic floodplain. Completion is anticipated in 2008.

5.4.3 Southwest Basin Flood Control Concept Plan

The study area is bounded on the north by Tucson Mountain Park, Hermans Road on the south which runs along the northern boundary of the San Xavier Indian Reservation, Sandario Road to the west and the Tucson Mountains to the east. Most of this area lies within the Black Wash watershed. This study was initiated due to projected growth and the fact that much of the area lies within floodplains. All-weather access is also limited. The concept plan identified potential basin locations as well as areas to be left natural. Perhaps most importantly the study provided discharge rates. The recommendations of this study are being incorporated into a detailed study known as the Southwest Infrastructure Plan.

5.5 FLOODPRONE LAND ACQUISITION PROGRAM

The Floodprone Land Acquisition Program (FLAP) began in 1984 and is funded by bond monies authorized by Pima County voters and by an annual allocation from the District's tax levy. FLAP is an effective nonstructural floodplain management tool that yields a number of community benefits. Some of these include removing residences and structures from vulnerable areas, preserving natural floodplain characteristics (and attenuation of downstream flood peaks), providing recreational opportunities, maintaining open space, and protecting groundwater quality and riparian habitat resources. The District administers FLAP solely on a voluntary basis without utilizing its land condemnation authority. Floodprone parcels have been acquired along the Cañada del Oro, in Avra Valley and in the southwest along the Black and Brawley washes, and along the Santa Cruz River. FLAP helps ensure that repetitive losses are minimized. Figure 3 illustrates floodprone properties purchased under FLAP during the reporting period. Table 5.4 provides a summary of acres purchased between FY 2000/01 and FY 2005/06.

Table 5.3
Floodprone Land Acquisition Program Summary

Fiscal Year	Land Purchased (acres)	Total
FY 2000/01	325	$ 577,600
FY 2001/02	816	$1,259,000
FY 2002/03	646	$1,309,048
FY 2003/04	204	$9,346,084
FY 2004/05	72	$2,217,828
FY 2005/06	64	$2,130,200

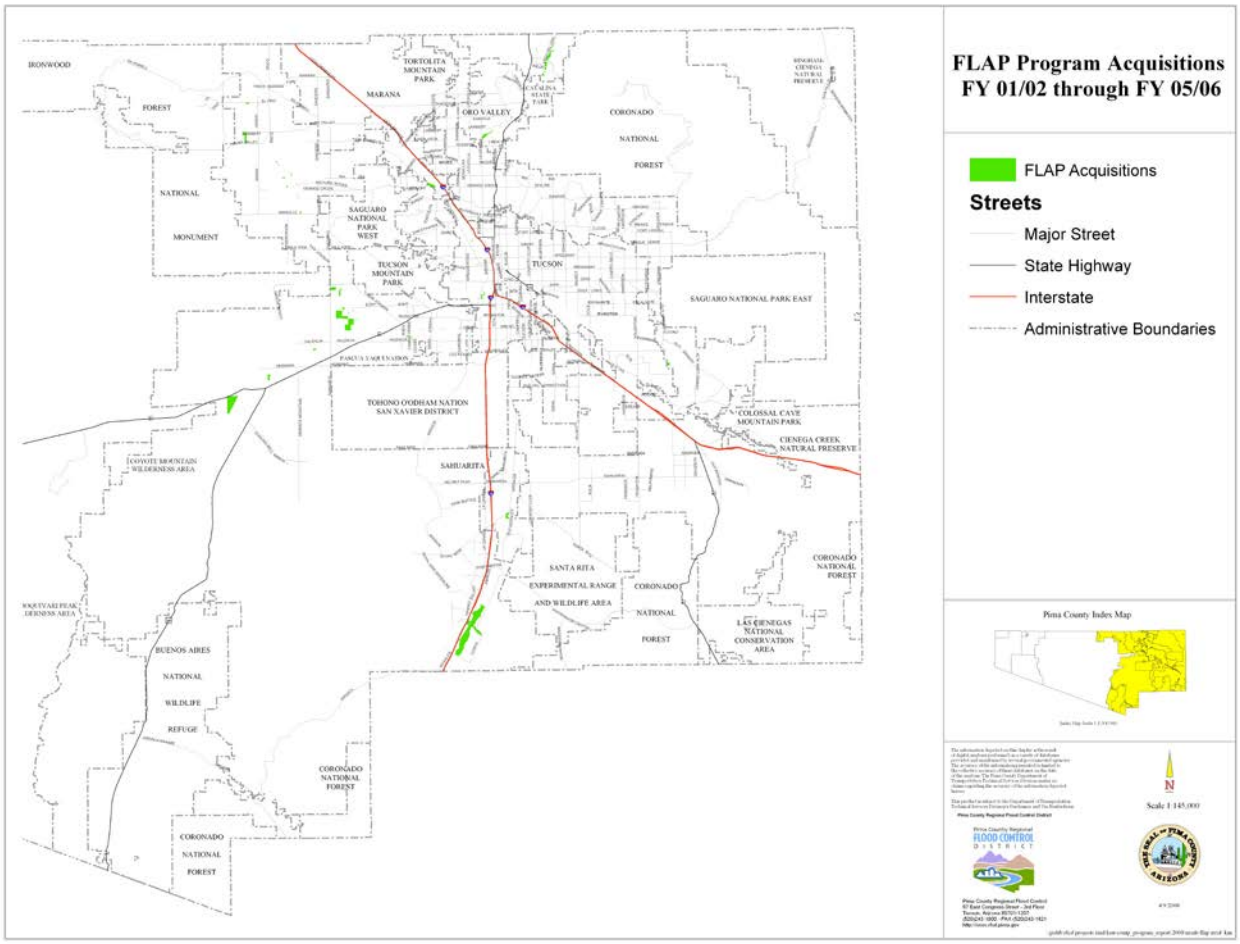


Figure 5-1
FLAP Acquisitions Map

5.6 FLOOD WARNING PROGRAM

The Flood Warning Program encompasses the District's Automated Local Evaluation in Real Time Warning System (ALERT), along with the District's Flood Response Plan and Flood Hazard Mitigation efforts.

The ALERT system consists of 82 automatic self-reporting precipitation gauges, 31 stream gauges, four weather stations, and four radio repeater stations. The system automatically transmits hydrometeorological data via radio telemetry to the District's base station and to the Tucson office of the NWS. During storm events, District staff evaluates incoming data to monitor changing flood conditions. The NWS also uses the information when issuing flash flood warnings and advisories. Finally, the Department of Transportation, Maintenance Operations Division relies on District ALERT data to determine storm-related road closures, and the Department of Environmental Quality uses ALERT data for the Pima County National Pollutant Discharge Elimination System (NPDES) Monitoring Program.

Every year significant storm events occur, which prompt more intensive ALERT system monitoring, the issuance of NWS advisories, road closures, and the preparation of summary storm reports by District staff.

During FY 2001/02, 10 precipitation and four stream gauges were installed in cooperation with ADWR. ALERT system hardware and software was upgraded in April 2002. District staff made an ALERT system presentation at a University of Arizona colloquium.

In FY 2002/03, one precipitation gauge was installed in the Santa Catalina Mountains to provide information on storms affecting portions of the Bullock Fire burn area. Three precipitation gauges and one stream gauge were installed in support of data collection concerning water quality and water supply to the Ed Pastor Kino Environmental Restoration Project. One precipitation gauge was installed in the Santa Rita Mountains. Staff worked with a consultant to design and implement an internet page so that ALERT system data could be viewed by the public.

In FY 2003/04, four precipitation gauges and two stream gauges were installed in the Santa Catalina Mountains to provide enhanced early-warning information on storms in the Aspen Fire burn areas. District staff made presentations on the functioning of the ALERT system after the Aspen Fire to the NWS and the Southwest Association of ALERT systems.

In FY 2005/06, staff made three ALERT system presentations to various groups including the Arizona Statewide Flood Warning Symposium.

5.6.1 Rain Gauge Volunteer Program

Since 1977, the District has operated a system of volunteer weather watchers known as rain gauge volunteers. Participants in the program are provided with a standardized rain gauge and data sheets to record daily rainfall information. Data about the duration and amount of each storm may be provided, if available. Volunteers submit the data to the District every two months at which time they are compiled and recorded. Since June 2001, the network has averaged approximately 74 volunteers distributed across the entire metropolitan and outlying areas (Figure 5 -2).

