



2006/2007 ANNUAL REPORT

REGIONAL FLOOD CONTROL DISTRICT

PIMA COUNTY, ARIZONA

PIMA COUNTY ADMINISTRATION 2006/2007

Board of Directors (Board of Supervisors)

Richard Elías, Chairman, District 5
Ann Day, District 1
Ramón Valadez, District 2
Sharon Bronson, District 3
Raymond J. Carroll, District 4

General Manager (County Administrator)

C.H. Huckelberry

Deputy County Administrator —Public Works

John M. Bernal

Director and Chief Engineer

Suzanne Shields

Deputy Director

Chris Cawein

Flood Control District Advisory Committee

Ralph Stein, Town of Oro Valley
Paul Cella, District 4
Jennifer Christelman, Town of Marana
Mike Zeller, Chair, City of Tucson
Andy Dinauer, City of Tucson
Scott Altherr, District 3
Linwood Smith, City of Tucson
Richard Salaz, City of South Tucson
Phil Pearthree, 2nd Vice Chair, District 5
Doug Shakel, Vice Chair, District 1
Vacant, District 2
Martin Roush, Town of Sahuarita

MESSAGE

FROM THE **CHIEF ENGINEER**

On behalf of the Board of Directors of the Pima County Regional Flood Control District, I am pleased to present the District's Annual Report for Fiscal Year 2006/07. The following are a few of this year's highlights, which are described in more detail later in this report:

In 2006, the Arizona Legislature provided flood control district boards with additional compliance enforcement powers by authorizing them to implement administrative hearing processes and to adopt and enforce civil penalties. As a result, the District began revising the Floodplain and Erosion Hazard Management Ordinance to allow these new tools to be used in Pima County.

Fiscal Year 2006/07 set rainfall records in June, July and August with 8.6 inches of rainfall at the Tucson International Airport, two inches more than the average. Intense rainfall from Tropical Storm Emilia produced a flood event on July 31, 2006, creating record stream flows in Tucson, Arizona. Flood Emergency Management Agency (FEMA) approved \$8 million in funding for emergency work and repair projects from the flood damage. By the end of the fiscal year, \$3 million in emergency work was completed.

The District initiated one its largest planning efforts since its inception—the Lee Moore Wash Basin Management Study. It is a comprehensive study that estimates flood and erosion potential for the watershed, maps watercourses, identifies existing and potential drainage problems and develops preliminary solutions and standards for sound floodplain and stormwater management. The total project watershed is approximately 213 square miles including parts of unincorporated Pima County, the City of Tucson, Town of Sahuarita, Coronado National Forest and Arizona State Land.

Our Capital Improvement Program continues to be successful, resulting in the completion of flood safety projects such as the River Road/Camino Real Wash Drainage Improvements and the San Xavier Estates Drainage Improvements as well as other significant projects.

I hope you'll take some time to read this year's annual report, which details the record rainfalls, CIP projects and other District activities. This year's report and all previous annual reports are also available at: www.rfcd.pima.gov.



Suzanne Shields, P.E.
Chief Engineer and Director
Regional Flood Control District



REGIONAL FLOOD CONTROL DISTRICT

PIMA COUNTY, ARIZONA

Vision

The District will continue to be a leader in providing quality flood protection and floodplain management services within Pima County.

Mission

The Pima County Regional Flood Control District is a regional agency whose 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 resources.



OVERVIEW OF THE DISTRICT

Establishment of the District

To comply with federal law, the State of Arizona passed the Floodplain Management Act of 1973. This act authorized Arizona counties to adopt rules and regulations concerning management of floodplain areas. The Arizona State Legislature subsequently authorized flood control districts to levy taxes on real property to finance district operating expenses. The Pima County Board of Supervisors, which sits as the Pima County Flood Control District Board of Directors (Board), organized the Pima County Flood Control District (District) on June 5, 1978. The District first became operational on July 1, 1978.

Provisions of state legislation also allow incorporated cities and towns within Pima County to undertake their own floodplain management duties and regulatory functions. In Pima County, the incorporated areas of the City of Tucson, the Town of Oro Valley, the Town of Marana, and the Town of Sahuarita have elected to assume floodplain management duties in their respective jurisdictions. The District is responsible for floodplain management activities for the remainder of unincorporated Pima County (with the exception of national forests, parks, monuments, and Indian Nations) and for the City of South Tucson.



Pantano Crumble



Goals and Objectives

The goals and objectives of the District represent both flood control and resource protection. The District's approach varies from traditional flood control approaches because of a multi-benefit public philosophy. The District recognizes that it is necessary and desirable to maintain a balanced relationship between human communities and the land and resources that sustain them. To that end, the following policy goals and objectives have been adopted by the Board as part of the District's Floodplain and Erosion Hazard Management Ordinance:



- Minimize flood and erosion damages.
- Meet or exceed state and federal requirements relating to floodplain management.
- Establish minimum flood protection elevations and damage protection requirements for structures and other types of development.
- Regulate encroachment and building development within areas subject to flooding or erosion.
- Encourage the most effective expenditures of public money for flood control projects.
- Minimize damage to public facilities, utilities and streets located in regulatory floodplain and erosion hazard areas.
- Help maintain a stable tax base by providing for the protection of regulatory flood and erosion hazard areas.
- Inform the public when property is in a regulatory floodplain or erosion hazard area.
- Encourage the preservation of natural washes and enhancement of the riverine environment.
- Emphasize overall watershed management.
- Protect, preserve and enhance groundwater recharge.

