FLOOD CONTROL DISTRICT of MARICOPA COUNTY

ANNUAL REPORT

JULY 1, 1987 to JUNE 30, 1988

ANNUAL REPORT

July 1, 1987 to June 30, 1988

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Flood Control District
of
Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

Editor: Helen Hayes

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On the cover:
An April storm rolls in over the Agua Fria River.

Photo by Ed Karnafel

FINANCIAL HIGHLIGHTS

FOR THE YEAR ENDED JUNE 30, 1988
(Preliminary and Unaudited)

	DOLLARS	PERCENT
REVENUES		
Flood Control Tax	$46,059,000	89%
Rental Income	554,000	1%
Interest	1,904,000	4%
State Assistance - Local Projects	526,000	1%
County and Local Participation	712,000	1%
Sale of Excess Land	2,187,000	4%
Miscellaneous	80,000	--
Total Revenues	52,022,000	100%
EXPENDITURES		
Administration and Maintenance	7,285,000	13%
Flood Control Capital Improvements	48,759,000	87%
Total Expenditures	56,044,000	100%
Excess (Deficiency) of Revenues Over Expenditures	(4,022,000)	
Fund Balance at Beginning of Year	27,138,000	
Fund Balance at End of Year	$23,116,000	
EXPENDITURES BY TASK		
Administration	$ 5,181,000	9%
Land Acquisition	15,121,000	27%
Relocation of Utilities, Bridges and Other Facilities	10,336,000	19%
Construction	22,281,000	40%
Maintenance	2,996,000	5%
Cost Sharing in Projects Managed by Others	129,000	--
Total	$56,044,000	100%

FLOOD CONTROL DISTRICT
of
Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 262-1501

Memo from the Chief Engineer and General Manager
Cooperation Brings Success on the Agua Fria

The most significant event of the year was the completion of construction of the Agua Fria Channelization project. This $45 million project extends from north of Indian School Road to the Gila River and was made possible by the cooperation of a number of organizations and a number of people with different interests and goals. We now have something to be proud of - the flooding potential of the Agua Fria has been greatly reduced.

Through cooperation with the County Highway Department, new bridges were constructed at McDowell and Van Buren across a much narrower Agua Fria River channel resulting in considerable cost savings to the County with a portion of these savings being used for the channel project. The Indian School Bridge was reconstructed, and a channel was constructed using land dedicated by sand and gravel operators.

ADOT needed 850,000 cubic yards of earth for construction of Interstate 10 east of the river, and the District needed to have a channel dug. An agreement was worked out whereby ADOT dug part of our channel and used the earth to build its freeway thus saving everyone money.

Cooperation with the Federal government was also an integral part of this project. The Corps of Engineers' levees will protect an existing subdivision on Lower Buckeye Road and Avondale's Wastewater Treatment Plant.

From the beginning of the project, the City of Avondale worked with us to find the best solutions to the challenges posed by the project. The water lines were a particular challenge, but by putting in two temporary bypass lines, service was not interrupted for more than two hours at a time during construction. The old Landfill needed to be moved out of the riverbed and, working together, we found a new location immediately adjacent to the new channel. Avondale will be building a park over the relocated landfill, partially with money supplied by the District.

All of us can be proud of the Agua Fria Channelization Project.

D. E. Sagramoso

The District performs a wide variety of maintenance activities, such as erosion control, fence repair, and irrigation of landscaped areas. In some cases, the work is simple and straightforward. For instance, there are 4,363 acres of natural streambed in the Gila and Salt Rivers which we have cleared of water loving plants called phreatophytes. These plants would otherwise change the course of the river and slow the flow of water. They cause the deposit of sediment in the riverbed which reduces the depth of the river and contributes to flooding. The Salt/Gila Clearing Project keeps the channel cleared, grubbed, and raked, enabling the unrestricted passage of stream flows.

A more complex project is the Arizona Canal Diversion Channel (ACDC). The District assumes maintenance responsibility for each reach of this project as it is completed, and for landscaping along both sides of its 17-mile length. Because Arizona's arid environment requires an irrigation system capable of supporting plants throughout the long hot summer, we had to design an extremely efficient water application system to irrigate long distances. We also needed a means of monitoring and controlling this extensive system from a single remote location at the District main office.

We are using drip irrigation, which applies small amounts of water over a period of several hours. The system we found enables us to deliver very accurate amounts of irrigation water over a wide range of pressures, allowing its use over much longer distances than conventional drip systems.

Looking upstream from Gillespie Dam at the Salt/Gila Clearing, which includes 36 miles of dirt road.

Maintenance Activities

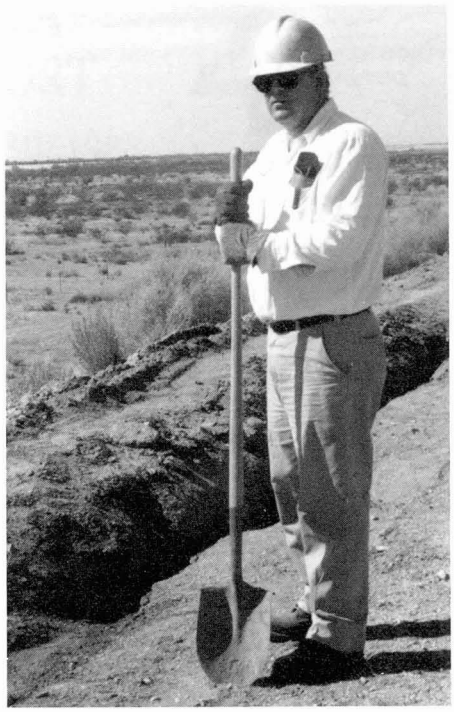
We combined this with a computer-based control system. It is capable of controlling the irrigation system on-site as well as from a remote location, i.e., the District main office, some miles distant from the project.

Because it is undergound, this system saves costs associated with vandalism and broken pipes. Because it can discern soil moisture, it can tell us when and how much an area needs to be irrigated. This saves the expense of sending field crews to inspect the system on a daily basis and prevents the inaccurate or excessive application of irrigation water. The system can also remotely change irrigation scheduling, remotely and automatically fertilize, and provide automatic sequential irrigation.

The District anticipates a savings in water use of 50-60% over the original irrigation and irrigation control design from this system. This translates to a substantial, though presently unquantifiable savings, both in dollars and conserved resources.

The District maintains 22 flood retention structures and is responsible for 50 different facilities throughout Maricopa County. Approximately 43% of our staff is involved in these activities.

The amount of maintenance work has increased dramatically over the last several years (see the chart on the next page), with new structures coming on line each year as projects are completed. The District has been able to maintain these structures without a proportional increase in staff through the extensive use of Department of Corrections prisoners.



Tony Guzak, a Maintenance Team Leader, supervising erosion control work at McMicken Dam.

This year we used 39,622 hours of prisoner labor to perform hand-intensive maintenance such as clearing vegetation and trash removal. The labor of each prisoner cost the District 50 cents per hour, saving taxpayers several hundred thousand dollars.

Cost-savings at the District

As part of an agreement with the Game and Fish Department and the U.S. Fish and Wildlife Service, the District agreed to perform wildlife mitigation around Gillespie Dam and the area north of the Dam. This entailed planting barley, canary grass, and bermuda grass to compensate for wildlife habitat losses elsewhere in the area. It was a large operation, covering about 400 acres, but staff at the District did some creative problem solving to come up with inexpensive, labor-saving solutions.

A District employee knew of a cooperative effort between the University of Arizona and the Soil Conservation Service to develop a barley variety that required only a single irrigation per growing season. They were interested in seeing how the barley variety would work in an actual, non-irrigation situation. The District agreed to provide updates on the progress of the plants and got the seeds free.

Because of the large area of the planting (400 acres), we decided to use aerial seeding. By this method, the seed's fall from the plane would create enough velocity to embed it into the ground on impact. Of course, the ground had to be softened first using tractor and farm implements (disking), but it is a much less labor-intensive and less expensive method of planting a large area than hand-seeding or pulling a seeder behind a tractor.