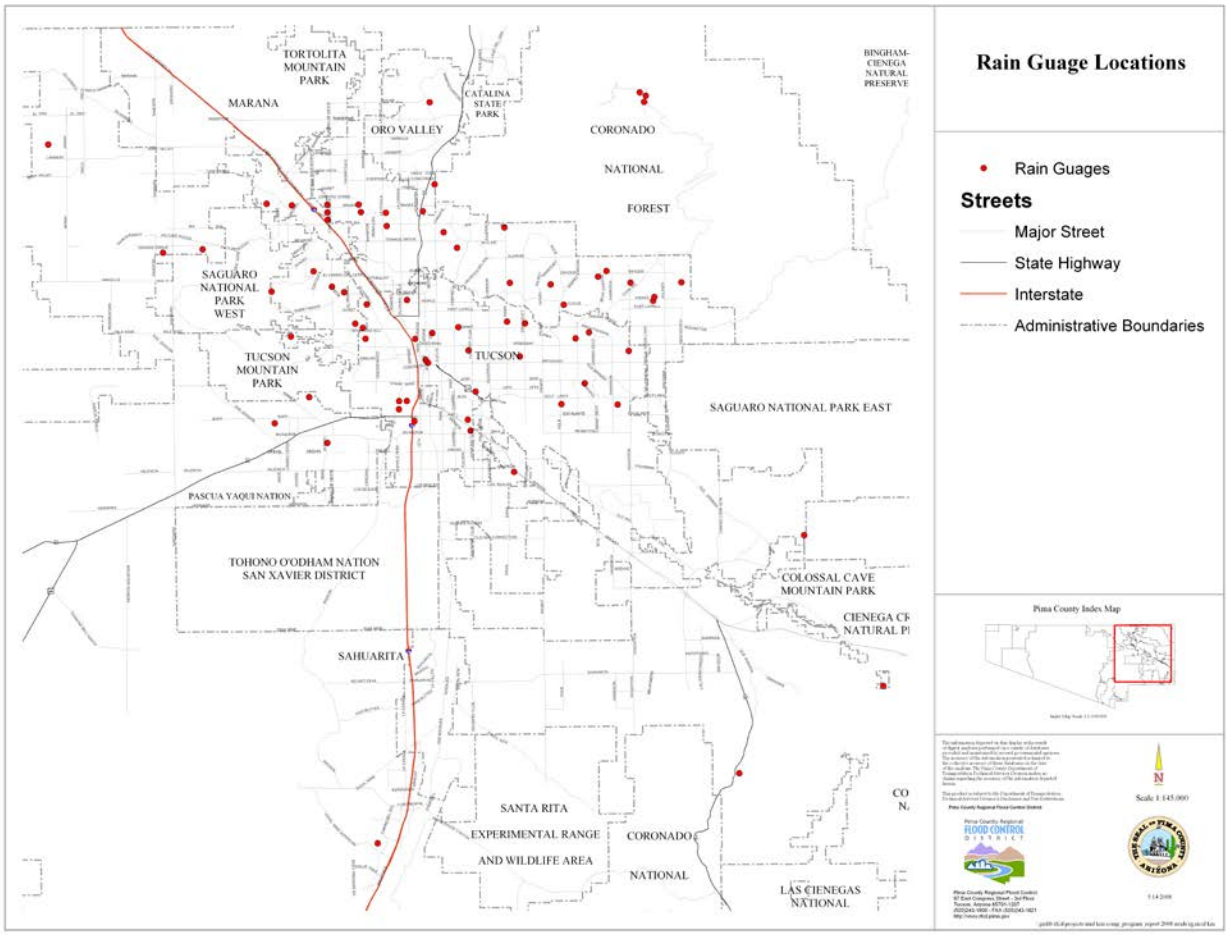


Figure 5 -2
Volunteer Rain Gauge Map

5.6.2 Flood Preparedness

The District, in cooperation with the Corps, ADWR, and other state and local agencies continues working to develop a statewide flood warning system. Plans for the system include installation of additional rainfall and stream gauges in the District's ALERT network and enhanced communication links both in Pima County and statewide. An Intergovernmental Agreement (IGA) was signed with ADWR in FY 2000/01 providing 10 additional precipitation sensors and four additional stream sensors which will be incorporated into the ALERT system.

In FY 1998/99, District staff embarked on a project with the Tucson-Pima County Office of Emergency Management to design a flood exercise for emergency response agencies. This flood exercise has been enacted in each successive year resulting in improved flood emergency preparedness for the community and allowing credits to be applied toward the District's rating in the CRS. District CRS activities have produced significant reductions in flood insurance premiums paid by Pima County property owners.

5.7 PUBLIC INFORMATION, EDUCATION AND PARTICIPATION PROGRAMS

District staff has developed a variety of brochures, presentations and displays that help educate the public and raise awareness of flood hazards within Pima County. Numerous free publications on flood and erosions hazards, floodplain regulations, and information on how to safely develop property within floodprone areas are available in the District's lobby and on their website. A recent publication on water harvesting has been added and a series of exhibits documenting historical flood events and highlighting flood safety information are on display near the customer service counter. Floodplain property owners are also notified annually and provided information on reducing flood risks.

Over the past six years, District staff has participated in the annual Earth Day for Kids and other events. Flood awareness, flood preparedness, and safety are major themes of these presentations. Groundwater recharge information, water quality and watershed protection topics are covered.

As part of its public safety campaign beginning in FY 1998/99 during summer monsoons, the District worked with local television stations to air three 30-second Public Service Announcements (PSAs) dealing with flash flooding. Prepared by the NWS, Office of Hydrology, the PSAs are made available to eight television stations in the Tucson area.

5.8 PHOTOGRAPHIC AND TOPOGRAPHIC MAPPING

Aerial photography is an essential tool used to fulfill many of the District's floodplain management directives. Considering that development is rising rapidly in Pima County, aerial photography must be updated regularly in order to ensure accuracy.

The District has contracted with the Pima Association of Governments (PAG) in a 4-phase mapping program for eastern Pima County. Phases I and II resulted in a complete set of 1" =1000' stereo aerial photography of eastern Pima County flown in the latter half of 2000, which updates the 1994 coverage.

Phases I, II, and III of PAG's mapping projects for eastern Pima County have been completed. The color imagery and topographic mapping obtained from these projects are being used extensively by the public and private sector businesses. The District is now proposing that the outlying populated communities of Pima County be included in Phase IV of this cooperative mapping effort. We expect the mapping to be completed in 2005.

The Town of Catalina, along with Pima County, is also seeing rapidly increasing development. In keeping with the pace, the Technical Services Division completed the topographic mapping product and integrated into the GIS database.

The Floodplain Management Section obtained a custom printing of a new color aerial photo mosaic, mounted on two wall size panels. Landiscore Incorporated created the "Tucson Mural" image from aerial photography they took in April 2001. At a scale of 1"=200', photographic coverage includes all of the metro area surrounding Tucson from Township 11S, Range 10E to Township 17S, Range 15E.

A digital terrain model and rectified aerial photographs were obtained for the area west of the Tucson Mountains, bound by Magee Road on the north, Mile Wide Road on the south, Saguaro

National Park on the east, and Avra Road to the west. Topographic data from this project will assist in identifying local floodplains and setting minimum finished floor elevations for new development.

5.9 GIS AND MAPPING – WORLDWIDE WEBSITE

In FY 1995/96, staff collaborated with the Technical Services Division to develop a series of worldwide webpages for the District. The goal of the project was to make floodplain management and flood control information more readily available to the public. Since its inception, expanded content areas have been developed and new functional areas added to the site.

The District's webpages provide information on a range of floodplain management topics, public safety issues, the District's CIP, and acquisition of floodprone parcels, among many other topical areas. Information on District governing, advisory boards, financial data and annual reports is also provided.

During FY1999/00, Pima County's Ordinance was added to the site permitting users to view regulatory and development requirements for properties within flood hazard areas. Demand for this information has been particularly strong from the development community, consulting engineers and, real estate agents. Ordinance language and maps showing Pima County's protected riparian habitat resources are also available.

In FY 2001/02, the District added a custom interactive map capability that allows online access to floodplain maps for unincorporated Pima County. The floodplain maps were developed utilizing the Pima County's parcel database, in conjunction with FEMA's FIRMs. The custom GIS maps allow users to search for specific parcels and display maps showing flood hazard information. The maps also feature panning and zooming functions allowing users to view floodplain information for neighborhood areas and larger regions within Pima County.

6.0 STRUCTURAL PROGRAMS

6.1 OVERVIEW

The District’s CIP includes both bond and non-bond projects. District CIP projects address regional flood and erosion control needs in incorporated and unincorporated areas of Pima County to areas with repetitive flood damages as well as reduce the potential for future flood damages. The District’s CIP for FY 2001/02 to FY 2005/06, focused on projects addressing flood and erosion control along the Santa Cruz River, urban infrastructure improvements to control drainage and repetitive flooding, as well as substantial floodprone land acquisition.

Funding

In FY 1996/97, Pima County voters authorized $21,500,000 in GO Bonds to fund 14 flood control improvement projects. In 2004, nine additional projects and FLAP funds were approved. The Non-Bond Program during the reporting period included 86 projects, which were funded using revenue derived from the District’s tax levy and other sources including state and federal funding.

The revenue from the District's tax levy and federal aid from the Corps provide the largest share of the annual District funding for CIP projects. Revenues from the District's property tax levy typically accounts for 83% of the funding for bond and non-bond flood control capital improvements. Other sources of revenue include GO bonds and state and federal grants.

In FY 2001/02, the District's Board of Directors approved an increase of five cents per hundred dollars of assessed property valuation. This increase to the tax levy has raised the annual amount of tax revenue to approximately $20 million and increased the funding for capital improvements. From FY 2001/02 to FY 2005/06, the District's tax levy revenue increased from $10 to almost $20 million annually.

Most of the federal aid received by the District comes from the Corps. Under the Corps' funding programs, the District pays for 35% of the cost for capital improvements as well as all rights-of-way and utility relocation costs. Since the Corps undertakes and directly pays for these projects, the District's reported expenditures do not include the federal match. However, the contribution from the Corps is significant and is therefore included in financial summaries of flood control capital improvements.

Projects

A complete listing of District CIP projects active between fiscal years 2001/02 and 2005/06 is provided in Table 6-1. Locations and status are shown on Figure 7. Many of the District's projects are constructed in phases due to the complexity of the project, total cost and funding sources. For example, the Arroyo Chico Flood Control Project is a $31.6 million project with the Corps, which is intended to relieve flooding along Arroyo Chico and tributary washes in central and downtown areas within the City of Tucson. The project has been divided into two phases: Phase I included the construction of the Randolph South Detention Basin, which was completed in 1997, at a construction cost of $7 million; and Phase II includes construction of four detention basins along the Arroyo Chico upstream of Park Avenue and a new storm drain system for High School Wash. This second phase is in final design and construction and is anticipated to begin in FY 2004/05.

Table 6-1
Capital Improvement Projects
FY 2001/02 – FY 2005/06

	Project Name	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
1	Agua Caliente Park Restoration (Corps)	93,873	66,870			
2	Agua Caliente Wash at Tanque Verde	2,666	2,105	1,064		
3	Agua Caliente Wash at Tanque Verde Road		47,588	40,334	51,760	34,852
4	Ajo - Curley School Detention Basin				15,056	125,750
5	Ajo - Second Avenue Bridge				23,160	102,076
6	Ajo Detention Basin Expansion	17,489	(1,862)			
7	Ajo Detention Basin Piping Improvement				354,528	(224,364)
8	Ajo Detention Basin Safety Improvement				2,709	

	Project Name	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
9	Ajo Detention Basin Wetlands (Corps)	550,367	74,572	694,938	155,988	246,694
10	Ajo Master Drainage				115,602	
11	Arroyo Chico Detention Basin (Corps)	768,508	126,023	306,277	168,376	1,227,342
12	Calle De Samuel Culvert			18	-	
13	Camino Verde Box Culvert			13,784	49,808	71,564
14	Cañada del Oro Flood Hazard Mitigation Project (FEMA Grant)				815,944	553,964
15	Cañada del Oro Floodplain Acquisitions			9,506,389	766,765	8,313
16	Cañada del Oro River Park, Thornydale to Magee				6,904	45,116
17	Canoa Ranch Flood Berm					419,803
18	Canoa Ranch Flood Control (FLAP)				34,501	36,305
19	Carmack Wash - Magee Road (Planning Only)				111,749	1,807
20	CDO Wash Bank Protection & Linear Park: Omni Golf Course					51,285
21	Cienega-Empirita Restoration (FLAP)				20,635	68,994
22	City of South Tucson Urban Drainage					141,548
23	Columbus Wash Phase II Drainage Improvement			3,197	784	2,124
24	Continental Vista Erosion Protection	138,953	156,994	483,760	8,437	191
25	Cortaro Farms Road Flood Mitigation Report				53,728	(1,778)
26	Cortaro Mesquite Bosque	36,746	46,811	91,426	82,424	19,238
27	Earp Wash Detention Basin - City of Tucson	78,007	87,921	39,776	156,974	1,739,335
28	El Rio Medio (Corps Study)		243,399	177,996	202,347	124,566
29	Fairview Limberlost Drainage Improvements	676,820	1,081,398	692		
30	Floodprone and Riparian Land Acquisition (2004 Authorization)				2,910	1,730,338
31	Floodprone Land Acquisition Program	1,606,959	2,562,387	1,487,641	802,190	1,567,722
32	Green Valley Abrego Drive Culvert				286,204	
33	Green Valley Drainageway #9	670,784	8,288	30,436	623	86
34	Green Valley Erosion Control				63,849	253
35	Green Valley Erosion Control (2004 Authorization)					126,462
36	Highland Wash					13,650
37	Holladay/Forrest Drainage Improvements	86,183	46,345	138,146	955,225	74,830
38	Juvenile Detention Center Drainage Improvement					138,079
39	La Cañada Dr.: Duval Mine Rd. to El Toro - Sahuarita				501,294	145