District Organization

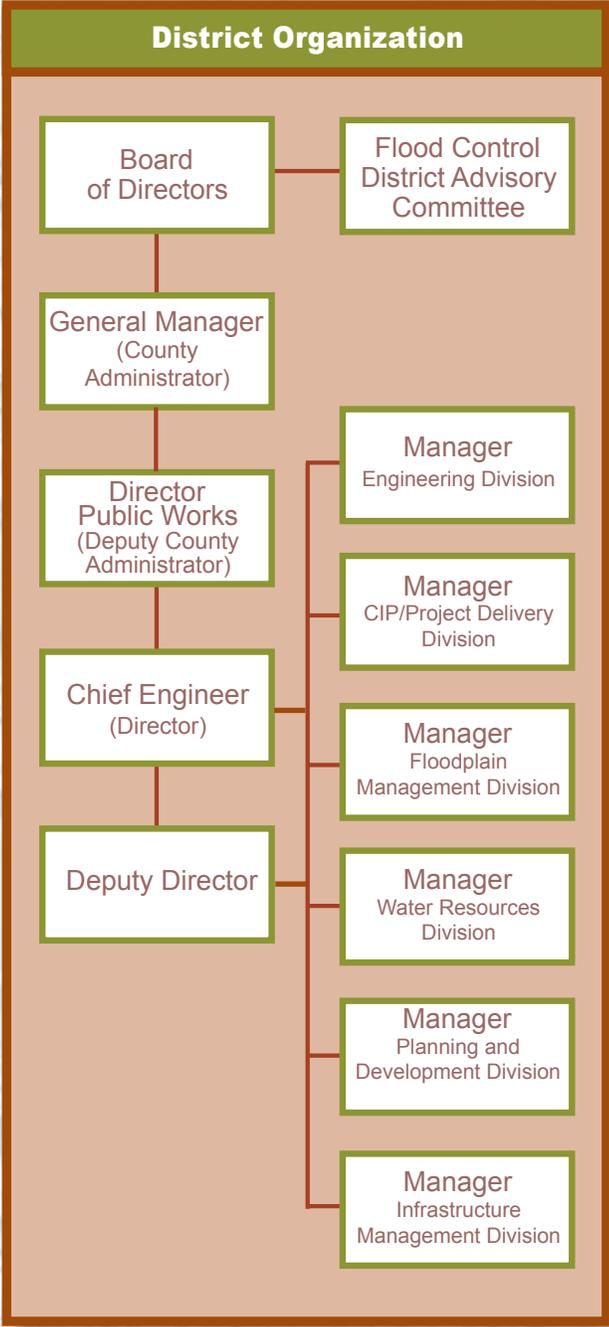
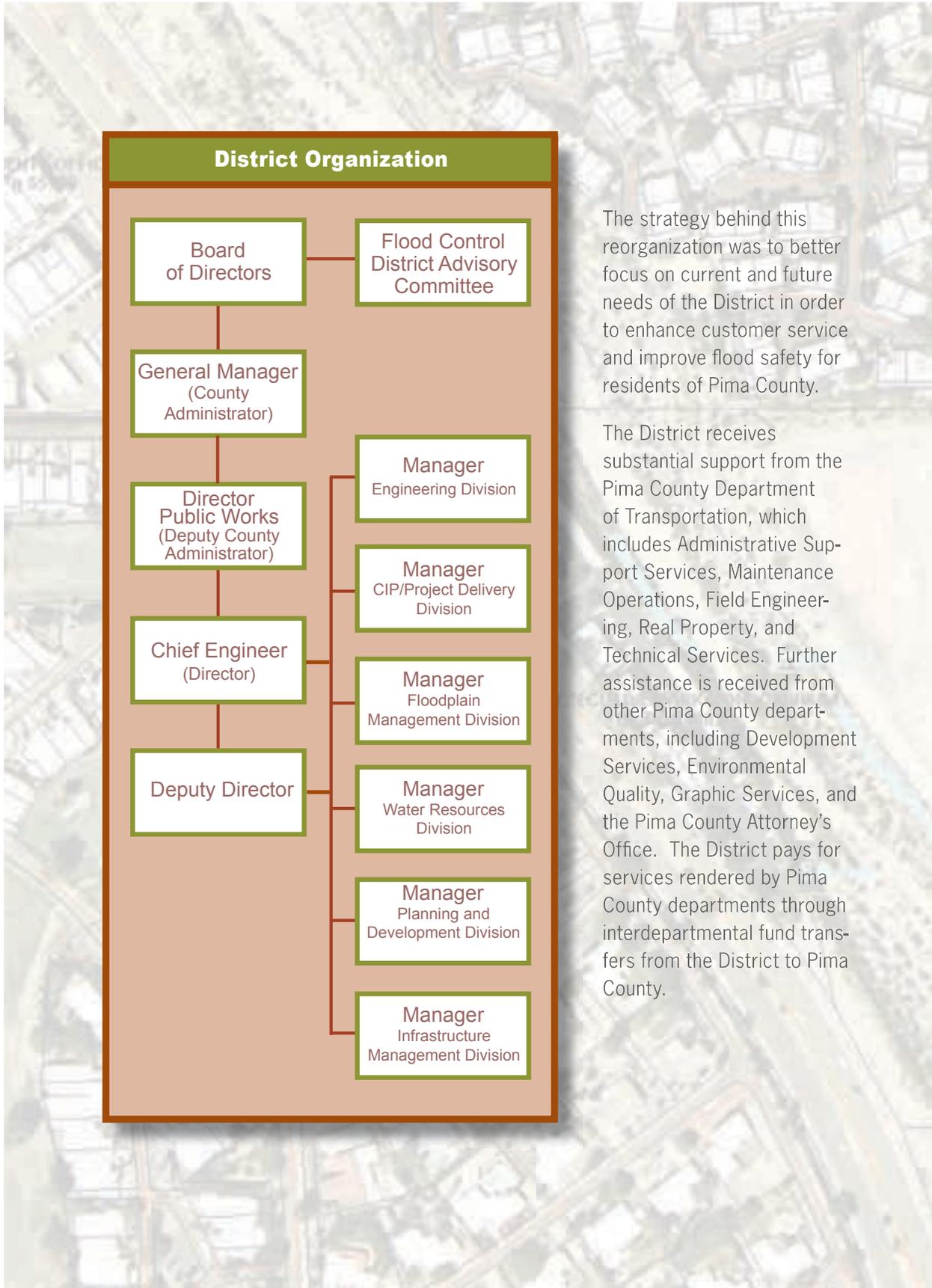


The District's Capital Improvement Program (CIP) has been expanding—growing from \$13,451,516 in Fiscal Year 2001/02 to \$18,659,200 in Fiscal Year 2006/07 to meet the needs for flood control improvements. Project design and construction can now be accomplished using a variety of methods, including the traditional design, bid and build as well as Job Order Contracts and Construction Manager at Risk.

In Fiscal Year 2006/07, the CIP/Project Delivery Division was added to better meet the District's needs for delivering projects on time and within budget.

In Fiscal Year 2006/07, 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 six divisions. Burgeoning urban growth and development as well as expanding infrastructure inventory necessitated dividing the former functions of the Floodplain Management Division into the following three divisions

- The Planning and Development Division's primary objectives are to progressively plan and ensure flood safety for developing areas throughout Pima County. It conducts detailed studies of drainage basins to determine appropriate flood protection strategies and performs comprehensive reviews of all proposed land development projects.
- The Infrastructure Management Division's 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 staff and the public.
- The Floodplain Management Division's focus is the review and permitting of individual lot development, high quality customer service for flood protection, drainage complaint response, and overall enforcement of the Floodplain and Erosion Hazard Management Ordinance.



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.

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.