Growth of Maintenance Responsibilities

	Inventory as of Jan 1 1980	Added 1/1980 to 1/1984	Added 1/1984 to 7/1987	Added 7/1987 to 7/1988	Total		Percent Increase 1/80-7/88
Access Ladder	-	-	10	-	10	each	-
Bank Protection - (R/R)	45025	271124	122057	23355	461561	sq yd	925
Bank Protection - (G R/R)	50	29671	64429	20165	114315	sq yd	228530
Bank Protection - Soil Cement	-	8850	-	-	8850	sq yd	-
Bank Protection - Shot Crete	-	4104	-	883	4987	sq yd	-
Bridges - Pedestrian	3	4	1	-	8	each	167
Bridges - Vehicle	8	6	-	-	14	each	75
Culverts, Box	5	8	1	-	14	each	180
Culverts, Pipe	14	29	34	-	77	each	450
Dip Crossings - Asphalt	-	3	1	-	4	each	-
Drainage Channel - Lined	48068	12144	6109	-	66321	feet	38
Drainage Channel - Lined (R/R)	-	2033	870	-	2903	feet	-
Drainage Channel - Lined (G R/R)	-	689	219	-	908	feet	-
Drainage Channel - Unlined	12.4	6.4	1.5	-	20.3	miles	64
Drop Structure	15	32	11	1	59	each	293
Embankment - Dirt	501	393	213	32	1139	acres	127
Embankment - Soil Cement	-	6.2	6.8	6	19	acres	-
Energy Dissipator	11	6	16	1	34	each	209
Erosion Protection - Conc Paving	-	-	-	8000	8000	sq ft	-
Fencing - Wire	401021	452012	172544	27209	1052786	feet	163
Fencing - Wrought Iron	-	-	-	10440	10440	feet	-
Floodway - Lined	-	4693	-	11405	16098	feet	-
Floodway - Lined (R/R)	-	8633	-	-	8633	feet	-
Floodway - Lined (G R/R)	-	974	650	-	1624	feet	-
Floodway - Unlined	802	397	422	67	1688	acres	111
Gabions	1200	-	16133	-	17333	sq.yd.	1344
Gated Outlet	15	4	1	-	20	each	33
Gates - Wire	29	10	-	3	42	each	45
Gates - Wrought Iron	-	-	-	1	1	each	-
Gates - Pipe	108	116	84	1	309	each	186
Grade Control Structures	8	8	3	1	20	each	150
Guardrail	327	1593	420	-	2340	feet	616
Gutters - Concrete	130	3940	6100	-	10170	feet	7723
High Flow	586	13	-	-	599	acres	2
Landscape - Erosion Control	351	1879	327	70	2627	acres	648
Irrigation Heads	-	147	-	17	164	each	-
Irrigation Controls	-	2	-	11	13	each	-
Irrigation Lines	-	2676	-	20921	23597	feet	-
Plantings	927	3666	2202	1748	8543	each	822
Low Flow - Structures	990	112	13	-	1115	acres	13
Manholes	18	12	-	-	30	each	67
Meter Houses	5	2	1	-	8	each	60
Outlet Structure	3	4	1	-	8	each	167
Pilot Channel - Gila River	-	5300	17424	-	22724	feet	-
Pool Area	8879	45474	5504	-	59857	acres	574
Principal Outlet	11	5	2	-	18	each	64
Principal Outlet - Pipe	11230	1458	580	-	13268	feet	18
Railing - Pipe	-	358	486	-	844	feet	-
Ramps - Asphalt	-	64	800	70	934	feet	-
Ramps - Concrete	348	90	-	221	659	feet	89
Ramps - Earth	2684	11178	7445	919	22226	feet	728
Ramps - Grouted Riprap	-	2080	2744	-	4824	feet	-
Ramps - Soil Cement	-	690	147	480	1317	feet	-
Retaining Wall	-	1085	290	267	1642	feet	-
Right-of-Way	8547	15460	7272	613	31892	acres	273
River Clearing	-	2480	1815	-	4295	acres	-
Roads - Asphalt	2.6	10.3	14	5.5	32.4	miles	1146
Roads - Dirt	152	144	45	10	351	miles	131
Sediment Basins	13	17	7	-	37	each	185
Side Inlet - Concrete	26	12	6	7	51	each	96
Side Inlet - Drop	3	6	-	-	9	each	200
Side Inlet - Flap Gate	10	23	16	4	53	each	430
Side Inlet - Grouted	11	67	50	10	138	each	1155
Side Inlet - Pipe	31	72	13	38	154	each	397
Spillway - Earth	484	27	1	-	512	acres	6
Spillway - Lined	944	260	53	-	1257	feet	33
Stormdrain Pipe	8186	18179	505	-	26870	feet	228
Trash Racks	44	40	22	11	117	each	166
Vegetative Drains	16	31	12	-	59	each	269

(R/R) = Rip/Rap
(G R/R) = Grouted Rip/Rap

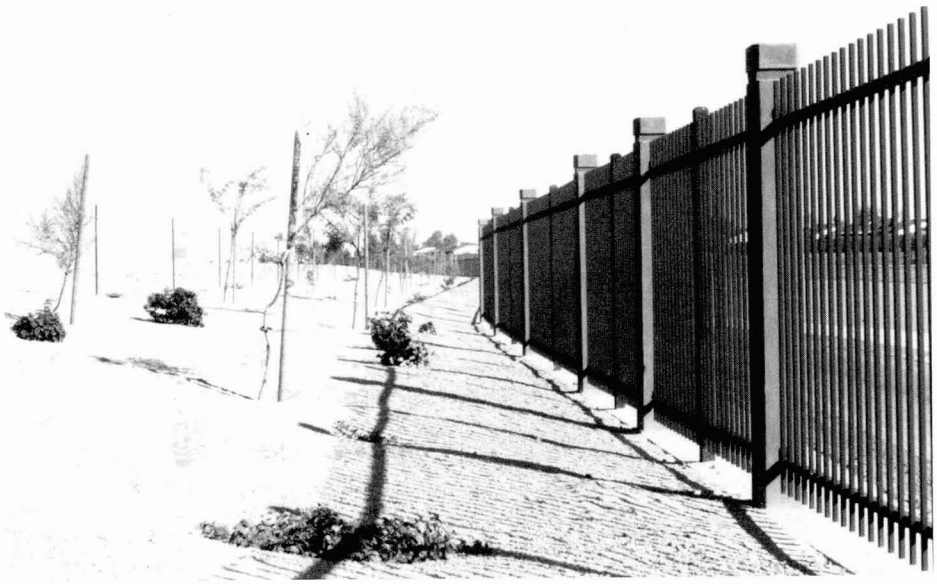
Rev. 3/16/88

Bob Pendergast, a maintenance supervisor who celebrated his 20th year of working with the County this year.

Department of Corrections' prisoners were used on the following projects:

Project	Hours
ACDC	5,983
Agua Fria	845
Buckeye	1,359
Buckhorn-Mesa	2,521
Cave Buttes	1,282
EMF	1,196
Harquahala	1,191
Indian Bend Wash	2,391
McMicken	10,172
Old Cross Cut	714
Powerline	1,320
Rittenhouse	688
Salt/Gila	947
Skunk Creek/New River	2,590
Sunset/Sunnycove	1,392
White Tanks	853
Other	4,078

Development of Flood Control Structures



Recently completed fencing and landscaping along the Arizona Canal Diversion Channel (ACDC), Reach 2A.

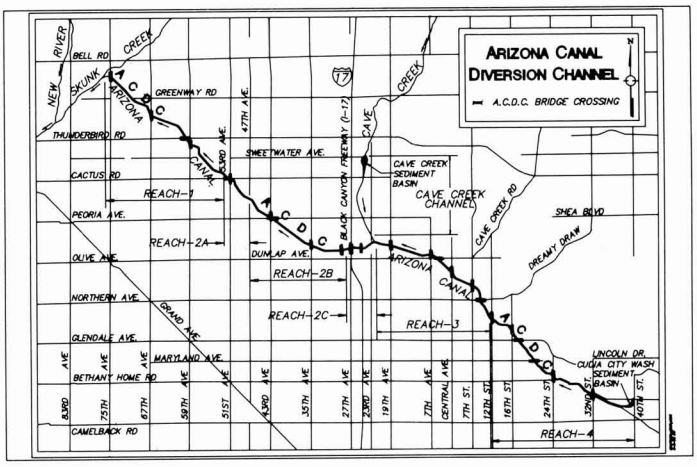
The Flood Control District has many roles. We function as a local sponsor for federal flood control projects, acquire needed rights-of-way for flood control, coordinate intergovernmental agreements, oversee contracts, and maintain completed structures. There is an intricate array of activities associated with each project. Below is an update on some of the work associated with our major projects.