	Project Name	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
	Drainage Improvement					
40	Littletown Urban Drainage (Bond)					35,476
41	Lower Rillito: La Cholla to I-10			79,305	25,839	47,624
42	Lower Santa Cruz Levee	1,004,644	9,860	165,520	387	
43	Massingale Detention Basin		25,079	119,526	256,635	3,410
44	Massingale Detention Basin Spillway Repair				193,490	383,927
45	McClelland River Park	183,242	14,427	547		
46	Mission View Wash	20,445	59,824	47,155	71,305	260,792
47	North Alvernon Road Drainage Improvement					79,085
48	NRP: Marana High Plains Grant	525,349	81,531	30,675	-	
49	Old Nogales Highway at Franco Wash					18,249
50	Old Vail Connection at Franco Wash					11,739
51	Oro Valley Drainage Improvements (Mutterers Wash)	53,988	107,529		-	
52	Oro Valley Flood Control District Drainage					9,522
53	Pantano Wash Bank Protection Project				-	
54	Pascua Yaqui Tribe Black Wash Urban Drainage Flood Control Improvements				34,000	86,958
55	Poinsettia Drive/Oro Valley					136
56	Rillito Creek Bank Stabilization (Corps)	72,756	40,098	61,140	93	
57	Rillito Creek Environmental Restoration / El Rio Antigua (Corps Study)	505,217	414,810	117,250	385,015	2,890
58	Rillito River Linear Park, Alvernon to Craycroft				147,833	202,256
59	Rillito River Linear Park: Modifications adjacent to Casas Adobes Wash	1,550	1,697	10,443	70,863	
60	Rillito River: Campbell Avenue to Alvernon Way			2,764	3,733	43,307
61	Rillito/Swan Wetlands (Corps)	6,557	11,478	14,912	708,792	72,464
62	River Road/Camino Real Wash			12,471	353,014	1,661,055
63	Sahuarita Drainage Improvements				34,730	
64	San Xavier Estates Drainage Improvements				13,073	668
65	Santa Cruz Riverbank Protection in vicinity of Continental Ranch				4,145	7,642
66	Santa Cruz River Flood Control, Erosion Control and Linear Park, Ajo to 29th St				1,928	119
67	Santa Cruz River Study (Corps	(41,629)				

	Project Name	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
	Study)					
68	Santa Cruz River Valencia to Irvington		524			
69	Santa Cruz River, Grant Road to Camino del Cerro River Park				15,743	209,812
70	Santa Cruz River: Grant Road to Ft Lowell Road	5,531,064	807,881	104,806	89,204	84,328
71	Santa Cruz River: Paseo de Las Iglesias Restoration(Corps Study)	373,925	408,274	123,618	127,656	203,218
72	SEP - Crossroads V Land					82
73	SEP - Dybvig Acquisition					714,162
74	SEP - Granite Construction Co Land					215,950
75	SEP - Tucson Electric Parcel					620
76	Shannon Road: Palmdale Subdivision Drainage Improvements	2,748	90,411	496,346	167	
77	Silvercroft Wash Pedestrian Bridge				67,647	207,307
78	South Tucson Library Drainage Improvements			55,999	426,495	155,626
79	South Tucson:10th Avenue Drainage Improvements	275,000				
80	Tanque Verde Creek at Castle Rock	(35,445)				
81	Tanque Verde Creek Lakes of Castle Rock Erosion Protection (Bond)					14,063
82	Tohono O'odham Nation Urban Drainage				374,555	2,382
83	Tres Rios del Norte (Corps Study)	226,506	295,721	198,749	81,703	56,810
84	Tucson Diversion Channel	796		(142,321)	5,997	58,294
85	Tucson Diversion Channel Drainage Improvements	31			23,196	251,814
86	TV Creek: Sabino Canyon to Craycroft (Corps)	18,108	30,283	38,190	82,705	86,265
87	Urban Drainage			267,710	(266,559)	1,570,943
88	Urban Drainage Infrastructure Program				251	646
89	Urban Drainage Infrastructure Program (JOC)				5,554	453
90	Various Additional Mt Lemon Projects					954
	Grand Total	**$13,452,206**	**$6,948,268**	**$14,820,679**	**$9,149,663**	**$15,207,340**

(See map for project locations indicated by numbers)

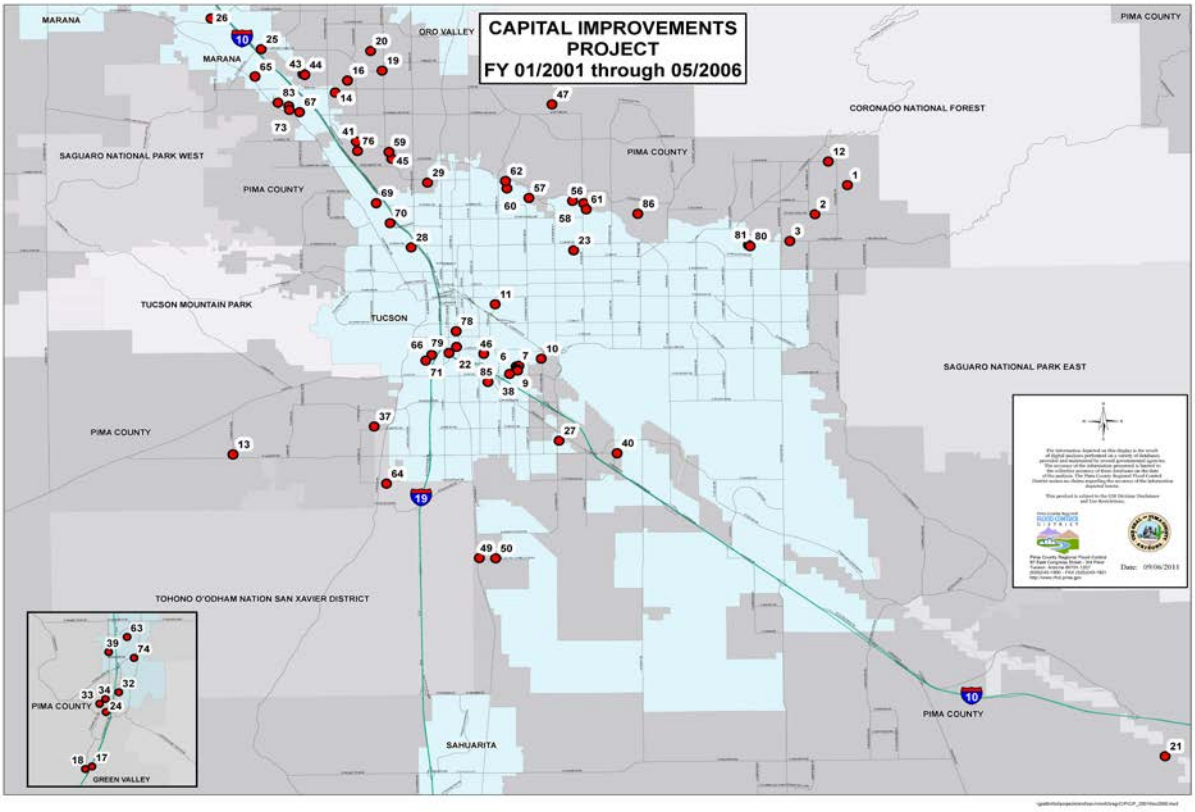


Figure 6-1
CIP Map

1997 Bond Projects

The 1997 Bond Program included eight flood control improvement projects that were active during the reporting period. Three of these were along the Santa Cruz River:

- FC-01 Bank Stabilization from Grant Road. to Ft. Lowell Road (completed 2002);
- FC-02 Santa Cruz River Valencia Road to Irvington Road, which has been combined with the Paseo de las Iglesias project; and
- FC-03 Lower Santa Cruz Flood Levee in Marana (completed 2001).

The remainder of the 1997 Bond Program identified various urban flood control improvements including projects for:

- FC-04 Mission View
- FC-07 Sahuarita Drainage Improvements (completed 2005)
- FC-08 Oro Valley (completed 2003)
- FC-09 Green Valley Drainageway 9 (completed 2002)
- FC-12 City of Tucson Fairview Limberlost (completed 2003)
- FC-13 Holladay/Forrest (Completed 2005)

2004 Bond Projects

The 2004 Bond Program approved by voters included urban drainage projects within unincorporated Pima County, City of South Tucson, the Pascua Yaqui Reservation, and the Tohono O'odham Nation. The voters also approved significant FLAP funds and the following river parks and flood control projects that were active during the reporting period:

- Santa Cruz River, Grant to Fort Lowell
- Pima County Urban Drainage Infrastructure Program:
  - Ajo Second Avenue
  - Curley School Detention Basin
  - Littletown Channel Improvements
  - Camino Verde Arch Culvert
  - South Tucson Library Drainage Improvements
- Rillito River Linear Park
- Santa Cruz River in vicinity of Continental Ranch
- Cañada del Oro River Park (Omni), Thornydale to Magee

Non-Bond Projects

The Non-Bond Program includes 86 projects that are funded using revenue derived from the District's tax levy and other sources including state and federal funding. Along the Santa Cruz River, the Non-Bond Program includes several reaches of bank protection, and Paseo de las Iglesias. The Non-Bond Program also includes the Ajo Detention Basin, Rillito River linear parks, and substantial acquisitions along the Cañada del Oro Wash.

Eight of the non-bond projects are being coordinated with the Corps with the majority of the funding and expenditures provided directly by the Corps. In reporting the District's CIP, the Corps' funding is reported to indicate the magnitude of the CIP effort and the amount of outside funding the District receives to augment local funding. Under the Corps' funding programs, the District must pay 50% of the cost for feasibility studies and 35% of the cost for capital improvements, as well as the cost for rights-of-way. Since the Corps undertakes these studies and construction projects, the District's expenditures do not include the federal match. In the past five years, the Corps has provided funding for the Arroyo Chico Project, and the District expended matching funds to increase the amount of the capital improvement budget for non-bond projects.