DISTRICT ACTIVITIES

Service Programs

Customer Service

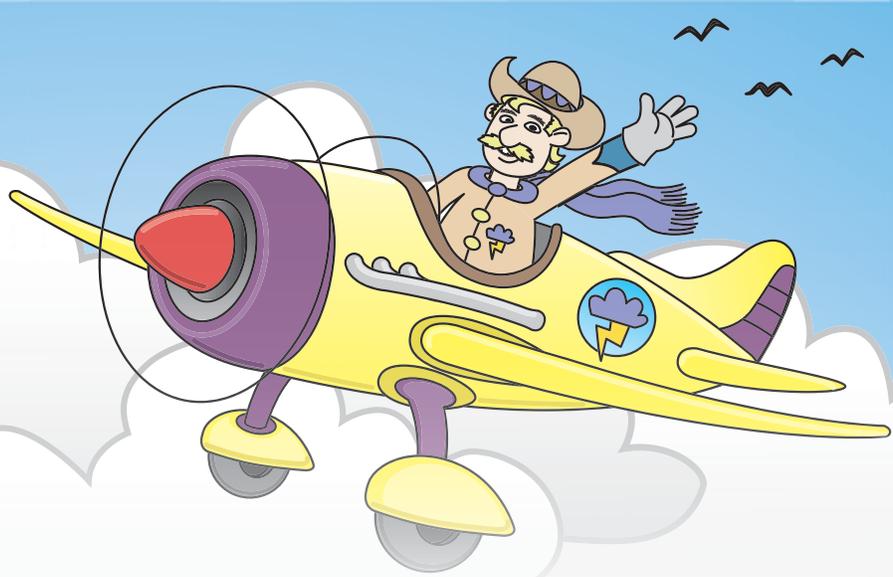
The District encourages residents to become familiar with flood related hazards that may impact their properties or properties they are considering for purchase. In order to assist in this research, the District maintains an abundant amount of information at our customer service counter which includes detailed hydrologic and hydraulic studies, historic and current aerial photos, and topographic information.

Residents may discuss any of this information with a hydrologist who can provide additional information regarding any limitations on the property or requirements that may apply for proposed improvements due to the extent of flooding or erosion hazards.

Floodplain Management also provides an efficient Special Flood Hazard Area Identification service. This information is conveniently provided in writing via a Flood Hazard Information Sheet. This form identifies whether the property is located in or out of the federal floodplain and/or floodway and whether the structure is in or out of the floodplain. This form can be completed at our customer service counter or submitted via fax.

Another customer service component provided by Floodplain Management includes performing field investigations in response to constituent complaints and concerns. Through these field investigations, Floodplain Management is able to ensure that property owners are not being adversely affected by improvements that they or their neighbors construct, and can provide advice regarding improvements that can be made in order to minimize the potential of flood damage. If non-compliant improvements are observed, Floodplain Management personnel will proceed with compliance enforcement actions.

*Rillito Site 2
Sediment Removal*



Public Outreach

District staff strives to develop and utilize the most current and accurate flood hazard information possible to promote the public welfare of all residents in Pima County. One of the most difficult parts of that process is conveying the significant risk of flood hazards in a desert environment. Let's face it—most people don't equate deserts with flooding. The District works diligently to ensure that the public has the information and tools available to know what hazards affect them.

One example is our *Flood Safety Fun Page* located on our website. Our spokesperson is Hank Highwater, who can be found telling kids about flood safety in the **Bear Essentials** newspaper and on SunTran buses. Hank has his own special place on our website—visit him at the **High Ground Ranch**.

The District encourages you to review the outreach information on our website to become better informed about flood hazards in Pima County.



Sheriff
Hank Highwater

Floodplain Management

The goal of Floodplain Management is to provide floodplain information, establish development requirements and provide assistance to Pima County residents with drainage questions in order to minimize the threat to life and property from flooding and erosion hazards. This includes ensuring that any new development within the floodplain is safe from flooding and erosion hazards, does not adversely impact adjacent properties, and maintains the integrity of the floodplain.

Another important goal is protecting natural resources within floodprone areas. Floodplains typically support important riparian ecosystems and associated wildlife. These riparian areas are also important for their role in mitigating flood hazards by maintaining stable flood flow conditions, providing natural erosion control, as well as promoting recharge into underground aquifers. As such, it is beneficial to all residents of Pima County that these critical resources are protected and maintained.

One of the ways Floodplain Management accomplishes these goals is by implementing floodplain regulations contained in the Pima County Floodplain and Erosion Hazard Management Ordinance (Ordinance). The Ordinance was developed to conform to the Na-



*Failed bank protection.
Pantano Wash, 2006.*

tional Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA), which allows residents of Pima County to purchase flood insurance. In addition, the Ordinance includes provisions regarding the construction of buildings and other man-made structures within regulatory floodplains. The Ordinance applies only to those areas prone to flooding where the peak discharge is 100 cubic feet per second or greater, or prone to sheet flooding. In other areas, the Ordinance does not apply; however, other ordinances may apply, such as the Grading Ordinance administered by the Development Services Department.

Floodplain and Erosion Hazard Management Ordinance Revisions

In 2006, the Arizona Legislature provided flood control district boards with additional compliance enforcement powers by authorizing them to implement administrative hearing processes and to adopt and enforce civil penalties. Subsequently, the District began revising the Floodplain and Erosion Hazard Management Ordinance to allow these new tools to be used in Pima County. In addition to updating the enforcement provisions, the District is revising some other portions of the rule to make them more clear and specific. Once the District has the ability to pursue compliance through the administrative hearing process, it will become very important to ensure that the requirements are as clear and explicit as possible so that property owners, hearing officers, and the general public can easily determine if new development complies with the performance standards established by the Ordinance.



ALERT

One of our most used services is the District's Automated Local Evaluation in Real Time (ALERT) system, which has been providing precipitation and stream flow data from a series of gauges located throughout Pima County since 1981. The ALERT system was established as part of a three-way agreement with the National Weather Service (NWS), the Arizona Department of Water Resources and the District. The ALERT system was initially installed to provide advanced warning of potential flood flows on the upper Cañada del Oro watershed as a result of the Golder Dam breach. Federal and state financial assistance combined with funding from the District has allowed us to expand the ALERT system. The system of gauges now covers most of the large watersheds in eastern Pima County and currently includes 93 precipitation gauges, 36 stream gauges, and four weather sites.

The precipitation gauges relay rainfall or snowfall amounts and intensities, stream gauges measure the depth of flow in streams, and weather stations provide precipitation information plus wind speed, temperature, relative humidity and barometric pressure. This network of automated gauges transmits data in real time using radio telemetry transmitted directly to the District, NWS, and the Arizona Department of Water Resources office in Phoenix. The NWS uses this data to produce flash flood watches and warnings and to ground-truth radar estimates of precipitation. District personnel utilize the information to assist emergency response agencies including the Pima County Department of Transportation's Maintenance Operations staff during storm events. Data generated by these sites may be viewed at the District's ***website***.



In fiscal year 2006/07, large rainfall events resulted in flooding of residential areas. This required close communication with the Pima County Office of Emergency Management, the Pima County Department of Transportation and the NWS.

The event that generated the greatest amounts of flooding occurred on July 31, 2006. In the early morning hours, a strong storm system moved from northwest to southeast across the Santa Catalina and Rincon Mountains. Rillito Creek, Rincon Creek, Sabino Creek and many small washes in the Santa Catalina foothills exceeded their capacity resulting in flooding of residential areas and roads. Rain gauges and Doppler radar indicated rainfall amounts of one to two inches in the Tucson valley and up to four to six inches in the mountains during a seven hour period. The highest intensity measured by an ALERT gauge was 2.32 inches in one hour. Stream flow on Rillito Creek at Dodge Boulevard was the highest flow measured since 1988.