Arizona Canal Diversion Channel

The Arizona Canal Diversion Channel (ACDC) will provide 100-year protection to large parts of the Phoenix Metropolitan Area south of the Cave Creek drainage area, which includes the state capitol complex, Glendale and Peoria. The channel will intercept Cudia City Wash and Dreamy Draw floodwaters as well as runoff from the Phoenix Mountains, Cave Creek and residential street flows north of the channel. It will divert these flows into Skunk Creek, eliminating stormwater flow into and subsequent breakouts of the Arizona Canal.

The Flood Control District is sponsoring this project for the U.S. Army Corps of Engineers. Approximately 40% of its overall cost will be paid by the District, and we will provide maintenance of the completed structure.

Because so much of this project is in the Phoenix Metropolitan Area, it requires 25 bridges and a special sensitivity to urban aesthetics. Many public meetings have been held, and a citizens' aesthetics committee was created in response to concern among members of the community. The District and Corps of Engineers staff attended the committee's meetings and have incorporated some of their ideas into the planning of the channel, such as curved fence tops and specific plant types and sizes for landscaping.



Left: The ACDC runs from Skunk Creek to 40th Street. The estimated date of completion for the project is 1992.

In the area of the Biltmore Hotel, CRS Sirrine, Consulting Engineers, are performing a study to investigate the possibility of constructing the channel as a tunnel in this area. It is likely that this would cost more than the usual method of digging and covering, but it would avoid the 6-month disruption of the area that would be caused by a cut and cover operation.

The width of the 17-mile channel will vary from 36 to 500 feet. In organizing design and construction, the Corps of Engineers has divided the channel into four reaches. Reach 1 was completed in 1986, and Reach 2 is being completed in three sections. The District's projected expenditure for Reach 2 is $24,700,000.

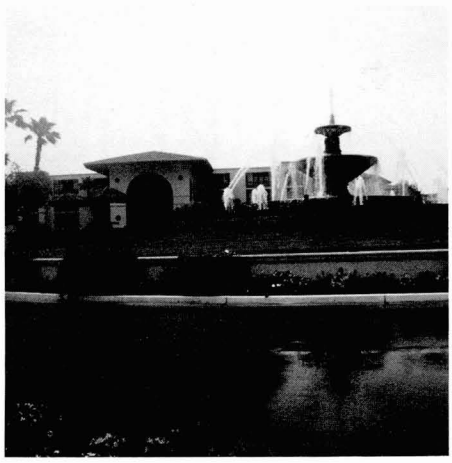
Construction began on Reach 2A in November 1986 and was completed in January of this year. This reach extends from 53rd to 47th Avenue. The construction contractor was CS Construction. At the end of this fiscal year, Reach 2B was 63% complete. The construction contractor is Kasler Corporation.

From 53rd Avenue west, the channel has an earth-lined trapezoidal cross section, and from 47th Avenue east it will have a rectangular concrete cross section. Reach 2A forms the transition between the east and west ends of the channel, and has a concrete trapezoidal cross section.

The channel will be covered from Central to Dunlap Avenue, so that Sunnyslope High School can maintain use of its athletic fields; along Stanford Drive east of 32nd Street to avoid

The Agua Fria Dedication Ceremony, where County Supervisor Carole Carpenter was the Master of Ceremonies.

David McClain operating a roller compactor to perform erosion control on the East Maricopa Floodway.



The Pointe at South Mountain, where the District operates Guadalupe Dam.

the cost of relocating Stanford Drive; and from 30th to 24th Street, in front of the Biltmore Hotel, where costs of covering are less than additional costs required to replace the disrupted facilities.

Of the 25 bridges required for the project, 11 have been completed, 3 are under construction, and 4 are being designed and will be constructed by the Corps.

Agua Fria

At a total cost of approximately $45,225,000, the Agua Fria Channelization Project is by far the largest and most expensive local project to have been completed by the District. It was completed in February 1988, and a dedication ceremony was held in April with Board of Directors members Carole Carpenter and Ed Pastor officiating.

The project was developed to resolve flooding problems along the lower Agua Fria River that became evident during the flooding of 1978 to 1980. It is designed to contain and convey the Standard Project Flood, which is 142,000 cfs, and runs from north of Indian School Road south to Buckeye Road.

The Corps of Engineers has constructed levees south of the District's project. These levees protect existing residential areas on both sides of the river and the Avondale Wastewater Treatment Plant on the west bank.

Soil cement was used on the project for erosion protection and stability of levees, riverbeds, and other features. This material had not been used extensively in Maricopa County before and is a new engineering application for the District. It works like concrete, but the color blends into the natural channel bottom and it is more economical than other protection methods.

As a part of the project, the District relocated the old Avondale Landfill. This opened the channel for the passage of floodwaters and helped clear up public health concerns about potential contamination of the ground water.

The City of Avondale plans to develop a park on the new landfill site, with ball fields, picnic areas, and other recreation activities. The Flood Control District will operate and maintain the channel, the County Landfill Department is responsible for the closed landfill, and Avondale will operate and maintain the park.

Buckhorn-Mesa

The Buckhorn-Mesa Watershed Project is a system of interrelated structures being built by the Soil Conservation Service to provide flood protection to rural and urban lands in the eastern Maricopa County area, generally south of Brown Road from about Bush Highway to Idaho Road.

The first structures, the Spook Hill Dam and Floodway, the Signal Butte Dam and Floodway, and the Pass Mountain Diversion, have been completed. The final structures, Apache Junction Dam and Bulldog Floodway, are now 85% complete. The construction contract for this portion is with Ashton Construction Company for $7,063,000.

East Maricopa Floodway

The East Maricopa Floodway is being constructed alongside the Roosevelt Water Conservation District (RWCD) Canal in Eastern Maricopa County, on the upstream (east) side. The 27.6-mile long Floodway is being built in six reaches and will extend from the Gila River to a little north of Brown Road in Mesa.

The Floodway is complete through Reach 4, which the construction contractor, Kiewit Western, finished this year. Reach 5 is expected to be complete in July 1988. The construction contractor for this reach is R.E. Monks, and it is expected to cost about $1,411,703. Three miles of Reach 5 were constructed in 1985 by Leisure World at substantial savings to the taxpayers.

Construction of Reach 6 has not yet begun, but the District has worked out an intergovernmental agreement with the City of Mesa concerning a part of this reach. Mesa is rebuilding Brown Road, where the District needs a box culvert as a part of the Floodway. The City of Mesa will build this culvert at the same time that they rebuild the road. The District will later reimburse Mesa at a cost lower than would have been paid had we built it ourselves.

Guadalupe Dam

The Flood Control District is working with the Soil Conservation Service and the Gosnell Development Company on this project. Gosnell, which has developed the Pointe at South Mountain in this area, is building a golf course and other recreation facilities in the Guadalupe Dam reservoir.

The District is pleased that this cooperative effort between business and government has worked to the mutual advantage of both. While Gosnell's development will not interfere with the flood control purposes of the Dam, it productively uses the reservoir area. It also will save the District from maintenance costs and liability, since Gosnell is taking on these two responsibilities.

Plan 6. Plan 6 is a part of the Central Arizona Project (CAP), a Bureau of Reclamation program to provide flood control, regulatory storage of excess Colorado River water, and the structural safety of existing Salt and Verde River Dams. The Flood Control District has committed itself to provide upfront funding for up to 20 percent of the flood control costs. The District is presently contributing $900,000 each quarter for the flood control features of Plan 6.

Sharing Costs to Prevent Flooding

One of the ways in which the District prevents flooding within Maricopa County is by helping other agencies and cities pay for the costs of design and construction of flood control projects.

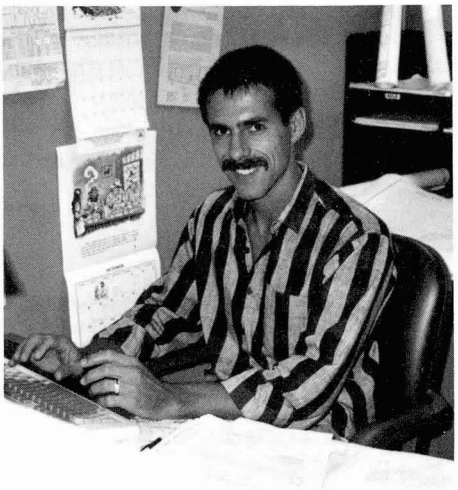
Bell Road. A six-lane divided major urban arterial street has been proposed along the 24.5-mile Bell Road Alignment from Grand Avenue to Scottsdale Road. The cost of the street construction is to be shared by the jurisdictions involved, with the County Highway Department as the coordinating agency. The District has agreed to contribute approximately $13 million for drainage improvements which include the 51st, 59th and 67th Avenue Drains. The communities of Glendale, Peoria, Phoenix, and Surprise, as well as the County Highway Department, are involved in this project.