6.2 BANK STABILIZATION

The District constructs bank stabilization along major watercourses within Pima County where flood and erosion hazards threaten public and private development or infrastructure. Bank stabilization projects along major watercourses typically employ soil cement, which is a mixture of cement and local soil materials. Soil cement is a cost-effective flood and erosion control solution that has many of the strength characteristics of concrete. It also retains much of the appearance and textural quality of a natural riverbank that occurs in an arid landscape.

6.2.1 Santa Cruz Riverbank Stabilization, Grant Road to Ft. Lowell Road

The District, the NRCS, Pima County Wastewater Management Department, the University of Arizona, and Arizona Department of Transportation combined their efforts to accelerate the bank protection and mainline sewer interceptor construction project from Grant Road to Fort. Lowell Road.

This area was subject to extensive lateral bank erosion, which threatened the I-10/Miracle Mile interchange, the ADOT Maintenance Yard, the University of Arizona's Agricultural Resource Center, Tucson Electric's transmission line, Tucson Water's main lines, two petroleum pipelines, two Southwest Gas pipelines, and commercial radio towers. The bank protection project provided one and a half miles of soil cement bank protection along both banks of the Santa Cruz River and sufficient freeboard above the 100-year water surface to satisfy FEMA regulations.

Construction of this $9 million project began in November 2001 and was promptly completed by March 2003.

6.2.2 Other Watercourses

Using the May 1997 bond monies, the District began constructing improvements to reduce flood and erosion hazards along Drainageway #9 in Green Valley. The project features additional cells for the box culverts at Camino Portillo and Camino Holgado, as well as various types of bank protection based on adjacent improvements. Construction was completed in 2002.

The District also began the design of improvements, which reduce the flooding and erosion hazards in several areas for the three major washes that cross Green Valley's Continental Vista Subdivision.

6.3 DETENTION BASINS

Another structural flood control strategy used by the District is the construction of detention basins. Detention basins are facilities that allow for the temporary storage and measured release or metering out of floodwaters. Control of flows exiting a detention basin during a storm event significantly decrease downstream flood peaks, and thereby minimize the potential for inundation in downstream areas.

6.3.1 Tucson Drainage – Arroyo Chico/Tucson Arroyo Project

This multi-million dollar flood control project will protect residents and businesses in downtown Tucson by removing 220 residences and 1,000 parcels from the 100-year floodplain. Working in conjunction with the City of Tucson and the Corps, the District produced the Tucson Drainage Feasibility Study for reduction of flood damages on the Tucson Arroyo/Arroyo Chico watercourses. With the Corps' approval of the study, planning began for a series of detention basins located near Park Avenue and Arroyo Chico.

Phase I of this project involved the planning and construction of the Randolph South Detention Basin, which was completed in March 1996 at a cost of $13,000,000. Also referred to as the Randolph South Golf Course Detention Basin, the project combines a series of interconnected detention basins designed to blend in with the existing golf course, which is now called Dell

Urich Golf Course. The project received an Honorable Mention from the American Society of Civil Engineers for Outstanding Project of the Year.

Phase II of this project entailed a series of linked detention basins and other improvements near Park Avenue/Arroyo Chico. The project also called for the replacement of existing sections of storm drains near the High School Wash and the Tucson Arroyo confluence. Design of Phase II began in March 2001 and was completed in January 2004.

Construction of the Park Avenue Detention Basins included development of the detention basins, relocating the historical foot bridge, construction of pedestrian/animal walk-through drainage culverts, elevating the Highland Avenue roadway crossing, re-establishment and expansion of the paved pedestrian and bicycle pathway, replanting of native plants to establish riparian habitat within the basins, and two small community turf areas. The Tucson Unified School District's Cherry Field is a combination of flood basins and athletic fields with a new locker room/classroom/snack bar building, a new parking lot, a new maintenance building, new field lights, new dugouts, backstops, a batting cage, and built-in bleachers. The project also included construction of a storm drain under the Tucson High School football field south to the 3rd Avenue and 8th Street intersection, and enlarging the existing upstream channel from Campbell Avenue to Parkway Terrace with new roadway culvert crossings at Plummer, Olsen, and Norris avenues.

The Corps has started the final construction plans and specifications, and construction will begin in June 2007. Construction of the Tucson Drainage/Arroyo Chico project will take approximately 30 months. Total cost is $41,000,000.

6.3.2 Ajo Detention Basin

The Corps constructed the Ajo Detention Basin in the early 1960s to address a number of urban flooding problems. Using federal environmental restoration funds, the District, Pima County Wastewater Management and the Corps reconstructed the basin to incorporate environmental habitat restoration and flood control features. The restoration element of the project involved 20 acres of wetlands and construction of a seven-acre lake. The lake supports wildlife habitat and supplies water for irrigation needs at Kino Sports Park. Construction began in October 2000 and was substantially complete in 2002.

In 2003, the District started the design phase to make improvements to the Ed Pastor Kino Environmental Restoration Project in response to safety related concerns noted by Pima County Risk Management. Construction began in January 2004 and will be completed in July 2004.

6.3.3 Earp Wash Basin

Flood Control Engineering reviewed alternatives to relieve flooding from Earp Wash west of Alvernon Way. This watershed includes residential, mobile homes, businesses and Chaparral Middle School, which were flooded by an unusually heavy localized storm in the summer of 1999. Two detention basins were proposed to reduce the peak discharges from the Earp Wash and mitigate downstream flooding. This project was funded from the May 1997 bonds.

Localized summer monsoons in July 1999 created flow depths of 1.5 to 3.0 feet. Residents and businesses between Alvernon Way and Palo Verde Road suffered extensive damage especially from the July 26, 1999 event. This storm produced 1.5 inches of rain, which represented a 25-

year storm for this watershed. Flood damage to manufactured homes, storage buildings, heating and cooling systems, loss of access to residents and businesses, and disruption of electrical power resulted in approximately 50 residents requiring emergency shelter.

Recent subdivision developments upstream of Alvord Road have increased the level of flooding downstream along Earp Wash. The District designed and constructed a detention basin east of Alvernon Way to attenuate peak flows downstream of Alvord Road. The detention basin is situated on a 9.2-acre site located approximately one-half mile north of Valencia Road along the east side of Alvernon Way. The detention basin has reduced the peak flow from 415 cfs to 32.4 cfs and stores approximately 32.5 acre-feet of stormwater.

Figure 6-2
Earp Wash Before
Wildcat dumping of roofing materials and tires along small wash.

Figure 6-3
Earp Wash After

The project's construction costs were $1,601,111 with a total project cost of $2,400,000, which was funded via the 1997 GO Bonds (FC05), and the District's Tax Levy. Construction of the project began in January 2006 and was completed in May 2006.

6.3.4 Mission View Wash

Few drainage facilities exist in portions of the City of Tucson and the City of South Tucson located west of Park Avenue and South of 22nd Street. Most flows in this area are conveyed in the streets, which have insufficient capacity to contain only the smallest flows resulting in repeated flooding of adjacent commercial and residential properties. This project includes design and construction of a regional detention basins east of Park Avenue and south of 36th Street in order to mitigate downstream flooding. Preliminary design of the facility began in 2001 and funds for this project were authorized under the May 1997 Bond Election.

6.4 RIVER PARKS

In order to satisfy permit requirements that are part of the Federal Clean Water Act, the District plans and constructs river parks and related features in conjunction with its bank stabilization projects. River parks along the major watercourses have proven to be very popular, meeting important recreation and public open space needs region-wide.

In December 1996, the District completed the River Parks Master Plan to provide the specific guidance and planning needed to further the development of an interconnected river park system. The plan defines various levels of river park development appropriate to the surrounding area, details linkage solutions in areas where existing conditions make river park development difficult and includes design guidelines, budget and implementation information for the river parks.

6.4.1 Rillito/La Cholla River Park (Former McClelland property)

In December 2001, the District began construction of this project, which included river park improvements in an area east of La Cholla Boulevard, and new parking and equestrian staging areas. This project was completed in January 2002.

6.4.2 Rillito River Linear Park: Alvernon to Craycroft

In 1996, the Corps and the District completed soil cement bank protection along the Rillito River from Alvernon Way to Craycroft Road. In 2000, the Corps completed the paved pathway on the north bank, a decomposed granite pathway on the south bank, pedestrian bridges over major washes, and an irrigation supply system. The District's goal then was to enhance the existing vegetation along this reach and provide amenities in the form of additional paved trails, parking and staging areas to improve the quality of this segment of linear park. This portion of the project was funded by the 2004 Pima County Bond Package. While an extensive design concept report was completed prior to the reporting period, in 2006 the District hired a design consultant and Construction Manager at Risk to complete the development and construction of this project. Completion is anticipated in 2008.

6.4.3 Catalina

After the Aspen Fire and significant flooding along the Cañada del Oro Wash through Catalina in the summer of 2003, the District continued acquiring flood damaged and floodprone properties through FY 2004/05. By the end of the fiscal year, the vast majority of property owners (nearly 95%) who lived in homes situated within the floodway of the Cañada del Oro Wash between the Miraval Resort and Catalina State Park and constructed before flood control regulations were adopted, had voluntarily sold their properties to the District. Only four property owners in or immediately adjacent to the floodway elected not to sell to the District. The acquired properties consisted of 67 mostly contiguous parcels of land sold by 57 owners that totaled nearly 200 acres. Total acquisition and relocation costs for the properties exceeded $10 million dollars.

As the cleanup process and interim management of the acquired properties progressed during the year, significant efforts were made in the planning and development of a regional park, which was most appropriate for the area. An initial public meeting with the Catalina community in November 2004 indicated a strong desire for local input into the park's planning process; subsequently, the Catalina Regional Park Advisory Committee (CRPAC) was assembled by Supervisor Ann Day and a series of meetings were held to formulate a park plan. After numerous meetings and discussions, a concept park plan emphasizing the retention of open space and the cultural character of the area was conceived and presented to the community.

Working closely with the Natural Resources, Parks and Recreation Department, the District began the process of planning and designing the park in accordance with the plan developed by the CRPAC. This park was also integrated into a larger Pima County vision of completing the linear park along the Cañada del Oro Wash from the Pinal County line to the confluence with the Santa Cruz River.

6.4.4 Silvercroft Wash Pedestrian Bridge

The District has designed a pedestrian bridge across Silvercroft Wash to provide for continuous pedestrian, bicycle, and equestrian access along the west bank of the Santa Cruz River

extending access from Grant Road north to Silverbell Golf Course. Construction of the bridge began June 1, 2005 and took six months to complete.