The maximum depth at this location was approximately 11.5 feet with a discharge of 39,000 cubic feet per second, exceeding the regulatory 100-year flood peak discharge.

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. It also aided in their response to emergency situations where people and infrastructure were in danger from the rising floodwaters.

Internal Business Processes

Drainage Maintenance Process Improvement

The Department of Transportation Maintenance Operations and the newly formed District Infrastructure Management divisions work together to resolve drainage problems affecting public infrastructure and safety. There are many causes for drainage problems that staff diligently works toward understanding and correcting to ultimately prevent future problems.

Process improvements enable better communication between staff. Multi-departmental meetings are held to resolve large watershed or development problems, to improve drainage design and construction methods for development projects, and to reduce maintenance needs and costs. These ongoing discussions integrate small projects, which remedy the smaller problems, with capital improvement projects.



Unified Hydrology

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 GIS system. The results will provide data to allow proper drainage infrastructure sizing that will

meet each 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.

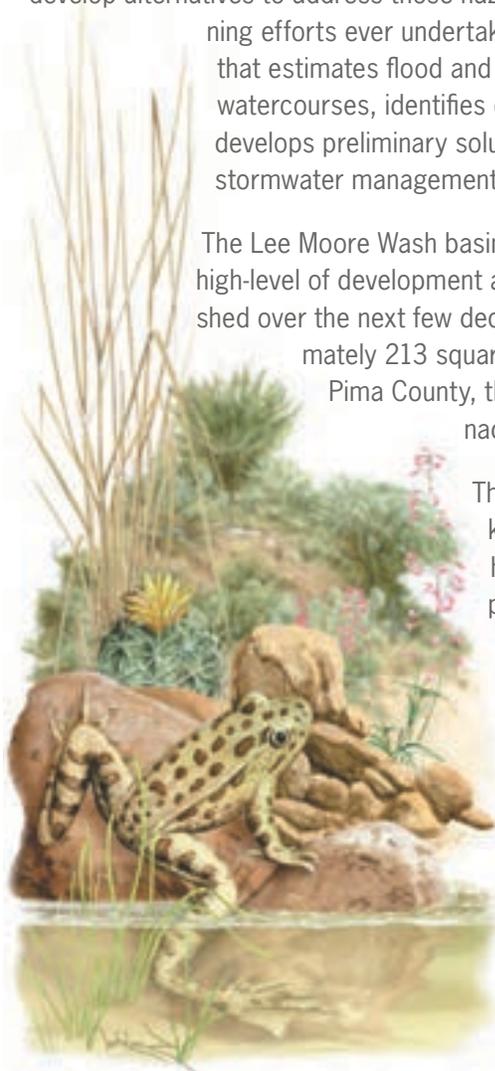
Management Programs

Lee Moore Wash Basin Management Study

In Fiscal Year 2006/07, the District initiated the Lee Moore Wash Basin Management Study to identify the regulatory flood and erosion hazards within the watershed and develop alternatives to address those hazards. This study, one of the largest planning efforts ever undertaken by the District, is a comprehensive study that estimates flood and erosion potential for the watershed, maps watercourses, identifies existing and potential future problems and develops preliminary solutions and standards for sound floodplain and stormwater management.

The Lee Moore Wash basin was selected for this study based on the high-level of development activity that is expected to occur in this watershed over the next few decades. The total project watershed is approximately 213 square miles including parts of unincorporated Pima County, the City of Tucson, Town of Sahuarita, Coronado National Forest and Arizona State Land.

The initial effort is to collect data, identify known flood hazards including researching historical flooding data and current land use plans, map floodplains, and solicit input from stakeholders and the public.





Lee Moore Wash Basin

Based on this information, the District will formulate a floodplain management approach consisting of structural and non-structural alternative solutions to reduce or eliminate flood erosion hazards. Those alternatives will be further compared and evaluated to develop a set of preferred alternatives.

The comprehensive basin management study is expected to be completed in the spring of 2009. Upon completion, the District will have a comprehensive assessment of flood and erosion hazards and, once implemented, the strategies in the plan are expected to reduce damage to property, loss of life and flooding.

Water Resources and Riparian Habitat Management

This program consists of activities intended to prevent flooding, erosion and riparian habitat loss by means other than constructing structural flood control improvements. The District promotes and supports regional riparian restoration with the intent that it will result in some level of recovery of natural functions within riverine systems.



Franco Wash

National Flood Insurance Program

Rillito Break

Map Modernization Process Improvement

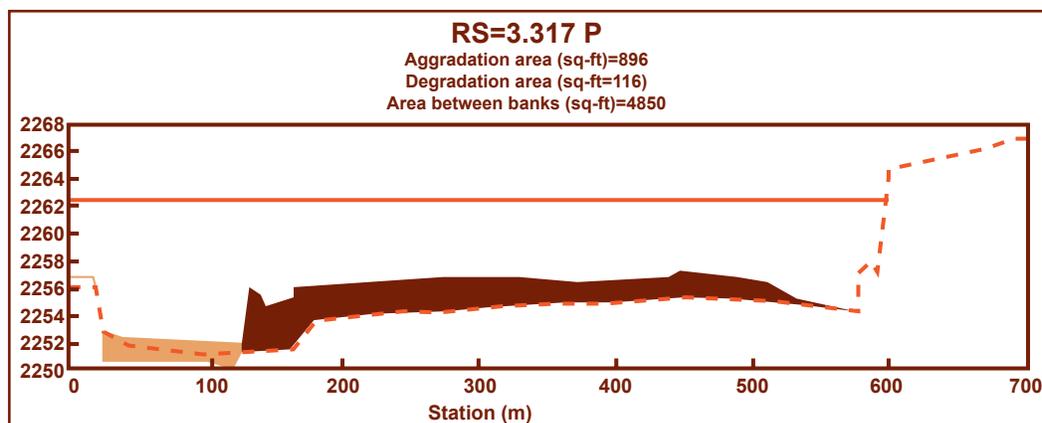
The national response to flood disasters prior to 1968 was to install dams, levees, and seawalls; however, this approach failed to reduce flood losses. Flood victims were often left destitute because homeowners and business owners could not purchase private flood insurance. Insurers were either unwilling to offer flood insurance or premiums were too costly—consequently flood disaster costs and the number of flood victims continued to increase over time.

In 1968, Congress created the National Flood Insurance Program (NFIP). The three basic goals of the program are to:

1) Promote sound floodplain management to reduce future flood losses, 2) Provide flood insurance, and 3) Identify flood hazards and create floodplain mapping. The Federal Emergency Management Agency (FEMA) identifies flood hazard areas by publishing Flood Insurance Rate Maps (FIRMs). The first FIRMs for Pima County became effective in 1983, however, revising the FIRMs to accurately reflect flood hazards is a never-ending process. Watercourses move and watersheds change over time, so the maps are continually being updated.

Levees are critical drainage structures that require more frequent inspection. In fiscal year 2006/07, the District began a re-study of the Canada Del Oro Wash which included levees in Oro Valley. These levees are the oldest levees maintained by the District. In a cooperative effort, the District shared this information with Oro Valley and worked with them in designing a linear park that will be constructed within the levee right-of-way.