51st Avenue Drain. A part of the Bell Road project is a drain along 51st Avenue. Glendale, Phoenix, and the County wanted to improve the road and it was logical to build the storm drain at the same time. The District will contribute $3 million for the storm drain.

Olive Drain. The County Highway Department was planning to reconstruct Olive Avenue from 99th Avenue to 67th Avenue, and the Cities of Glendale and Peoria proposed constructing the Olive Avenue Storm Drain at the same time. This drain includes detention basins in the vicinity of 79th, 75th and 67th Avenues. The District has agreed to contribute 50%, or up to $4.5 million, for this project.

Union Hills Storm Drain. A storm water drainage problem exists along Union Hills Drive between Skunk Creek, at approximately 59th Avenue and the Black Canyon Freeway. Union Hills Drive is an inverted crown roadway, established while the area was unincorporated, whose elevation is low with respect to adjacent properties and intersection roadways. The drainage area includes runoff from Phoenix, Glendale, and runoff pumped from the Black Canyon Freeway. Phoenix, Glendale, and the District shared the study costs and are now proposing to share construction costs. It is proposed that the District's contribution be approximately $3.5 million. An agreement is presently being negotiated.

East Fork Cave Creek. A study of flooding problems along the East Fork of Cave Creek was completed in 1987. The area is growing rapidly and rights-of-way for basins and channels must be purchased soon while some land is still vacant. Phoenix and the District have proposed sharing the costs of design and right-of-way acquisition for the later construction of flood control projects. The District contribution for land rights is proposed to be approximately $5.5 million. Phoenix and the District are now discussing an intergovernmental agreement.



H. Scott Clement, a Project Manager who helped negotiate the Price Drain agreement. This agreement provides for an outlet for flood waters from the Mesa/Chandler area.

Price Drain. The District has been working with communities in the east valley to find an outlet for storm waters. A number of projects have been developed, including the 48th Street Storm Drain, the Gila Drain, the ADOT Pit and Diversion Channel, and two basins in Gilbert. The last project in this group, the Price Drain, is now under construction. The Price Drain will provide drainage facilities for the Price/Pima Expressway and a storm water outlet for Mesa and Chandler. The District has agreed to contribute about $8.4 million for the Price Drain.

Old Cross Cut Canal. The Flood Control District is sharing the cost of a feasibility study with the U.S. Army Corps of Engineers for flood control in the Arcadia area. The proposed project would use the Old Cross Cut Canal as an outlet to the Salt River.

Concurrently, the City of Phoenix and ADOT have plans to build the Hohokam Freeway/Parkway north to Indian School Road using the right-of-way of the Old Cross Cut Canal. This requires that the canal be relocated and placed in a closed conduit north of McDowell Road. The District and Phoenix have agreed to pay the incremental cost of upsizing a replacement for the Old Cross Cut Canal from McDowell Road to the Salt River. The District's share for upsizing the canal is estimated to be $2 million. Future cost sharing agreements are anticipated for the project north of McDowell Road.

East Maricopa Floodway Extension. Mesa would like to provide an outlet for storm drainage facilities to the north and east of the East Maricopa Floodway. This outlet would extend the floodway to a point approximately 700 feet north of Brown Road. The District proposes to share the cost of this project with Mesa at a cost of $218,500.

Non-structural Protection from Flooding

Valerie Rice, a hydrologist working on computer modeling of District watersheds. Her work often takes her into the field to update data and check conditions, but much of her time is spent indoors with maps, data books, the computer, and her football cup.

A flood in an urban area can wipe out thousands of dollars in business and personal property. In rural areas, it can destroy unprotected homes and farms. Worst of all, flooding endangers lives. The Flood Control District has worked to prevent such damages, in part through structural solutions such as dams. But an increasing component of the District's work is in non-structural solutions, such as floodplain and drainage regulation, which can alleviate flood damages and protect people and property before an emergency arises.

Floodplain Management—"Floodplain" means the areas adjoining the channel of a watercourse, including areas where drainage may be restricted by man-made structures which may be covered partially or wholly by floodwater from the 100-year flood. The District delineates floodplains and restricts development to uses that are compatible with the floodplain and adequately protected from flood flows.

By regulating the use of floodplains and by reviewing residential, commercial, and industrial development plans, the District sees that new developments will not have or cause drainage problems. It reviews development plans in unincorporated areas outside the floodplains to be sure the development will not adversely affect adjoining property by diverting or increasing runoff or cause drainage and flooding problems within the development itself.

The *Floodplain Regulation for Maricopa County* is a resource for this work. This regulation guides developers and property owners in obtaining permits for development within various areas of a floodplain. They specify the areas in which development can take place, the types of development to be permitted in each area, and the permitting and insurance requirements for different uses of the land within the floodplain.

The District has used great care in putting together these regulations under the review of the Flood Control Advisory Board and the Board of Directors. This year they were updated and revised to reflect changes in federal and state policies. The District will continue to maintain them and other such protective measures in the coming years.

The chart below shows the floodplain management work load during the last three years.

Fiscal Year:	85-86	86-87	87-88
Floodplain Use Permits	20	49	57
Floodplain Variances	20	13	6
Appeals	4	0	1
New Delineations	10	7	14
FCD Clearances	78	55	31
Violation Cases	11	10	6
Referrals to County Atty	0	3	2

Drainage Criteria—The District reviews and inspects drainage facilities in the unincorporated areas of Maricopa County to insure that no development alters the course or amount of drainage downstream of its own lot. Proposed drainage regulations for the county would require that every developer retain all surface runoff water originating in that lot. Our staff reviews development plans to see that such requirements are met in the design of a structure and later inspect the facility to see that all goes as designed.

Besides performing drainage review for the unincorporated areas of Maricopa County, the District also performs reviews for jurisdictions that request our services, on a fee-for-service basis. This year, we took over drainage review for the newly incorporated town of Cave Creek and the City of Litchfield Park.

The chart below shows the work load of the Drainage Branch during the last three years.

Fiscal Year:	85-86	86-87	87-88
Zoning Cases Reviewed (including Resubmittals)	259	370	357
Subdivision Cases Reviewed	55	94	94
Master Plans Reviewed	10	11	2
Board of Adjustment Cases Reviewed	21	106	128
Drainage Inspections	462	916	579

Drainage Regulation—Until recently, each city has operated by its own set of regulations on drainage. While each of these, in itself, is competently handled, the result is a multitude of regulations, each slightly varying from the other, by which engineers in the valley must design. The District is working to improve and standardize drainage policies throughout the county.

In response to the need for more uniform drainage requirements for the various jurisdictions in Maricopa County, the District facilitated a task force on Uniform Drainage Standards. This group planned a set of standards

for all cities, towns, and the county, which is being compiled in three phases.

Phase I: *The Uniform Drainage Policies and Standards for Maricopa County, Arizona* is a consolidation of various agencies' common approach to drainage management. The policies advocate master drainage planning, a central library for drainage reports, multiple uses of drainage works, and common storage facilities rather than on-lot retention. The standards provide criteria for water storage facilities and their drainage.

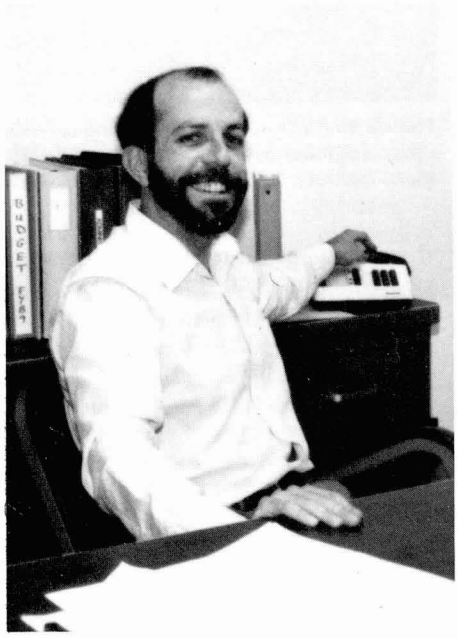
Phase 2: This two-part design manual is currently being prepared. It will outline the application of the policies and standards. One part will present methods for calculating peak discharges and volumes of water for which drainage engineers must design. The other will outline criteria and methods for these designs.

Phase 3: Maricopa County area rainfall maps will be reviewed and updated to insure that the best available precipitation data is used as a basis for drainage design.