6.5 DRAINAGEWAY AND DRAINAGE IMPROVEMENTS

6.5.1 Fairview/Limberlost Drainage Improvements

This is a joint project between the District and the City of Tucson providing a storm drain system that reduces flooding of single-family residences and manufactured homes west of Fairview Avenue and south of Wetmore Road. Construction began in April 2002 and was completed in December 2002. The total cost of the project was $1.89 million funded by the 1997 Bonds.

6.5.2 Green Valley Drainageway #9

In February 2002, the District completed construction improvements to reduce flood and erosion hazards along this drainageway. The project featured additional cells for the box culverts at Camino Portillo and Camino Holgado, and various types of bank protection based on adjacent improvements.

6.5.3 Continental Vista Erosion Protection

The District designed improvements that would reduce the flooding and erosion hazards in several areas for the three major washes that cross Green Valley's Continental Vista Subdivision. In addition, a new pedestrian bridge was provided at the Green Valley Recreation Center. Construction began in December 2003 and the project was completed in April 2004.

6.5.4 Holladay/Forrest Drainage Improvements

In order to eliminate repeated local flooding of homes in the neighborhood northwest of Mission and Drexel roads, the District designed a drainage swale and berm system to collect roadside and sheet flows, and a storm drain system to carry the floodwaters to an existing downstream channel. Construction of the project began February 14, 2005 and was substantially completed on June 16, 2005.

6.5.5 Shannon Road Drainage Improvements

The Palmdale Mobile Home subdivision was constructed in 1962. This subdivision has sustained long-standing drainage and ponding issues along Shannon Road creating a myriad of safety hazards and in general is a nuisance to the residents. The District designed a new concrete drainageway next to Shannon Road, which will alleviate the ponding problems. Construction began in October 2003, and the project was completed in February 2004.

6.5.6 Avra Valley Road Flood Control Improvements

The District designed and constructed a flood control berm and wall along the north side of Avra Valley Road to remove the Happy Acres subdivision from the regulatory floodplain. Construction began in November 2003 and was summarily completed within one month.

6.5.7 Gibson Arroyo in Ajo, Arizona

Ajo, Arizona, is an unincorporated community located within Pima County, Arizona, and lies approximately 160 miles west of Tucson. On July 29, 2003, the community of Ajo experienced a severe thunderstorm producing significant rainfall—approximately 1.3 inches of rain in just over one hour. Flooding occurred primarily along the Gibson Arroyo and tributaries located south of the arroyo.

The District quickly responded by providing immediate assistance with clean up and maintenance of streets, bridges, and portions of the Gibson Arroyo. In addition, the District immediately requested and received approval to enter a portion of the Gibson Arroyo owned by Phelps Dodge in order to dredge along an extensive stretch of the channel to provide increased hydraulic capacity.

As part of the District's response, a consultant was hired to provide an emergency evaluation and report on the flooding including new aerial-topographic mapping, a field review of the flooding, data collection, and preparation of preliminary hydrologic and hydraulic analyses. Accordingly, a Master Drainage Plan was developed to recommend specific approaches to address these floodprone areas including the Second Avenue Bridge and southern tributary flooding.

Second Avenue Bridge Replacement

Eyewitness accounts of the July 29, 2003 flood provided ample evidence that debris and sediment effectively blocked the conveyance area of the bridge and increased flooding conditions during the flood event. The bridge is a three-cell structure with a relatively low profile with two pier walls between the cells, which restrict the amount of debris and sediment that can freely pass downstream. Hydraulic modeling of the existing bridge reveals that if the opening were not clogged by debris and sediment the 100-year flow depth at the bridge would be reduced by about 1.3 feet. A new bridge can be designed to accommodate debris and sediment, thereby reducing flooding.

Curley School Site Detention Basin

The southern portion of Ajo contains several tributaries to the Gibson Arroyo. This area maintains poor drainage infrastructure such as private culvert systems that run under residential structures. The most effective way to alleviate the flooding problem is to reduce the peak discharge by storing the flood volume in a flood control basin. The former football field at Curley School is a prime location for the detention basin as this is a sizeable piece of property capable of sustaining a detention basin. Therefore, the planning has been initiated in concert with the renovation planned for Curley School.

6.5.8 Kino Hospital/Tucson Diversion Channel Drainage Improvements

In conjunction with improvements to the Kino Hospital complex, the District contributed to the channel drainage improvements through this vital community complex. Construction of drainage improvements began in May 2005 and completed in November 2005.

6.6 MAINTENANCE PROGRAM

6.6.1 Major Watercourse Flood Control Infrastructure Inspection Program

The Floodplain Management Division implemented a new inspection program during 2001. District staff routinely conducts physical field inspections of the District's drainage structures for all major watercourses and regional detention/retention basins. As part of this program, a consolidated resource base of all construction plans for bank protection, levees, grade control structures and detention/retention basins were compiled in the Floodplain Management Division. In addition, a cross-referenced filing system for inspection documentation was created with digital photographs for monitoring potential structural failure. Maintenance service requests were prepared for structural maintenance including appropriate permits from the Corps and notification to the U.S. Fish and Wildlife Service.

6.6.2 Operations Division

Maintenance Operations staff inspects, maintains, and repairs watercourses and associated improvements owned by or granted as easements to Pima County or the District. Through IGAs, the District maintains major watercourses, bank stabilization and other improvements within the City of Tucson, and the towns of Oro Valley and Marana. Tasks include repairing constructed improvements, removing sediment buildup, clearing vegetation and other debris, maintaining drainageway access roads, and grading channels to provide positive drainage.

7.0 NATURAL RESOURCES PROTECTION PROGRAM

7.1 ENVIRONMENTAL PROTECTION AND RESTORATION

7.1.1 Watercourse and Riparian Habitat Protection

The Board adopted the Watercourse and Riparian Habitat Protection and Mitigation Requirements as part of the Pima County Ordinance No. 1994-FC2 in July 1994. In July 1998, the Board amended Ordinance 1994-FC-2 so that mitigation requirements would apply to all properties within unincorporated Pima County, not just those entering the rezoning of subdivisions process. Other 1998 changes in the Ordinance language included: 1) disturbance to any hydro/mesoriparian habitat requires a mitigation plan to be approved by the Board; and 2) the trigger for mitigation requirements for xeroriparian classes was changed from 10 percent or one acre of disturbance of the mapped habitat (whichever was less) to any disturbance of 1/3 acre or more now requires a mitigation plan.

The 1998 Ordinance modifications were written to encourage property owners to avoid disturbing riparian areas, but it does not prohibit development within those areas. If a property owner demonstrates that avoidance of riparian habitat is not possible, then mitigation of affected habitat areas is mandated. Onsite mitigation is preferred since it helps provide continuity of habitat. Offsite mitigation and mitigation banking options are also available as alternative approaches to habitat conservation.

In 2005 the Board again amended the Ordinance to greatly expand the geographic coverage.

7.1.2 Riverine Environmental Restoration & Water Resources Projects

Environmental restoration capital improvement projects are intended to protect and/or enhance riparian habitat and promote groundwater recharge utilizing a combination of constructing structural improvements and planting native habitat

The following three environmental feasibility studies were conducted in partnership with the Corps on the Santa Cruz and Rillito River systems. Environmental and riparian objectives include developing a hydrogeomorphic model of the physical, biological and chemical function of wetlands. Existing conditions reports have been submitted to the Corps, and staff has conducted public group meetings for input in developing the design alternative. They include:

Santa Cruz River Park: Paseo de las Iglesias Restoration

Working in cooperation with the Corps, City of Tucson, and other stakeholders, the District began a feasibility study in the latter half of 2001 to evaluate the possibility of restoring the Santa Cruz River in an area from the Tohono O'odham San Xavier District to downtown Tucson. This study, estimated to cost $3.6 million, involved ecosystem restoration, flood control improvements, and river park trail development. The Corps obligated funds in the amount of 50 percent of the total cost for the study; and the District applied matching funds in both cash and in-kind services. Both the feasibility study results and community input favor a mesoriparian restoration approach. Methods considered to implement a project include a variety of water harvesting features, irrigation, riverbank terracing, and reestablishing native trees, shrubs and emergent wetland communities. Restoration alternatives are being analyzed for biologic, hydrologic, and economic costs and benefits.

After soliciting public input, Pima County endorsed the Corps' recommended plan, which used a mesoriparian dominant approach for environmental restoration along the riverbanks and terraces. The recommended alternative includes restored and irrigated mesquite-hackberry bosques on river terraces and floodplain. Watercourse areas will be bordered by mesquite and palo verde woodland and Sonoran desert scrub species. Riverbanks will be laid-back and/or terraced and planted. Water harvesting features will be incorporated. Vegetation will provide improved habitat for native wildlife and a pleasant setting for passive recreation. Numerous viable water sources are under consideration—1.7 MGD (1,900 acre feet/year) of irrigation will be needed to accomplish draft design goals. Recreational elements including the Juan Bautista National Historical Trail and other amenities are being planned. Design of the first phase began in FY 2004/05.

Rio Antiguo (Formerly Rillito Creek Environmental Restoration)

Working in cooperation with the Corps, the District began a feasibility study in the latter half of 2001 to evaluate the possibility of restoring the Rillito Creek between Campbell Boulevard and Craycroft Road. Funding was sought for the $26 million construction project under WRDA 2004 (Water Resources Development Act). Goals of the project include habitat restoration, restoration of natural river functions, stormwater harvesting, and providing passive recreational opportunities along the Rillito River between Craycroft Road and Campbell Avenue. The feasibility study phase began with a public meeting held in November 2001. The feasibility study report was completed in December 2003, which was then sent to Corps headquarters for final review. The project is on schedule for the WRDA 2004 Federal Funding schedule. The project design began in 2005 with construction anticipated in 2008.

Santa Cruz River: Tres Rios Restoration

The Tres Rios del Norte project is an environmental restoration study being conducted in cooperation with the Corps, the Town of Marana, and the City of Tucson. The project area covers 18 miles of the Santa Cruz River from Prince to Sanders roads in northern Pima County. This study, estimated to cost $5.8 million, will include ecosystem restoration; groundwater recharge, flood control improvements, and river park trail development. The Corps has obligated funds in the amount of 50 percent of the total cost for the study; and the City of Tucson, Town of Marana, and District working as local co-sponsors will collectively apply matching funds in both cash and in-kind services. Design began in FY 2004/05.

Proposed restoration efforts in this reach focus on capitalizing on available resources such as stormwater runoff and effluent discharged from the Ina Road and Roger Road wastewater treatment facilities to enhance riparian habitat. Other features include channel stabilization projects, grade control structures to increase infiltration and widen the extent of the shallow groundwater table, a trail system, and connections beneath I-10 and Silverbell Road to provide habitat connectivity between the Tucson Mountains, the Santa Cruz River and the Tortolita Fan area. This feasibility study is expected to be concluded early in 2006.