Post Flood Study on Rillito Creek Cross Section



Accurate floodplain mapping generated by the District's participation in the NFIP provides other benefits to Pima County. On July 31, 2006, the flood of record occurred on the Rillito Creek. The peak discharge flood for that event was 39,000 cfs, which was larger than FEMA's 100-year peak discharge value of 32,000 cfs. The District modified the computer model associated with the floodplain mapping to incorporate changes in channel geometry, which quickly identified maintenance needs.

COMMUNITY RATING SYSTEM

Pima County—a Class 5 Community

The Community Rating System (CRS) is a voluntary incentive program that rates local communities participating in the National Flood Insurance Program (NFIP) who are interested in providing a level of service that is above and beyond the minimum NFIP requirements. Participating communities receive discounted flood insurance premium rates in increments of 5%. For example, a Class 1 community, whose service is considerably above the minimum, would receive a 45% premium discount, while a Class 9 community whose service is nominally above the minimum would receive a 5% discount. A Class 10 community only meets the minimum level required, which in turn would not receive a discount for their constituents.

The CRS classes for local communities are based on 18 activities and are organized under four categories: 1) Public Information, 2) Mapping and Regulations, 3) Flood Damage Reduction, and 4) Flood Preparedness.



In fiscal year 2006/07, in recognition of the excellent level of floodplain management performed by the District, Pima County was upgraded to a Class 5 Community, which yields a 25% discount in flood insurance premiums for our constituents. Pima County ranks in the top 3% of all participating communities nationwide.

Floodprone Land Acquisition Program



Before Flood

In October 1983, Pima County received three days of heavy rains resulting in a 100-year floods along some watercourses. Many bridges across Pima County were closed, damaged or swept away. Travel throughout the community became extremely difficult, residents in the northwest portion of the city were inundated and entire subdivisions were flooded. As a result, a new program was developed—the Flood-prone Land Acquisition Program (FLAP).

FLAP provides relocation assistance to property owners and purchases flood damaged land, whether it is improved property or vacant land. Specific criteria used to rank FLAP applications and determine eligibility include the extent of flood damage or severity of potential flood and erosion hazards on the property. The highest priority is given to improved properties that have or may suffer significant damage as a result of flooding.

This program is completely voluntary and is designed to assist property owners who are likely to experience, or have experienced, flooding which resulted in severe damage and flood hazards. The community also benefits from these acquisitions, which increase open space for overbank storage, enhance groundwater recharge, and provide riparian habitat preservation, wildlife corridors, passive recreation opportunities and protects cultural resources. FLAP also protects emergency responders and county resources from harm by reducing potential rescue needs.

Additional grant monies to purchase additional floodprone and damaged property became available after subsequent disasters because Pima County had an established flood-prone land acquisition program.



During Flood

In 1986, after voters approved general obligation bond sales of \$20 million for floodprone land acquisition, a land acquisition plan was adopted by the Pima County Board of Supervisors outlining criteria to guide the District's overall acquisition efforts and allow the dedication of tax levy revenues to be used for acquisition of floodprone lands. This newly adopted plan aided in the expansion of the program to include purchasing undeveloped land to prevent future floodplain development in sensitive riparian areas and to meet the open space goals of the community. In fiscal year 2006/07, the District spent nearly \$4 million and added 218 acres to the FLAP inventory.

In late July 2006, a significant rainfall occurred in Rincon Creek on the far eastside. Four property owners saw their homes, which were built prior to the Floodplain and Erosion Hazard Management Ordinance, flooded with up to 41 inches of water, and two of the owners were on the roof of their homes due to the rapid rise of the floodwater after the storm.

All four homes were purchased using FLAP monies, as well as assisting the families with relocation expenses. The homes were later demolished, leaving a vast open area which can now serve as a storage area for floodwaters when Rincon Creek experiences another significant flood event.

FLAP has proven to be very successful in protecting the public's safety and minimizing future flood losses. FLAP allowed for the acquisition of all four homes, including assistance for relocation expenses.



After Acquisition

2006 Debris Flows and Flooding

The 2006 summer monsoon season turned out to be a record year for rainfall and stream flow in eastern Pima County. The total rainfall received in June, July, and August was 8.6 inches at the Tucson International Airport. This rainfall total is 2 inches above the average rainfall for the same time period.

Rainfall in mid-July created saturated soil conditions in the upper watersheds, especially the Rillito-Tanque Verde-Pantano watershed. In late July, moisture from Tropical Storm Emilia created a period of intense rainfall in eastern Pima County starting on July 27 and ending on July 31, 2006. During this five-day period, rainfall totals ranged between 5 to 11 inches in the Catalina and Rincon Mountains and from 1 to 6 inches in the valley, with many locations receiving over 50% of their average annual rainfall.

TABLE OF DISCHARGE ESTIMATES

Gaging Station Name	Years of Record	Previous Flood Record (ft³/s)	Date of Previous Record Flood	New Flood of Record (ft³/s) 2006	Recurrence Interval (yrs)
Rincon Creek Near Tucson (09485000)	54	9,670	1971	15,000	100
Pantano Wash at Tucson (09485450)	232	11,000	1983	15,900	<50
Sabino Creek near Tucson (0984000)	75	14,100	1999	15,700	~200
Bear Creek near Tucson (0984200)	16	1,400	1978	2,400	>100
Tanque Verde Creek at Tucson (09484500)	39	24,500	1993	26,600	>500
Rillito Creek near Tucson (combined record)	86	29,700	1983	38,700	>500

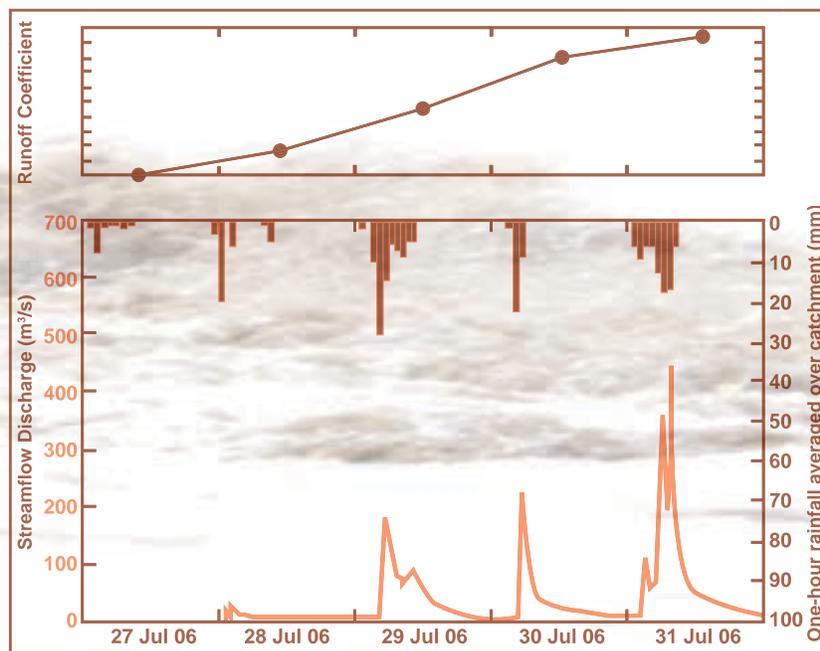
Table of discharge estimates for new flood of record from July 31, 2006 and comparisons with previous floods.