Watershed Management Branch—A watershed, for a given point, is all the upstream land area that would drain to that point. The Watershed Management Branch is a new branch of the District, developed to facilitate the planning functions of the District, and ultimately to help make drainage design throughout the county more uniform. It generates mathematical models of watersheds based on hydrologic and hydraulic information.

The District's goal is to provide complete, accurate, and up-to-date information on any aspects of the watershed that would effect water flow, such as storm drains, land development, and highways. There are many uses for such information.

It can be used to **quantify flood hazards** within a given location, to predict the magnitude and frequency of potential flooding, and to assess whether they warrant a project's development.



Greg Rodzenko, a hydrologist who wrote a paper on overbank storage and urban development which he presented at a national conference on floodplain management (see next page).

It can be used to **generate data for floodplain mapping studies.**

It saves time and money that would otherwise be spent "recreating the wheel." Currently, a developer preparing to design drainage facilities for an area must pull together various data for assessing drainage patterns in that area, creating a new study any time an area is to be developed. Instead the Watershed Management Branch would **maintain up-to-date models of each area, which could be used by the District, by cities, and by developers.**

It **facilitates consistent design of structures throughout the district.** At present, a variety of methods are used to assess drainage needs. This data would offer a consistent reference on which to base design throughout the county. It would also enable developers to see data for the larger area in which their development is planned.

It allows us to **monitor the impacts of developments on the effectiveness of hydrologic structures,** as when more runoff is getting to a dam and decreasing its level of protection.

Staff began this year to compile the data for this enormous undertaking. In some cases we are detailing areas as large as 30 sq. miles down to 1/10 sq. mile. It is a lengthly process, but there are many benefits to look forward to as a result, and exciting work along the way.

CONTRACTS AWARDED FISCAL YEAR 87/88
(Preliminary and Unaudited)

Type of Contract	Number	Contract Amount Including Contingencies
Appraisal	7	$ 305,000
Aerial and Mapping Services	1	57,000
Construction	10	4,424,000
Engineering Services	30	2,807,000
Legal Services	5	775,000
Relocation Assistance	1	524,000
Rental Property Maintenance	16	58,000
Wellness Program	1	15,000
Total	71	$8,965,000

Innovations Gain Recognition for the District

Employees at the District received local and national recognition for their hard work and original thinking over the last year. These kudos acknowledged the staff's continuing commitment to explore new ways to serve the public. Unfortunately, there are always ideas and activities that get overlooked. We are proud that these didn't.

Award-winning innovators Jay Paxson, Ron Nevitt, Linda Young, David Johnson, Davar Khalili, and Dick McNamara. Each submitted a NACo proposal and won.

NACo Awards

The District received six awards this year from the National Association of Counties (NACo). The NACo awards give national recognition to innovations that improve the organization, management, or services of member counties. Below is a summary of our six winning proposals.

Reconstructive Hydrology Method. A system of volunteer observers and precipitation gauges supplements data from our flood warning system. Through this combination, we can create reliable models of rainfall events after they occur.

Hylink, A Procedure for Efficient Data Management. Data on the geometric shape and flow of local bodies of water has previously been available to the public only by a lengthy and inefficient photocopying process. We now isolate a segment of information in our computer file, then copy it onto a diskette for the person requesting the information, saving both time and money.

Elroy Stone receiving his Suggestion Program Award and check from County Supervisor Fred Koory, Jr.

Rental of Spoil Sites for Flood Control Projects. Usually we buy land for spoil sites for our projects. One owner was unwilling to sell, but was interested in using the soil to increase his land value. We leased the land as a soil disposal site for $2,475.00 instead of paying $1,205,000.00 to buy it—we saved money and the owner benefited.

County-Wide Flood Insurance Mapping Program. We were a pilot program for county-wide mapping for the Federal Emergency Management Association. We coordinated map review by communities in Maricopa County and now have a set of Flood Insurance Maps that offer the most current data available and a consistent county-wide design.

High-Tech Irrigation Technology Using a Telemetered Computer System. On the ACDC, we combined state-of-the-art drip irrigation technology with radio-linked computers and on-site sensors for remote data acquisition and analysis. We can now monitor and manage the ACDC irrigation remotely from District offices.

Lease of Flood Control Property to Maricopa County Human Resources Department. We have arranged with Human Resources to lease excess property to a battered womens' shelter. Among the benefits: the public is served, we are in a good position regarding liability, our maintenance burden is reduced, and the land is productively used.

Suggestion Award

In 1987, a Suggestion Award was made to Elroy Stone, a District maintenance technician. Mr. Stone proposed that we purchase a stationary type shielded metal arc welder which could be used in the shop area. Its use frees up our portable welder for field welding operations only, thereby extending the portable unit's life. The stationary welder has more varied uses, and has lower operating costs. This suggestion will save the District $2,685 per year, and it earned Mr. Stone $268 for his resourcefulness.

In 1988, Dr. Davar Khalili received a Suggestion Award for his Hylink procedure, which also earned him a NACo Award (see above). The procedure saved the District $3,770 per year. Dr. Khalili was awarded 10% of the first year's savings, or $377, for this suggestion.

Publications

Three District hydrologists wrote a paper for the District on overbank storage which was delivered at a national conference in May 1988. Greg Rodzenko, Joe Tram, and Doug Plasencia wrote the paper. The primary author, Greg Rodzenko, presented the paper at the Association of State Floodplain Managers' Annual Conference in Nashville, Tennessee.

This paper reminds the country's floodplain managers that overbank storage is damaged or eliminated by encroachment caused by urban development. Each jurisdiction must compensate for this encroachment to maintain the floodplain's balance, or cause significant flooding problems in downstream communities. Most importantly, alterations to rivers cannot be made in a piecemeal fashion, but must be system-wide.

On his own time, Dr. Davar Khalili, one of the District's hydrologists, has co-authored a paper which is to be published in the Water Resources Bulletin. The paper describes the ecological processes that a rangeland watershed goes through because of human activities such as land development and cattle grazing.

Because of limited rainfall and soil moisture content in these areas, human activities tend to aggravate a process called desertification. Growth of native grasses decreases, increasing soil erosion and crusting. This in turn makes it harder for native grasses to grow. In this situation, more rugged plant species increase, such as scrub brush.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
STATEMENT OF REVENUES, EXPENDITURES AND CHANGES IN FUND BALANCE
BUDGET AND ACTUAL
YEAR ENDED JUNE 30, 1988
(Preliminary & Unaudited)

REVENUES	BUDGET	ACTUAL	VARIANCE FAVORABLE (UNFAVORABLE)
Flood Control District Tax Levy	$48,000,000	$46,059,000	$(1,941,000)
State Share of Costs			
Federal Projects	0	498,000	498,000
Local Projects	0	28,000	28,000
County Reimbursement	739,000	11,000	(728,000)
Local Participation	1,774,000	701,000	(1,073,000)
Rental	625,000	554,000	(71,000)
Interest Earnings	1,360,000	1,904,000	544,000
Sale of Excess Land	8,000,000	2,187,000	(5,813,000)
Miscellaneous	800,000	80,000	(720,000)
Total Revenues	61,298,000	52,022,000	(9,276,000)
EXPENDITURES			
Personnel Services			
Salaries and Wages	5,496,000	4,419,000	1,077,000
Overtime	56,000	4,000	52,000
Total	5,552,000	4,423,000	1,129,000
Supplies and Services			
Professional Services Contracts	3,040,000	1,301,000	1,739,000
Maintenance Contracts	552,000	472,000	80,000
Maintenance Supplies	410,000	243,000	167,000
Insurance	24,000	25,000	(1,000)
Other Supplies and Services	994,000	680,000	314,000
Total	5,020,000	2,721,000	2,299,000
Capital Outlay			
Real Estate	25,769,000	14,791,000	10,978,000
Engineering & Scientific Equip.	5,839,000	2,311,000	3,528,000
Motor Vehicles & Equipment	721,000	1,037,000	(316,000)
Const. & Other Capital Outlay	33,779,000	30,761,000	3,018,000
Total	66,108,000	48,900,000	17,208,000
Total Expenditures	76,680,000	56,044,000	20,636,000
Excess (Deficiency) of Revenues over Expenditures	(15,382,000)	(4,022,000)	11,360,000
Fund Balance at Beginning of Year	26,607,000	27,138,000	531,000
Fund Balance at End of Year	$11,225,000	$23,116,000	$11,891,000