El Rio Medio

This study is a cooperative effort with the Corps, the District and the City of Tucson to provide ecosystem restoration; flood control improvements, river park trail development and water recharge development along the Santa Cruz River between Congress and Prince Road. This study in conjunction with the Paseo de las Iglesias and Tres Rio del Norte studies completes an environmental, hydrological and economic cost and benefit review of the Santa Cruz River within the Tucson metropolitan area. Methods being considered for possible implementation of the project include a variety of water harvesting features, irrigation, riverbank terracing, and reestablishment of native trees, shrubs, and riparian communities.

7.1.2 Cienega Creek Natural Preserve

In November 1986, the Board of Directors established the Cienega Creek Natural Preserve to conserve riparian habitat, reduce flood peaks, increase groundwater recharge, and prevent unwise and detrimental use of the Cienega Creek floodplain. Establishment of the 4,000-acre preserve marked Pima County's first major effort to protect riparian habitat.

Protection measures have included obtaining a Unique Waters designation and obtaining an In-stream Flow Water Right. The Unique Waters designation prevents the state from issuing permits that might degrade water quality. The In-stream Flow Water Right certificate, the fifth ever issued in the state of Arizona, provides a legal basis for the Board to defend the flows within the preserve from depletion or diversion. Over the past 20 years, the District and others have also worked to reduce the threats of depleting groundwater flows to the creek.

Passive restoration activities include fencing and management to eliminate cattle grazing within most of the preserve, as well as restricting motor vehicle access. In response to the reduced grazing and off-road vehicle activity, grassy and woody riparian vegetation along the stream has increased dramatically.

Active measures to repair land damaged by farming and grazing began in 1996 with the Pantano Jungle Project funded in part by the Arizona Game and Fish Department and the U. S. Fish and Wildlife Service. Specific objectives for the grant-funded portion include increasing the structure and species diversity of native vegetation for the benefit of neotropical migratory birds. In addition, several acres were revegetated as offsite mitigation for impacts to the Santa Cruz River as a result of soil-cement bank protection.

7.1.3 Bingham Cienega Natural Preserve

In 1989, the District acquired 285 acres of land along the San Pedro River to preserve a natural spring-fed marsh known as Bingham Cienega. The site also supports a deciduous woodland, mesquite bosques, riverine floodplain, and saguaro-dominated uplands. Because of the site's remote location and sensitive environment, the District entered into a long-term agreement with The Nature Conservancy to manage the property.

In the 1990s, a study of the soil and sub-surface hydrology of the site in order to conduct an active restoration project in 25 acres of abandoned agricultural fields was facilitated by obtaining grants from the Heritage Fund and Game and Fish Partners in Wildlife. An ADWR grant funded a major portion of the subsequent work which included planting saplings, dormant poles, giant sacaton plugs, and seeding native grasses and forbs (Figure 7-1).

The active restoration project was completed in the fall of 2001, and supplemental irrigation of the plantings ceased. Drought and falling groundwater levels have affected every plant community at the site but all elements continue to endure, with the exception of the open marsh area, which supported a cattail-dominated plant community when there was a surface or near-surface water level. The District has installed a small check dam, which successfully arrested erosion that threatened the marsh.

Wildfires in April of 2003 and 2005 were suppressed before they moved out of the open marsh adjacent to the road. Larger scale wildfire events occurred in January 2000 and May 2003, and were confined to the open cienega, the restoration fields, and the deciduous and mesquite forests north of the inholding and west of the river.

Perimeter fences were improved in 2003 and 2004. New quarterly photo point monitoring was initiated in 2004 to include sites at the springhead in the deciduous forest and the river channel east of the marsh and fields. Groundwater monitoring at the shallow wells installed as part of the earlier restoration study was abandoned due to fire damage to the PVC casings and groundwater level decline below casing depths. An existing deep well located at the southern part of the preserve was added to the monitoring protocol.

Adapting to the lack of surface water prompted research into historical rainfall, river flow, farming, and groundwater levels. New monitoring protocol was recommended. Concern about the wildland-urban interface between the preserve and the inholding and neighbors to the north determined that the existing fire response plan should be revised.

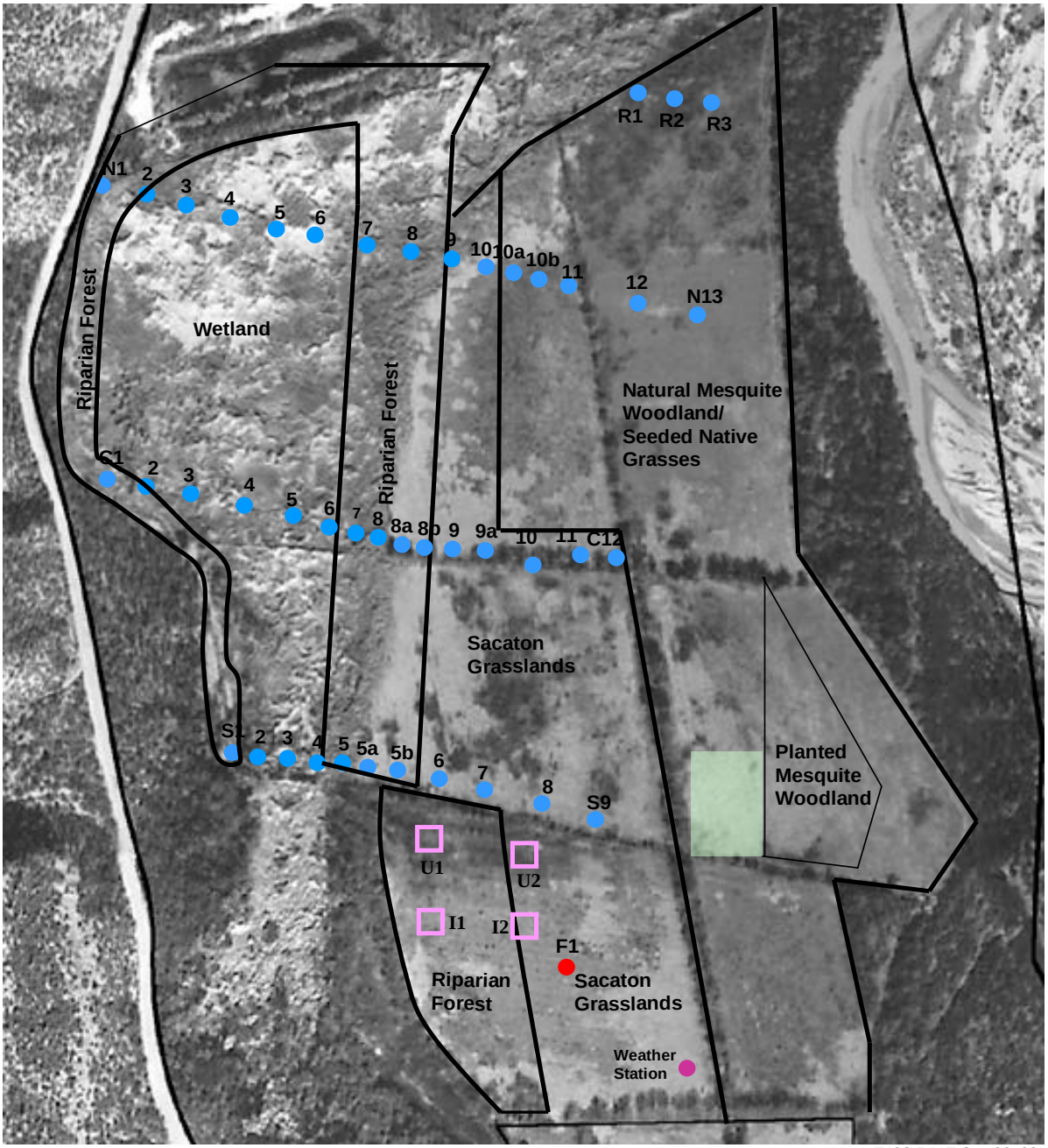


Photo Date July 1994

T18S R11E Sec 22, 23

BINGHAM CIENEGA NATURAL PRESERVE

RESTORATION PLANTING AREAS

S2 Wetland Monitor Well and Identifier

Boundary of Restored Plant Community

N

Thinned Mesquite Test Plot

Irrigation and Depth to Water Test Plot

U=Unirrigated; I = Irrigated

Figure 7-1
Bingham Cienega

7.1.4 Cortaro Mesquite Bosque

In 2000, the AWPF awarded $486,640 to the District as a grant to restore 80 acres of riparian habitat on the 100-year floodplain terrace of the Lower Santa Cruz River. The project is located adjacent to the Continental Ranch residential community within the Town of Marana. It will include restoration of approximately 73 acres of mesquite bosque and seven acres of subsurface marsh. Approximately 80 acres of riparian woodland and Sonoran desert scrub will be re-established on the Lower Santa Cruz River floodplain. Water harvesting from tributary washes will supplement irrigation for the vegetation. The project will allow passive recreation opportunities such as walking and birding, and serve as open space. A path will connect the project with the Town of Marana's river park path, which will be utilized as a portion of the historic Arizona Anza Trail and eventually connect to other regional trail systems. This project complements other efforts by Pima County Cultural Resources and the Town of Marana at the northern end of the Tucson Mountains to improve habitat conditions, highlight cultural history of the region, and maintain landscape connectivity in a rapidly urbanizing area. A design and planting plan was completed during FY 2002/03, construction is expected to begin in FY 2006/07.

7.1.5 Rillito/Swan Wetlands

The Rillito/Swan Wetlands is an ecosystem restoration project being conducted in partnership with the Corps. The Corps completed a feasibility study to determine the costs and benefits of enhancing approximately 60 acres of riparian habitat between Craycroft and Columbus roads along the Rillito River. This project will be partially funded by the Corps' Section 1135, Ecosystem Restoration Program. The Environmental Restoration Report is complete and staff is negotiating with the Corps for the design of the recommended alternative. Staff conducted a public workshop in an effort to obtain input into the selection of the final design alternative. Following the completion of the feasibility phase, the Board and the Corps signed a Project Cooperation Agreement in FY 2004/05. Construction is expected to begin in FY 2005/06.

7.1.6 Agua Caliente Aquatic Ecosystem Restoration Project

Working in partnership with the Corps, this feasibility project for the Agua Caliente Park will allow Pima County to study the tradeoffs, costs, and benefits of restoring ecosystems. Public education efforts have been coordinated with the Pima County Natural Resources, Parks and Recreation Department. District staff has established a website and newsletter.