Saturated conditions increased so that each successive day of rainfall increased the amount of runoff. Consequently, by July 31, 2006 over 90% of the rainfall on the Catalinas resulted in runoff. Rainfall on the morning of July 31, 2006 was especially intense over the Tanque Verde Creek Watershed where 4 to 6 inches of rainfall occurred between midnight and 7:00 A.M. The National Weather Service (NWS) estimates that the 4-day rainfall event was a 1,000-year event.

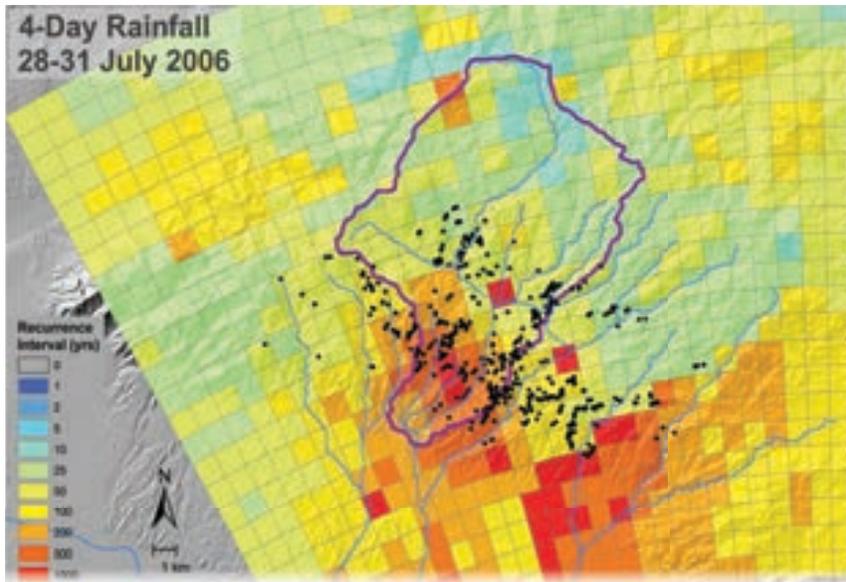
The U.S. Geological Survey's (USGS) estimate of the flood peak in the Rillito River is 38,700 cubic feet per second (cfs) and the flood peak on the Santa Cruz River at Continental is 42,000 cfs. By compari-

son, the Federal Emergency Management Agency's (FEMA) estimate for the 100-year flood on the Rillito River is 32,000 cfs, and the 50-year flood on the Santa Cruz River is 48,000 cfs. The USGS estimates that the flood on the Rillito exceeded the 500-year event.

Flows in many of the mountain washes exceeded the 100-year event. The most intense flood damage occurred in the Tanque Verde Creek Watershed including Sabino Canyon and other mountain washes along the southern Catalina Mountains where heavy rains on the weekend of July 27 to July 31, 2006 deposited 6.97 to 10.28 inches of rain. For example, the 100-year estimate for Bear Canyon Wash is 1,940



The hydrograph measured at the USGS gaging station at Sabino Canyon recreation area. Virtually none of the rainfall that fell on July 27th resulted in runoff. Most of the rainfall occurred on July 29th, but only about 40% became runoff. By July 31st, over 90% of the rainfall became runoff resulting in a flood of 15,700 cfs, which was estimated to be a 200-yr event by the USGS.



Four-day recurrence interval estimate of total rainfall depth falling between July 28 and July 31, 2006. In the area of the slope failures (black dots), the rainfall recurrence interval is between 100-year (yellow) and 1,000-year (red).

cfs and the estimate for July 31st is 2,400 cfs. The 15,700 cfs discharge at Sabino Canyon was estimated to be about a 200-year flood event.

While flood damages were relatively light given the magnitude of the storms and floods, there were some areas where there were significant damages caused by floodwaters and, in some cases, debris flows, including:

- Flooding of 35 residential structures, the most severely damaged were along Rincon Creek,
- Debris flows and rockslides that damaged the Sabino Canyon Recreation Area, Catalina Highway and Mt. Lemmon Short Road,
- Erosion damage and 8 feet of channel bed lowering along the Pantano Wash downstream of Speedway Boulevard, and
- Significant accumulation of sediment and debris in the Rillito River that in one case backed up local drainage into the adjacent Lazy Creek subdivision.



Rockslide on Mt. Lemmon

The most unique features of the storms and flooding were the debris flows along the southern Catalina Mountains. The USGS has identified over 435 slope failures and debris flows which occurred in the Catalina Mountains between Esperero Canyon and Solider Canyon. The Sabino Canyon Recreation Area was impacted by 36 debris flows. The USGS is classifying the storm and subsequent debris flows as an extreme event. The USGS estimates that this magnitude of debris flow activity has not taken place in the Catalina Mountains for at least 2,000 years. In the Sabino Canyon Recreational Area, the Rattlesnake Canyon debris flow traveled more than 2 miles downstream to the Sabino Creek. The Soldier Canyon debris flow damaged the Catalina Highway at Milepost 1, the Mount Lemmon Short Road, and some of the surrounding homes.



Debris flow initiation and transport zones on the western side of Sabino Canyon.

After the July 2006 flood event, FEMA approved funding for emergency work and repair projects totaling \$8 million for the Santa Cruz River, Rillito River and Pantano Wash. By the end of Fiscal Year 2006/07, \$3 million in emergency work was completed to re-establish the flood carrying capacity and stabilize areas eroded during the flood.

The completed emergency repair work includes:

- Debris removal along the Rillito and Santa Cruz River bridges,

- Rillito River sediment removal to restore channel capacity on the Rillito River from I-10 to La Cholla Boulevard and Country Club Road to Alvernon Way,
- Emergency erosion protection on the Pantano Wash upstream of Speedway Boulevard along the Kolb Executive Park, Pantano Townhomes and Mullins Landfill,
- Rillito River at the Campbell Avenue bank protection repair, and
- Tributary repair work for Alvernon Wash at the Rillito River, Lazy Creek at the Rillito River and Nebraska Wash at the Pantano Wash.



Rillito River sediment removal

In future fiscal years, the remaining flood repair work will take place which will include permanent improvements and erosion control on the Pantano Wash upstream of Speedway Boulevard and repairs along the Santa Cruz River—Continental Ranch Low Flow Channel.