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
EXPENDITURES BY ACTIVITIES AND FUNCTIONS *
FY 87/88
(Preliminary & Unaudited)

ACTIVITY	OPERATIONS EXPENDITURES		CAPITAL IMPROVEMENTS PROGRAM		
	Administrative	Maintenance	Engineering	Lands	Relocation & Construction
Administrative Overhead	$2,270,000	$ 37,000	$ 1,000	$1,761,000	$ 36,000
Maintenance Overhead	6,000	1,456,000			
FCD Yard Maintenance		88,000			
USGS Service Work	24,000				
Enforcement of Flood-plain Regulations	27,000				
Work done for Planning & Development	277,000				
Watershed Hydrology	140,000				
Work done for County Highway Department					
Floodplain Delineation	768,000				
Flood Insurance	67,000				
Hydrologic Data Collection	95,000	4,000			
Flood Warning System	51,000	47,000			46,000
Flood Emergency Operations	1,000	1,000			
Floodplain Administration	199,000				
Computer Systems	83,000				
City of Glendale	2,000				
City of Mesa		2,000			
City of Phoenix	8,000				
City of Scottsdale					19,000
City of Tempe					225,000
Dysart Road - Agua Fria Drain	2,000	7,000			
48th Street Drain		5,000			
Alma School Drain	2,000	7,000			
Old Cross Cut Canal	15,000	46,000	83,000		
Broadway Road Bank Stabilization			1,000		
Salt/Gila Clearing & Channelization	12,000	192,000			
Salt/Gila Control Works	5,000	11,000	46,000	12,000	322,000
Sossaman Road		9,000			
Agua Fria River	4,000	24,000			
Agua Fria River (ADOT Agreement)	4,000		484,000		5,532,000
Indian Bend Wash Outlet	1,000	17,000			
Indian Bend Wash Inlet	4,000	17,000			
Indian Bend Wash Interceptor and Side Channels	1,000	25,000			
Gila Drain	3,000		286,000		931,000
ACDC	10,000	340,000	772,000	9,026,000	10,010,000
EMF-Williams/Chandler	4,000	104,000	1,000	2,000	39,000
EMF-Apache Jct./Gilbert	1,000	1,000	10,000	92,000	147,000
EMF-Buckhorn/Mesa	2,000		16,000	11,000	300,000
Rio Salado	1,000				
Salt River Channel - ADOT	3,000				

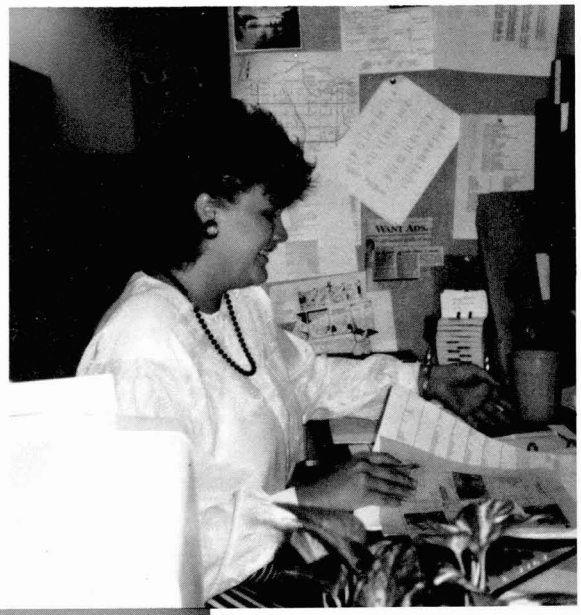
ACTIVITY	OPERATIONS EXPENDITURES		CAPITAL IMPROVEMENTS PROGRAM		
	Administrative	Maintenance	Engineering	Lands	Relocation & Construction
White Tanks Dam #3		25,000			
White Tanks Dam #4		8,000			
McMicken Dam	3,000	29,000			
Dreamy Draw Dam		8,000			
McMicken Dam Outlet Channel	2,000	42,000			
Guadalupe Dam	7,000	2,000			
Buckeye #1		45,000			
Buckeye #2		10,000	1,000		
Buckeye #3		8,000			
El Mirage Rd. Drain Channel		14,000			
Spook Hill FRS & Outlet	4,000	39,000			
Signal Butte Floodway		9,000			
Pass Mountain FRS & Outlet		3,000			37,000
Apache Jct. FRS, Floodway, Outlet and Bulldog Floodway	1,000	11,000	13,000	3,000	6,529,000
Signal Butte FRS		9,000			
Powerline Dam		4,000			
Powerline Floodway		22,000			
Vineyard Road FRS		19,000			
Rittenhouse FRS		10,000			
Harquahala FRS & Floodway		18,000			
Saddleback FRS		6,000			
Saddleback Diversion Channel		2,000			
Centennial Levee	2,000	2,000		127,000	
Harquahala Floodway	1,000	1,000			
Sunset FRS		5,000			
Sunnycove FRS		3,000			
Sunset/Sunnycove Pipeline		5,000			
Wittmann ADMS	5,000		82,000		
Cave Buttes Dam	1,000	39,000			
Adobe Dam	3,000	32,000		807,000	
Skunk Creek Channel at I-17		11,000			
New River Dam		40,000		18,000	
Skunk Creek and New River Flowage Easements	6,000	74,000	395,000	1,976,000	3,939,000
Agua Fria River Flowage Easements	10,000		37,000	1,214,000	609,000
East Maricopa ADMS			11,000		
Glendale-Peoria ADMS	14,000		196,000		
East Fork Cave Creek ADMS	3,000		13,000		
Queen Creek ADMS	3,000		35,000		
Bell Road Expansion	27,000		36,000		3,000
Plan VI Funding	2,000				2,466,000
Groundwater Recharge	105,000				
Total	$4,291,000	$2,995,000	$2,519,000	$15,049,000	$31,190,000

* Expenditures by Activities and Function will not always agree with Expenditures by Task in the Financial Highlights chart (inside front cover) except in total.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
RENTAL PROGRAM FY 87/88
(Preliminary & Unaudited)

Project Name	# of Leasable Properties*	# Leased*	Vacancy Rate	Gross	Net
Arizona Canal Diversion Channel	88	78	11.4%	$497,000	$287,000
East Maricopa Floodway	3	3	0.0%	31,000	30,000
Signal Butte Floodway	2	2	0.0%	11,000	10,000
Apache Junction FRS & Bulldog Floodway	2	2	0.0%	7,000	(2,000)
Skunk Creek/New River	3	3	0.0%	5,000	(1,000)
Agua Fria River	1	1	0.0%	4,000	4,000
New River Dam	1	1	0.0%	3,000	3,000
Adobe Dam	1	1	0.0%	2,000	0
Cave Buttes Dam	1	1	0.0%	2,000	1,000
Indian Bend Wash	2	2	0.0%	$ 1,000	1,000
Total	104	94	9.6%	$563,000	$333,000

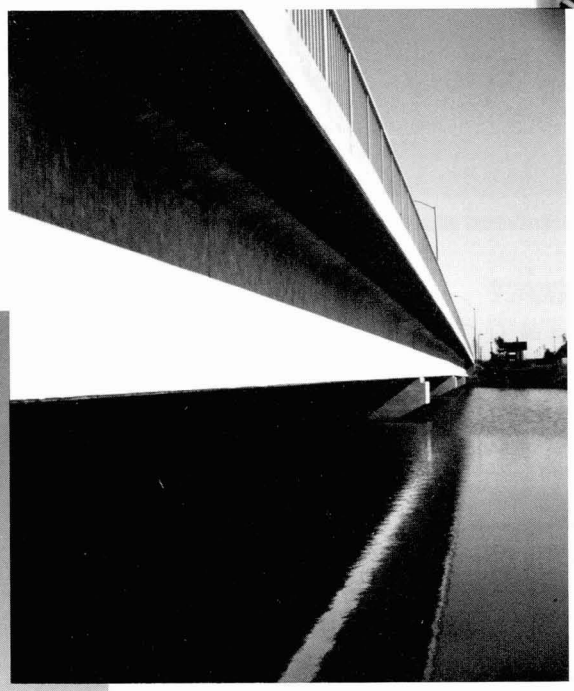
* Average of Beginning and End of FY 87/88