7.1.7 Marana High Plains Effluent Recharge Project

This project is a two-year pilot to investigate the feasibility of using treated effluent to enhance riparian habitat while recharging the groundwater aquifer. Construction of the facility has been completed and recharge is expected to begin in summer 2003. The water diverted from the Santa Cruz River nourishes the densest riparian patch along this effluent-dominated river. Additional plantings of native trees and shrubs adjacent to the recharge basins broaden and extend the riparian corridor. This multipurpose project is partially funded by the AWPF and is operated in conjunction with the Town of Marana and the Cortaro-Marana Irrigation District. Stormwater harvesting is also used on the site along with fencing to restrict cattle.

A total of 364 AF has been recharged at the facility since operations began in February 2003. Biological studies have noted significant habitat improvement to the site due to the successful

establishment and recruitment of native plants and shrubs. The District is looking at opportunities to expand the facility in cooperation with the Town of Marana.

7.1.8 Lower Santa Cruz Recharge Project

The Lower Santa Cruz Recharge Project is a State Demonstration Recharge Project developed jointly by the District, Central Arizona Water Conservation District, and the Town of Marana. The facility consists of approximately 30 acres of spreading basins that are used to recharge up to 30,000 acre-feet of CAP water into the underlying aquifer. Approximately 37,758 acre-feet were recharged during FY 2003/04.

7.2 SONORAN DESERT CONSERVATION PLAN

The SDCP is a large scale concept in regional planning, initiated by the Board directing the Pima County Administrator to develop a science-based program to address conservation of both cultural and natural resources in eastern Pima County. The plan contains six major elements: 1) ranch conservation; 2) historic and cultural preservation; 3) riparian restoration, 4) mountain parks, 5) conservation of habitat, biological resources and ecological corridors; and 6) critical and sensitive habitat preservation. Since December 1998, District staff has been closely involved with the riparian restoration element of the plan and has supported the work of the Science and Technical Advisory Team (STAT) and other Pima County Departments.

The most important result of the SDCP so far is the effect on Pima County's Comprehensive Land Use Plan (Plan). The Plan aligns conservation of biological resources in unincorporated Pima County with urban service areas, a big step toward "no adverse impact" floodplain management. The plan also provides a framework for concurrent financing of public infrastructure with development. This is described more fully in the next section.

Much of the new information concerning floodplain resources is summarized in the September 2000 report *"Riparian Protection, Management, and Restoration*" (available through the SDCP website http://www.co.pima.az.us/cmo/sdcp/index.html.)

Since then, a number of important new studies have been completed. One example is the recent report entitled, *"Biological Values of the West Branch of the Santa Cruz River*" also available on the website. This report helped to inspire the Board to protect one of the most biological intact areas along the Santa Cruz floodplain in Tucson. The study *"Pima County Riparian Habitat Mitigation Ordinance: Effectiveness Review"* will guide upcoming revisions to our floodplain management regulations.

These reports and over 100 others are available for downloading from the website. They include the following:

- *Focus on Riparian Areas*
- *Environmental Restoration in Pima County in Cooperation with the U. S. Army Corps of Engineers*
- *Impacts of Unregulated Development at the Community Level*
- *Floodplain Primer*
- *Survey and Assessment, Altar Valley*
- *Altar Valley Watershed Protection*

- *Comprehensive Plan Update (Adopted)*
- *Climate Variability in Pima County*
- *Riparian Protection*
- *Riparian Mapping*
- *Prioritization of Streams*
- *Pima County Watersheds/Watercourses*
- *Cienega Creek Storm Flow Frequency Analysis*
- *Historic Occurrence of Native Fish in Pima County*
- *Suitability Analysis and Representation Goals for Cottonwood-Willow Forest Habitat*
- *SDCP Riparian Vegetation Mapping and Classification*
- *Aquatic Vertebrate Conservation in Pima County*
- *Bingham Cienega Restoration*
- *Water Resources and the SDCP*

7.3 COMPREHENSIVE LAND USE PLAN ADOPTION

With the adoption of the Pima County Land Use Comprehensive Plan (Plan) in December 2001, the Board has taken steps to protect the environment and reduce the costs to local taxpayers for future floodplain management. The Plan anticipates continued growth within the human population of Pima County. It establishes growth areas and other land use categories that complement the biological reserve defined through the SDCP.

The Plan targets riparian and aquatic areas for the highest levels of protection. Analysis of habitat loss and land ownership indicates that while riparian habitat is the most imperiled of the local communities, it is the least protected.

Because of their biological value, the Plan has been revised to protect mesoriparian and riparian linkage areas at a minimum of 95 percent of their current level, including all riparian linkage areas delineated by the Science Team within the biological reserve, and all washes with a discharge value of 250 cubic feet per second or larger, regardless of whether such wash is located within or outside the biological reserve boundaries. These standards will reduce the development pressure on floodplains.

New rezonings and specific plan requests approved within the CLS will need to conform to the intensity that is appropriate to protect biological resources. Specific percentages for conservation of non-riparian areas will require leaving 30 to 80 percent of the land in a natural condition. These standards will encourage a more compact urban footprint.

Plans for development located within floodplains that propose densities or uses consistent with urban land use intensity categories shall be regarded as inconsistent with Pima County policy, unless the development plan removes the area from flooding hazards. Other new policies reduce the placement of utilities, including sewers, along watercourses, and discourage the development of areas remote from urban infrastructure.

7.4 WATER RESOURCES AND RECHARGE PROJECTS

The District's Water Resources Program includes efforts directed toward managing both surface water and groundwater to benefit the health of the land and the sustainability of human enterprise.

The District joined with PAG and Pima County Technical Services to complete the first detailed and comprehensive inventory of the streams and springs in Pima County. Our studies found that Pima County, outside the Tohono O'odham Nation, has 66 perennial stream reaches and 120 intermittent stream reaches on 57 different streams. At least 257 springs exist in Pima County. Many reaches of stream flow and some of the largest springs were not previously identified by any agency.

In addition, one hundred potential shallow groundwater sites were identified, and 23 have their boundaries delineated. Shallow groundwater areas support lush riparian environments and are exceptionally sensitive to groundwater pollution.

These new data are available on the SDCP Map Guide website located at: http://www.dot.co.pima.az.us/cmo/sdcpmaps/ and in Pima County's GIS library. In addition, the District and PAG completed a number of scientific and water policy reports about groundwater and surface water resources in Pima County. The following reports are available to the public at:
http://www.co.pima.az.us/cmo/sdcp/index.html.

- *Springs in Pima County*
- *GIS Coverage's of Perennial Streams, Intermittent Streams and Areas of Shallow Groundwater*
- *Water Usage Along Selected Streams in Pima County*
- *Groundwater Level Changes in the Tanque Verde Valley*
- *Water Resources in Pima County*
- *Lower Cienega Source Water*
- *Bingham Cienega Source Water*

The District lacks authority to make most water resource decisions, but Pima County does have authority to regulate land use over much of the landscape. The District continues to work with other Pima County departments, the ADWR, and federal agencies to connect land use and land management decisions with water resource impact analysis. Specific areas of collaboration have included the golf course ordinance, evaluation of the plan amendments, and input into ADWR management plans.

The District can maximize the potential for effective solutions to landscape-level issues, including water supply issues, through partnerships with other agencies and citizens. Staff has developed and disseminated educational materials about the location and relationship between aquifer and riparian areas to the general public and other agencies. Staff participates or funds collaborative research and education efforts with federal land management agencies and local communities. For instance, the District has sponsored development of groundwater models for remote areas having groundwater-dependent riparian areas, such as Arivaca, the San Pedro River, and the lower Cienega basin. In addition, the District monitors the availability of surface water and groundwater at various sensitive riparian areas in Pima County, and prepares annual summaries of total runoff along gauged streams.

7.4.1 Northwest Replenishment Program/ Lower Santa Cruz Replenishment Project

In 1996, the District completed an interagency evaluation of the feasibility of recharge along the

Santa Cruz River downstream of Avra Valley Road and the Cañada del Oro Wash downstream of Catalina State Park. The feasibility study resulted in the eventual construction of the Lower Santa Cruz Replenishment Project. This project is a joint effort to store CAP water underground for eventual recovery during times of drought.

The project consists of three groundwater recharge basins, located south of the main channel of the Santa Cruz River that is used to recharge CAP Water Replenishment Project (Figure 9). Earthen materials excavated from the basins were put to use in the Lower Santa Cruz River Levee Project, described in the Structural Programs section, thus resulting in a cost savings to the public. Construction of the basins was completed in May 2000, and the Central Arizona Water Conservation District began recharging CAP water in June 2000 for a variety of clients including the Arizona Water Banking Authority, Metropolitan Water District, and Town of Marana. During the reporting period a total of approximately 50,000 AFY of CAP water was recharged into 30 acres of these very permeable basins making it one of the most productive facilities in Arizona.

Figure 7-2
Lower Santa Cruz Replenishment Project

7.4.2 Northwest Replenishment Program/Marana High Plains Effluent Recharge Project

The Marana High Plains Effluent Recharge project is a two-year pilot project to investigate the feasibility of using treated effluent to enhance riparian habitat while recharging the groundwater aquifer. Treated effluent is diverted from the Santa Cruz River and recharged in a series of constructed basins. The pilot project will evaluate issues such as the rate of recharge,

groundwater quality effects, and enhancing the value of the facility with vegetated side slopes and basin bottoms (Figure 10).