CAPITAL IMPROVEMENTS PROGRAM

**Fiscal Year
July 1, 2006–June 30, 2007**

CIP No.	PROJECT NAME	COMPLETION DATE	*TOTAL COST
FC-04-502	Verde Meadows Crest Improvements	September 25, 2006	\$22,008
FC-04-502	Littletown Urban Drainage	September 25, 2006	\$248,104
FC-04-502	Old Nogales Highway at Franco Wash Bank Protection Repairs	September 25, 2006	\$102,261
FC-03-005	River Road/Camino Real Wash Drainage Improvements	October 31, 2006	\$2,026,540
FC-04-502	Ajo–Second Avenue Bridge Construction	November 6, 2006	\$529,378
FC-06-001	Mt. Lemmon–Drainage Improvements	December 31, 2006	\$1,021,550
FC-97-030	Tucson Diversion Channel Drainage Improvements	February 27, 2007	\$233,083
FC-98-006	Ajo Detention Basin Improvements	April 10, 2007	\$2,287,105
FC-03-002	San Xavier Drainage Improvements	June 30, 2007	\$3,656,361
TOTAL			\$10,126,390

*Lifetime Project Costs



Camino Real Wash Floodplain
BEFORE Drainage Improvements



Camino Real Wash Floodplain AFTER Drainage
Improvements

Structural Improvements

River Road/ Camino Real Wash Drainage Improvements

Implementing drainage improvements to reduce future flood damages often involves coordinating efforts with other agencies and departments. The River Road/Camino Real Wash drainage improvements east of Campbell Avenue are an example of cooperation among the Pima County Department of Transportation, the District and private developers to reduce the flood threat of the Camino Real Wash.

The existing drainage channel for the Camino Real Wash was undersized and limited right-of-way and topographic constraints made improvements to this channel impractical. A large flood would create a wide floodplain that would restrict access on a major roadway. This distributary flow inhibited the ability of property owners to install drainage improvements.

Formulating a solution to this flood hazard required the creation of additional flow paths east of the existing floodplain. On October 4, 2004, FEMA approved a Conditional Letter of Map Revision report (CLOMR). The CLOMR process was used to refine the design of the drainage improvements to ensure that the improvements would be acceptable to FEMA. The post-construction floodplain remapping process began in May 2007. Once approved by FEMA, the final floodplain map revision will remove close to 200 residential and commercial structures from the floodplain.



Storm damage from August 23, 2005 storm, west branch channel upstream of Valencia Road. (Left) Looking southwest towards Black Mountain. (Right) Looking south towards San Xavier Mission.

San Xavier Drainage Improvements

In 1999, the District began working with the U.S. Bureau of Reclamation (BOR) and Tohono O'odham Nation (Nation) on drainage improvements necessary for flood control along the West Branch of the Santa Cruz River and Mission Wash, and the rehabilitation of the San Xavier Farm.



*San Xavier Farm
Drainage Improvements*

Pima County's project goal is to address longstanding flooding and maintenance problems along Mission Road, the West Branch of the Santa Cruz River, Valencia Wash at Westover and numerous other locations along the Panhandle Area. The drainage improvements for San Xavier Farm would provide flood control along the West Branch of the Santa Cruz River and protect properties north of Los Reales Road. The final design will provide:

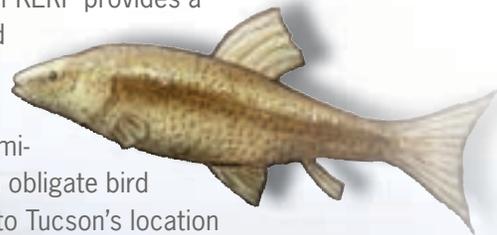
- Redirection of upstream flows in the West Branch directly toward the Santa Cruz to reduce the 100-year flood peak to the capacity of the downstream drainage infrastructure.
- Improve channel capacity in the Los Reales collector channel, which will remove 326 properties from the FEMA 100-year floodplain.
- Channel improvements along the West Branch upstream of Valencia Road.

Environmental & Water Resources

Kino Environmental Restoration Project

In the mid 1990s, the U.S. Army Corps of Engineers, Pima County and the District entered into a cooperative agreement to create the Ed Pastor Kino Environmental Restoration Project (KERP). This project was the result of the agencies' desire to redevelop an existing unlined storm water detention basin—Tucson (Ajo) Detention Basin—into a detention basin that was more environmentally sensitive and aesthetically pleasing to the community. Water sources in fiscal year 2006/07 were 160 acre-feet of reclaimed water and 422 acre-feet of harvested stormwater. KERP uses storm water, thereby contributing to groundwater conservation goals and improving aquifer water quality.

As further urban growth occurs in this already heavily urbanized area, the restoration component of KERP provides a managed watercourse environment and increases wildlife habitat for Tucson's metropolitan area. The project provides valuable habitat for resident and migratory waterfowl, shore birds, riparian obligate bird species and upland bird species. Due to Tucson's location along the Pacific Flyway, there is a need for wetland habitat to provide important resting and foraging areas for migratory bird species. It also provides additional habitat for reptiles, amphibians, small mammals and invertebrates.



The ponds are now used by a wide variety of waterfowl. Development of open water, emergent freshwater marsh and upland cover provides habitat for waterfowl such as black-bellied whistling duck, northern shoveler, mallards and the American widgeon.

Development of mudflats and shorelines in the basin provides habitat for shorebirds and associated species, such as black-neck stilt, greater yellowlegs, long-billed dowitcher, western sandpiper and least sandpiper. The project's riparian habitat provides areas for riparian obligate bird species such as yellow warbler, song sparrows, rufous-sided towhee and blue grosbeak.

KERP PROJECT

ACRE FEET	2004	2005	2006	2006/2007
Reclaimed Water	330	180	395	160
Harvested Storm Water	252	402	187	422
TOTAL SUPPLY	582	582	582	582

Based on the water demand of 582 acre-feet, the cost to purchase reclaimed water exclusively would have been \$393,000 under the standard reclaimed water rate of \$675 per acre-foot. However, because of water harvesting practices, only 160 acre-feet of reclaimed water were needed in Fiscal Year 2006/07. The reclaimed water costs were \$108,000, which meant a savings of \$285,000 because harvested storm water was used in place of reclaimed water.

However, even greater savings have been achieved due to the inter-governmental agreements approved between Pima County and the City of Tucson. These agreements establish the basis to allow county-treated effluent into the city's reclaimed system for delivery

to county facilities. The operating rate of \$70.84 per acre-foot applies to effluent that has been treated by the county at the Randolph Park Water Reclamation Facility and delivered through Tucson Water's reclaimed lines.

Using harvested water and the operating rate for reclaimed water, the costs to irrigate the KERP and Kino Sports complex was approximately \$11,300 in Fiscal Year 2006/07. In other words, storm water harvesting and a reduced reclaimed water rate resulted in a 97 percent savings in water costs in Fiscal Year 2006/07.