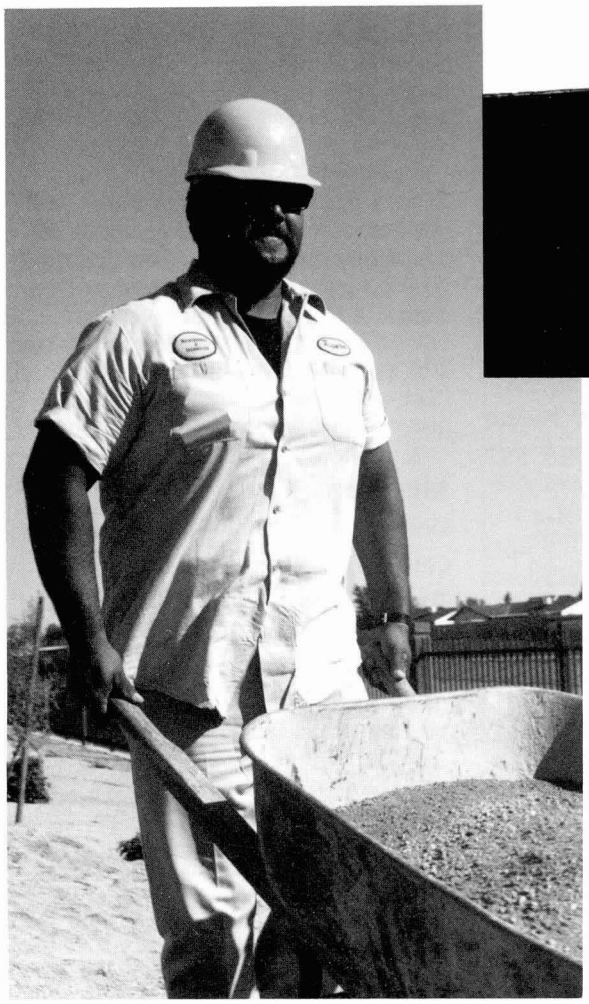


Above: Beth Jensen, Administrative Co-ordinator in the Land Management Division.

Right: A bridge over the Arizona Canal Diversion Channel (ACDC). Because the ACDC is through Metropolitan Phoenix, the District has been able to lease much of the project's property, pending construction.

Below: Carlos Rivera, a Maintenance Technician II, landscaping ACDC Reach 2A.





EXPENDITURES ON LAND
BREAKDOWN BY PROJECT
(Preliminary and Unaudited)

Project	Number of Parcels Bought This Year	FY 87/88 Total Land Acquisition Costs	% of Land Acquired To Date
Administrative Facility	1	$ 1,761,000	100%
Adobe Dam	1	807,000	100%
Agua Fria River	34	1,214,000	60%
Apache Junction/ Bulldog Floodway	7	3,000	100%
Arizona Canal Diversion Channel	43	9,026,000	90%
Centennial Levee	1	127,000	100%
East Maricopa Floodway	20	105,000	99%
New River Dam	2	18,000	100%
Salt Gila	1	12,000	75%
Skunk Creek/New River	54	1,976,000	25%
Total	164	$15,049,000	

Board of Directors

Board of Directors: George Campbell, Robert Mauney (County Manager), Fred Koory, Jr., Tom Freestone, Carole Carpenter, Ed Pastor.

Flood Control District

The Flood Control District of Maricopa County, founded in 1959, is a municipal corporation and political subdivision of the State of Arizona. The District is governed by a Board of Directors which is also the Board of Supervisors of Maricopa County. A Flood Control Advisory Board advises the Board of Directors.

The purpose of the District is to prevent loss of life or injury to residents of Maricopa County and to eliminate or minimize flood damages to real and personal property. In fulfilling its purpose, the District:

1. Provides floodplain management for Maricopa County and certain municipalities within the County.
2. Provides stormwater drainage review for the unincorporated area of Maricopa County.
3. Studies flooding and drainage problems and plans and constructs projects alone or in cooperation with others.
4. Acts as the local sponsor of federal flood control projects designed and constructed by the U.S. Army Corps of Engineers and the Soil Conservation Service. The District acquires the necessary rights-of-way and relocates facilities and people affected by the projects.
5. Operates and maintains completed flood control structures.
6. Assists in providing early warning of potential floods and provides technical leadership during flood emergencies. Collects and distributes hydrometeorological data from the District's rain and stream gauge network.

The activities of the District are funded by a Flood Control Tax Levy assessed on all real property within Maricopa County and a variety of cost sharing arrangements with the State, Maricopa County and local governments.

HISTORY OF THE TAX LEVY RATE
FOR THE FLOOD CONTROL DISTRICT

For fiscal year ending	Levy Rate per $100 assessed value	Tax Revenue
1961	0.05	$ 253,000
1962	0.05	$ 288,000
1963	0.02	$ 126,000
1964	0.02	$ 135,000
1965	0.02	$ 145,000
1966	0.02	$ 153,000
1967	0.02	$ 158,000
1968	0.02	$ 164,000
1969	0.05	$ 446,000
1970	0.05	$ 454,000
1971	0.05	$ 480,000
1972	0.04	$ 425,000
1973	0.05	$ 645,000
1974	0.20	$ 3,428,000
1975	0.20	$ 3,747,000
1976	0.20	$ 4,154,000
1977	0.20	$ 4,395,000
1978	0.20	$ 4,675,000
1979	0.20	$ 5,026,000
1980	0.20	$ 5,342,000
1981	0.43	$11,825,000
1982	0.34	$13,720,000
1983	0.50	$21,779,000
1984	0.48	$25,780,000
1985	0.50	$28,697,000
1986	0.50	$33,644,000
1987	0.50	$41,566,000
1988	0.50	$46,059,000

Board of Directors

The Board of Directors of the Flood Control District is also the Board of Supervisors of Maricopa County. The Board consists of five elected representatives, one from each of the five Supervisorial Districts of the County. Under the Board's supervision, the District has all the powers, privileges and immunities granted generally to municipal corporations. The Board of Directors exercises all powers and duties in the acquisition and operation of District properties, contracting, and in carrying out regulatory functions as ordinarily exercised by governing bodies.

Members

George Campbell, District 2

Carole Carpenter, District 4

Tom Freestone, District 1, *Chairman* January 4, 1988 to June 30, 1988

Fred Koory, Jr., District 3, *Chairman,* July 1, 1987 to January 4, 1988

Ed Pastor, District 5

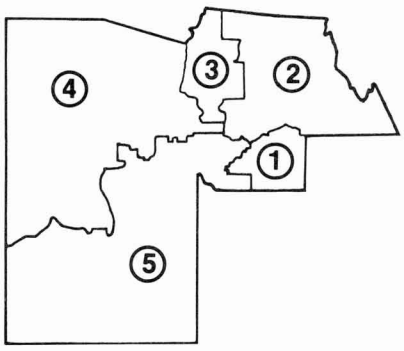
Flood Control Advisory Board

Flood Control Advisory Board: Charles A. Sykes, John E. Miller, Jr., Robert Towner, H. Lynn Anderson, David Harmon (City of Phoenix), William LoPiano, Tim Phillips.

Flood Control Advisory Board

The Flood Control Advisory Board advises the Board of Directors on flood control, water conservation and related matters. It reviews planning, operations, and maintenance of flood control facilities, and recommends an annual budget to the Board of Directors.

The Advisory Board consists of seven members, appointed by the Board of Supervisors to five-year terms. At least one member must be a resident of the City of Phoenix. The Phoenix City Engineer and the General Manager of the Salt River Project, or their representatives, are ex-officio members of the Advisory Board.



The boundaries of the Supervisorial Districts are drawn by the Maricopa County Board of Supervisors to give each an equal share of the population.