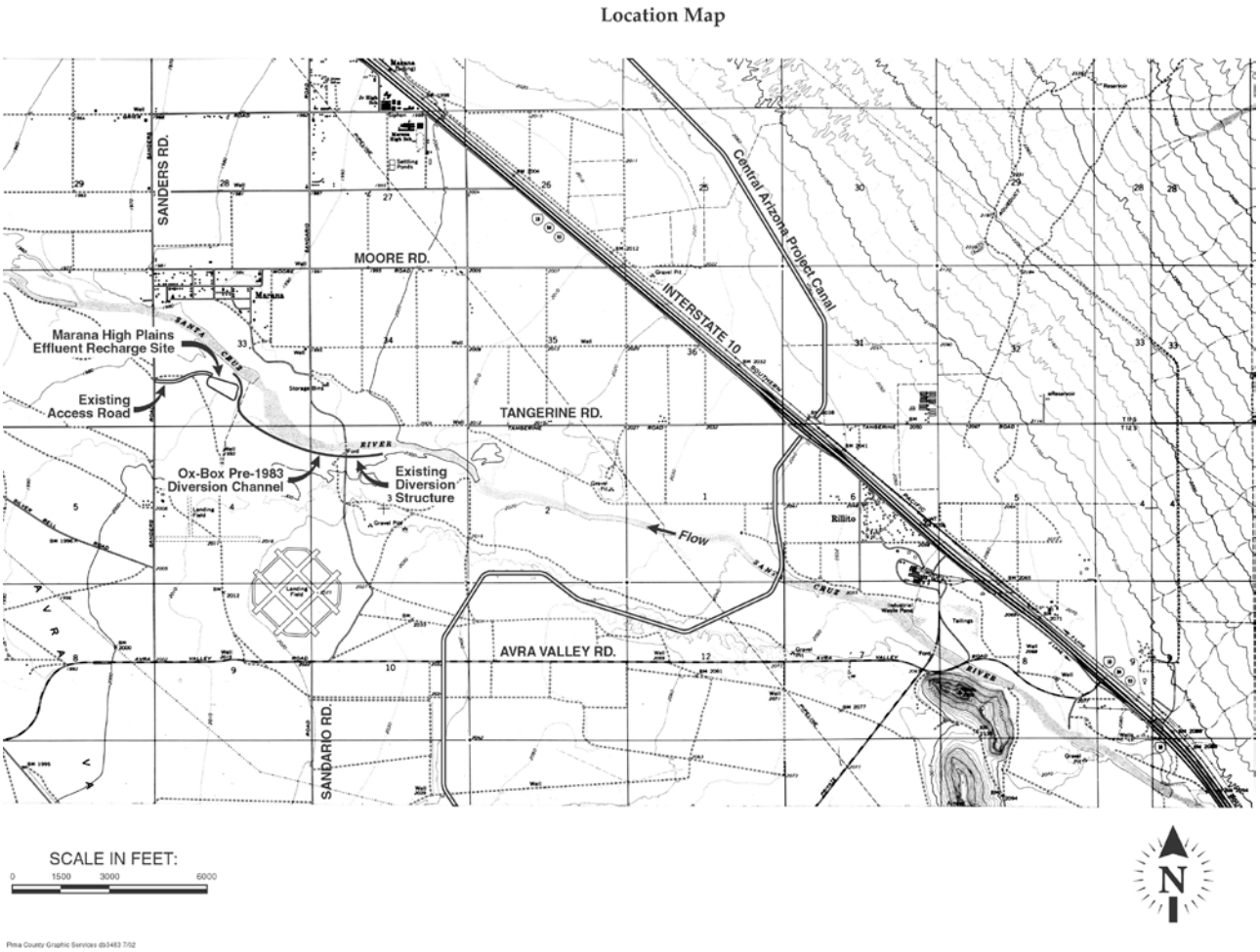


Figure 7-3
Marana High Plains Effluent Recharge Project

Located near Sanders Road and the Santa Cruz River, the project has received all of the necessary permits. Construction began in 2001. The District, the AWPF and the U.S. Bureau of Reclamation funded the project. The District utilizes a Surface Water Right owned by Cortaro-Marana Irrigation District to divert effluent from the Santa Cruz River; such flows maintain a lush riparian area along an “oxbow channel” of the river. The AWPF grant was used to inventory wildlife and vegetation, and funded trail construction, and vegetation in and around the recharge basins.

Modifications made to correct initial operational problems and enhance the facility’s recharge capacity may allow up to 750 AFY. Noticeable environmental benefits were observed as a result of the additional vegetation and wetland environment including breeding activity by residential songbirds and use by migratory waterfowl and wading birds. Establishment of vegetation at the site appears successful.

8.0 COMPREHENSIVE PLAN SUMMARY

8.1 OVERVIEW OF COMPREHENSIVE PLAN

Floodplain management and flood protection is a continuous process requiring a comprehensive plan to provide flood hazard mitigation, address existing needs in developed areas, plan for future development and changes in land uses, and provide an emergency response and preparedness plan to respond to severe weather, flooding and other natural disasters. Long-range planning is a necessary part of the District's Comprehensive Plan for floodplain management strategies, resource protection, and CIP. Additionally, regular updates and review of the Comprehensive Plan are necessary to address changes in environmental regulations, manmade and natural impacts to watersheds, and Pima County's dynamic and growing community.

8.2 HAZARD MITIGATION PLANNING

Natural hazard mitigation planning is the process of identifying and implementing programs to reduce or eliminate the loss of life and property damage that may result from natural hazards such as floods. Through the Disaster Mitigation Act of 2000, the federal government has established criteria for state and local governments to develop a community-based hazard mitigation plan for natural and manmade disasters. Pima County with assistance from the Arizona Department of Emergency Management has begun the development of a Hazard Mitigation Plan for Pima County. The basic steps for mitigation planning include:

Organization of Resources. For state and local communities, the initial focus is gathering resources including identifying the necessary technical expertise and community agencies in hazard mitigation.

Assess Risks. The characteristics and potential consequences of natural hazards need to be identified and the potential risks and damages estimated.

Develop a Mitigation Plan. Prioritize structural and nonstructural approaches to avoid or minimize damages by development of a formalized hazard mitigation plan.

Implementation of the Plan and Monitoring of Progress. Implementing specific mitigation projects, adopt land use regulations to avoid future hazards, periodic evaluation of the effectiveness of the plan, and project improvements and regulations in reducing or avoid damages and loss from natural hazards.

The Department of Emergency Services and Homeland Security is the agency responsible for coordination with local, state and federal agencies for hazard mitigation and emergency response. The District provides the local technical expertise for flood and erosion hazards.

Through annual reports and 5-year comprehensive reports, the District has been formally reporting and evaluating flood hazard mitigation strategies. These hazard mitigation strategies include floodplain management, riparian habitat protection, and capital flood control improvements.

8.3 FLOODPLAIN MANAGEMENT

Floodplain Management includes; nonstructural programs such as regulation of land use in

floodplains, developing watershed plans, river and basin management studies to improve delineation of flood hazards and avoid future risks, expanding public information on flood hazards, and floodprone land acquisitions.

8.3.1 Floodplain Regulations

The Ordinance provides goals and objectives to guide nonstructural activities, regulate land use and reduce the potential for future flood damages. The Ordinance and associated standards and guidance are reviewed annually for consistency with land development patterns and the NFIP.

8.3.2 Watershed Planning

Watershed plans are developed as strategic floodplain management tools to address the unique physical and hydrological characteristics of each watershed and major watercourse. The goal of watershed planning is to control the impact of urbanization within each watershed to minimize the potential for increased flood peaks and erosion that may occur with urbanization. Watershed plans provide guidance for acquisition of floodprone land, protection of natural conditions in upper watersheds, urban stormwater controls and detention, riparian protection, and control of soil erosion. Watershed studies include topographic and aerial mapping to allow for improved identification of flood and erosion risks and to prepare improved floodplain mapping. Within an urbanizing watershed, basin management plans address the need for stormwater detention to minimize the potential for increased flood peaks with development.

8.3.3 Public Education and Technical Assistance

Public education and awareness of potential severe storm and flood hazards is a vital component of the floodplain management strategy. Education includes addressing issues on the NFIP for homeowners and businesses; educating professionals in real estate, building and manufactured housing; and educating citizens on storm and flood hazards including safety tips about entering flooded washes.

8.3.4 Floodprone Land Acquisition

Since 1984, the District has been active in acquiring floodprone land in upper watershed areas such as Cienega Creek and the Santa Cruz River at Canoa as a means of preserving the natural floodplain functions including over-bank floodwater storage. This program also provides a cost effective means of removing residents from floodprone areas where structural flood control options are not available. The program also provides protection of riparian areas and natural stream channels that controls the potential for erosion hazards within watershed areas.

8.4 RESOURCE PROTECTION

8.4.1 Riparian Habitat

Protection of riparian habitat is an essential part of managing watersheds and watercourses. Vegetation along stream banks and in the over-bank serve to slow the flow of floodwaters, encourages the infiltration of floodwaters, and stabilizes soil against erosion. The vegetation in the over-bank allows floodwaters to spread out over the floodplain reducing the velocity of the floodwaters and detain floodwaters as over-bank flood storage reducing the peak flood flow.

Reducing the flow velocity and providing a wide expanse for floodwaters to spread encourages infiltration and ground water recharge, which also reduces the volume of floodwaters and peak flood flow. Bank erosion and soil loss are critical concerns in Pima County; most property damage occurs from erosion rather than flooding. Preserving the natural vegetation stabilizes the stream banks and reduces the velocity of the floodwaters, which further aids in preventing erosion. Furthermore, riparian preservation retains nutrient recharge, as well as contaminant dispersal and attenuation functions of floodplains. Protection of the natural riparian habitat is provided through land use regulations in the Ordinance, acquisition of floodprone land to preserve riparian habitat, erosion control and the management of water resources to maintain the environment necessary for healthy riparian vegetation.

8.4.2 Sonoran Desert Conservation Plan

Since the adoption of the SDCP and the CLS, important riparian areas along the major watercourses and other streams have been identified for protection. The District has assisted in the development of updated riparian mapping of Pima County's resources and will be revising the Ordinance to be aligned with the land use plan of the SDCP and the updated and more detailed mapping of riparian habitat in Pima County. In concert with the SDCP, the District will continue technical studies and evaluations of habitat and water resources for the preservation and protection of riparian habitat in Pima County.

8.5 CAPITAL IMPROVEMENTS

Since inception, the District has commenced with capital improvements to reduce the risk of flood damages to private and public improvements and to respond to flood damages in a manner that provides flood mitigation as well as restoration. The District develops both an annual and a 5-year CIP to address the needs within each jurisdiction or geographical area. Projects are developed based on recommendations from watershed plans and available funding. Variables considered in developing the District's CIP include:

- *Previous Flood Damages.* Priority is given to projects that address previous flood damages and areas subject to repetitive flooding and drainage problems.

- *Regional Programs*. The District's projects and programs are regional and provide countywide benefits.

- *Downstream Benefits.* The District has developed master management plans for the major watercourses and watersheds to reduce the hazards from flooding and erosion that also consider downstream impacts and benefits.

- *Evolving Urban Edge*. The District has constructed a significant amount of bank stabilization and flood control improvements in existing urban and growth areas. The projects in existing urban areas mitigate flooding problems in areas developed prior to floodplain management regulations and improvements in the growth areas, and evolving urban edge, help the communities avoid future flood hazards.

8.6 SUMMARIES AND CONCLUDING STATEMENT

Flood hazard mitigation, floodplain management, resource protection and flood control capital

improvements are the fundamental elements of the District's Comprehensive Program. Implementation of the Comprehensive Program and each element will be evaluated on an annual basis. An annual report, the 5-Year Comprehensive Report and the District's annual CRS re-certification are all a part of this annual evaluation and review with ADWR and FEMA. Annually, the District will review:

- The Comprehensive Program,
- Any floods that occurred during the previous year,
- Land use changes and regional needs,
- Progress made towards implementing each element of the plan, and
- Plan goals and objectives, and implementation requirements.

As appropriate to address changing conditions and community needs, new projects and programs will be established and implemented.