District Financial Overview

Flood Control District Tax Levy Rate 1981 to 2007		
FISCAL YEAR ENDING	*LEVY RATE	TAX
1981.....	0.5143.....	\$4,637,000
1982.....	0.4683.....	\$5,342,000
1983.....	0.5072.....	\$6,882,000
1984.....	0.4739.....	\$7,652,000
1985.....	0.5269.....	\$9,243,000
1986.....	0.5102.....	\$9,969,000
1987.....	0.5346.....	\$11,713,000
1988.....	0.7630.....	\$17,272,000
1989.....	0.5592.....	\$13,730,000
1990.....	0.5985.....	\$14,663,000
1991.....	0.5985.....	\$14,058,000
1992.....	0.5871.....	\$13,689,000
1993.....	0.5871.....	\$13,767,000
1994.....	0.5398.....	\$12,678,000
1995.....	0.4623.....	\$11,379,000
1996.....	0.3596.....	\$9,368,000
1997.....	0.3596.....	\$9,467,000
1998.....	0.3296.....	\$10,392,000
1999.....	0.3246.....	\$10,411,000
2000.....	0.3046.....	\$10,327,151
2001.....	0.3046.....	\$10,414,427
2002.....	0.3546.....	\$13,713,102
2003.....	0.3546.....	\$14,467,389
2004.....	0.3546.....	\$14,467,389
2005.....	0.3546.....	\$14,467,389
2006.....	0.3746.....	\$19,720,839
2007.....	0.3746.....	\$22,620,303

*Per \$100 assessed value

Revenues

Although the District receives assistance from state and federal agencies to construct major capital facilities, most of the District's funding is generated from the property tax levy along with general obligation bond sales authorized by the electorate. Information on the District tax levy rate is shown in the table at left.

United States Army Corps of Engineers (USACOE)

In addition to direct cash received from the federal government, the District received monies for in-kind services from the USACOE. Some projects under our cost sharing financial agreement are as follows:

- Paseo de las Iglesias \$197,000
- Tres Rios del Norte \$47,000
- El Rio Medio \$43,000
- Rillito/Swan Wetlands \$38,000

TOTAL \$325,000

Expenditures

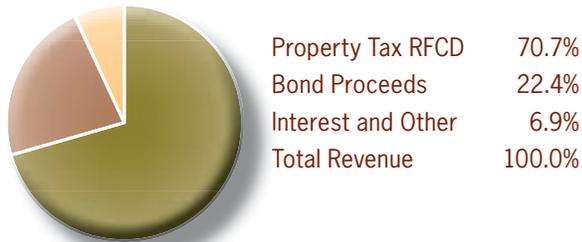
The table on Page 25 provides information on capital project expenditures for projects completed during Fiscal Year 2006/07. The remainder of District expenditures goes toward debt service and operating expenses, which include funds allocated for maintenance of flood control structures, floodplain management, planning and administration activities.

District Financial Highlights

for Fiscal Year 2006-2007

Revenues

The primary source of revenue is the District's secondary property tax levy of \$0.37456 per \$100 of real property assessed valuation. In Fiscal Year 2006/07, the District received approximately \$22.6 million dollars in tax levy revenue. Other local sources of revenue for capital improvements are generated from the sale of general obligation (GO) bonds (\$7.2M) and reimbursements for other funds (\$2.2M). The total revenue from all sources in Fiscal Year 2006/07 was \$ 32.1 million.



Expenditures

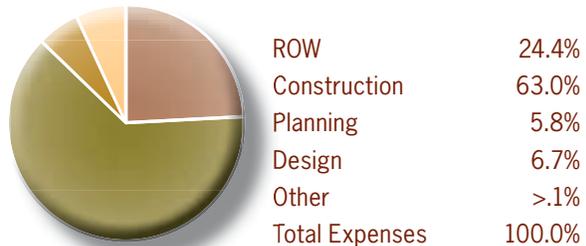
The total expenditures for the District in Fiscal Year 2006/07 were approximately \$35.0 million. The Capital Improvement Program expenditures of \$19.8 million were direct capital expenses. The annual operating budget for the District was approximately \$14.3 million. Contained in this figure is \$1.3 million used for bank repairs following the July 31, 2006 flood. The other significant expenditure was \$1.0 million in debt service for flood control bonds.



Breakdown of Expenditures

Capital Improvements

The expenditures for capital improvements include engineering service costs for planning and design; construction costs; right-of-way acquisition costs; and other costs such as preparing new FEMA Flood Insurance Rate Maps once a capital project is completed. Nearly \$3,000,000 of the Right-of-Way figure was spent by the District's Floodprone Land Acquisition Program to purchase real estate and pay relocation expenses for seven properties impacted by the flooding. The Corps also provided in-kind assistance in the amount of \$325,000 on various CIP projects.



Operating Budget

The District's operating budget includes administrative, personnel, supplies and service costs associated with Flood Control, Flood Prevention and Riparian Protection. Flood Control Support Services include programs such as customer service, permits, public education, and financial management. Flood Prevention Services include maintenance, flood warning, emergency preparedness and enforcement activities. Riparian Protection Services include the environmental restoration, water resources and riparian habitat management programs.





COORDINATION WITH OTHER AGENCIES

Pima County Department of Transportation

The District contracts with Pima County for services from divisions within the Department of Transportation:

- Field Engineering Division
- Maintenance Operations Division
- Real Property Division
- Technical Services Division
- Administrative Services Division

Other Pima County Departments

The District cooperates with other Pima County Departments on various projects and exchanges information as needed:

- Pima County Attorney's Office
- Development Services Department
- Department of Environmental Quality
- Health Department
- Natural Resources, Parks and Recreation Department
- Tucson-Pima County Office of Emergency Management
- Regional Wastewater Reclamation Department (RWRD)

Local Governments

The District has entered into intergovernmental agreements (IGAs) to provide specific flood control or floodplain management services to, or to jointly fund flood control activities with, the following:

- City of Tucson
- City of South Tucson
- Town of Oro Valley
- Town of Marana
- Town of Sahuarita

Pima Association of Governments (PAG)

PAG facilitates coordination among local government agencies, including the District, on environmental matters affecting the community.

State Agencies

The District coordinates activities with the following state agencies:

- Arizona Department of Water Resources (ADWR)
- Arizona Department of Environmental Quality (ADEQ)
- Arizona Game and Fish (AGFD)
- Arizona State Land Department

Federal Government

Several federal agencies participate in local flood control projects, as listed below:

- U. S. Army Corps of Engineers (USACOE)
- Federal Emergency Management Agency (FEMA)
- Federal Highway Administration (FHWA)
- U. S. Bureau of Reclamation (USBR)
- U. S. Natural Resource Conservation Service (NRCS)
- National Weather Service (NWS)
- U. S. Geological Survey (USGS)
- U. S. Fish and Wildlife Service (USFWS)

Nongovernmental Organizations

Other nongovernmental agencies that the District works with include:

- The Nature Conservancy (TNC)
- Cortaro-Marana Irrigation District (CMID)
- Central Arizona Water Conservation District (CAWCD)
- Metropolitan Domestic Water Improvement District (MDWID)
- University of Arizona (UA)



Pima County Regional
FLOOD CONTROL
DISTRICT



Pima County Regional Flood Control District
97 East Congress Street • 3rd Floor
Tucson, Arizona 85701-1797