Members

H. Lynn Anderson, District 4, *Chairman,* November 1987 to June 1988

James Atteberry, *ex-officio member,* City of Phoenix, July 1987 to March 1988

William LoPiano, District 1

Ramon Miguez, *ex-officio member,* City of Phoenix, March 1988 to June 1988

John E. Miller, Jr., District 2

Charles A. Sykes, District 3, *Chairman,* July 1987 to October 1987

Robert Towner, District 5

Tim Phillips, *ex-officio member,* Salt River Project, September 1987 to June 1988

Don Womack *ex-officio member,* Salt River Project, July 1987 to September 1987

Principal District Staff

D. E. Sagramoso, Chief Engineer and General Manager

Stanley L. Smith, Jr., Deputy Chief Engineer

David A. Brozovsky, Flood Control Administrator

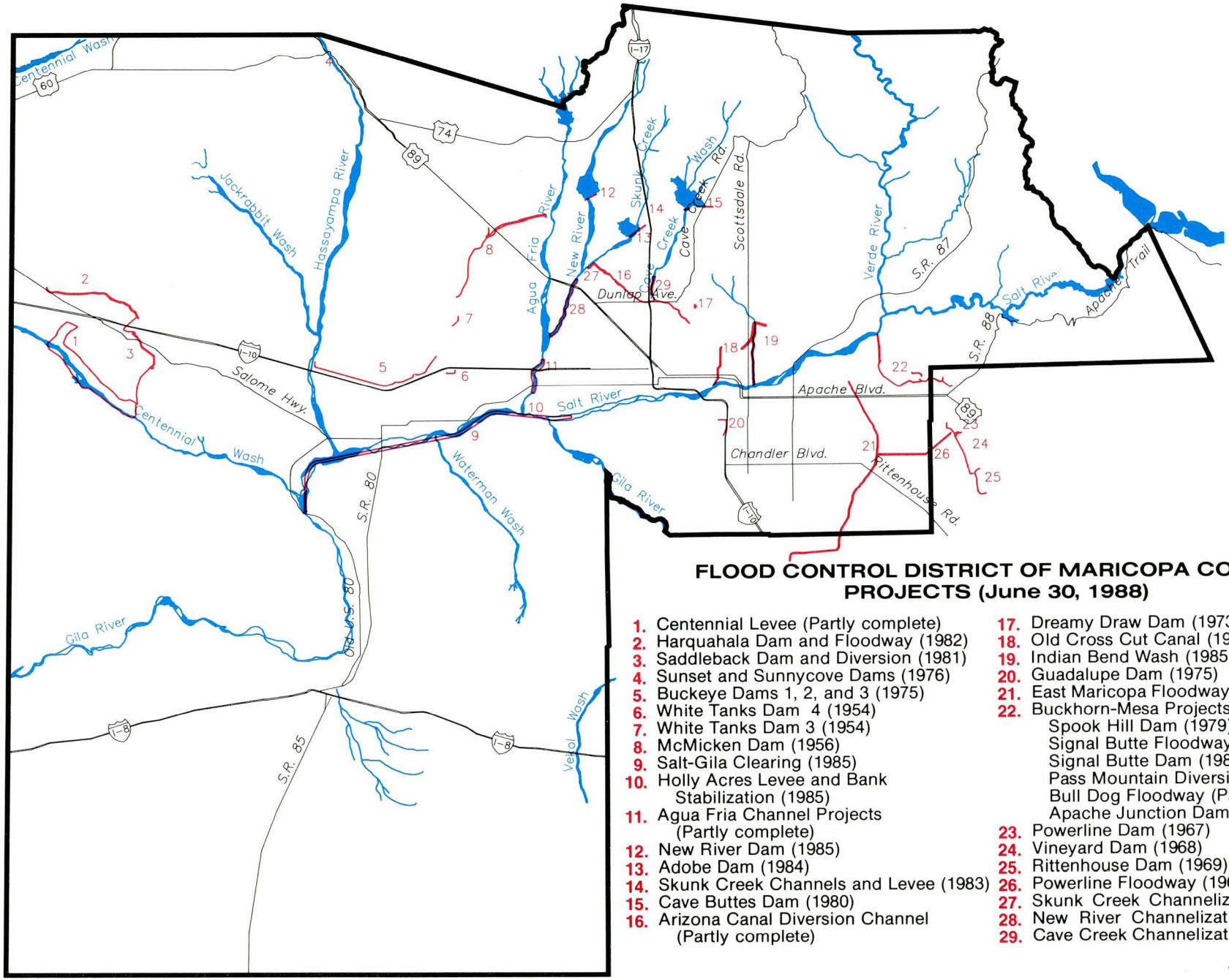
Robert C. Payette, Chief, Construction and Operations Division

Nicholas P. Karan, Chief, Engineering Division

David R. Johnson, Chief, Hydrology Division

Edward D. Opstein, Chief, Land Management Division

John E. Rodriguez, Chief, Planning and Projects Management Division



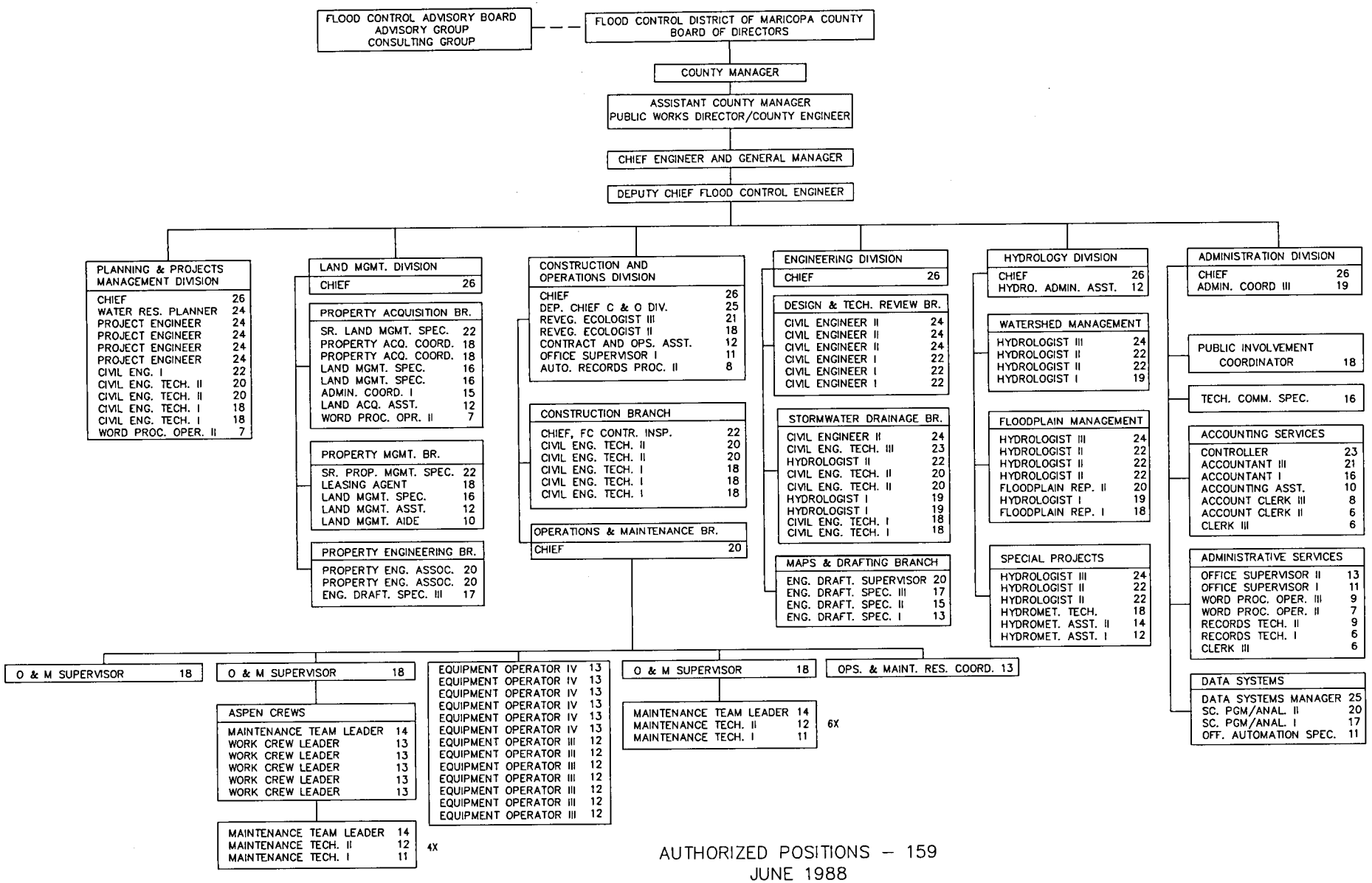
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY PROJECTS (June 30, 1988)

1. Centennial Levee (Partly complete)
2. Harquahala Dam and Floodway (1982)
3. Saddleback Dam and Diversion (1981)
4. Sunset and Sunnycove Dams (1976)
5. Buckeye Dams 1, 2, and 3 (1975)
6. White Tanks Dam 4 (1954)
7. White Tanks Dam 3 (1954)
8. McMicken Dam (1956)
9. Salt-Gila Clearing (1985)
10. Holly Acres Levee and Bank Stabilization (1985)
11. Agua Fria Channel Projects (Partly complete)
12. New River Dam (1985)
13. Adobe Dam (1984)
14. Skunk Creek Channels and Levee (1983)
15. Cave Buttes Dam (1980)
16. Arizona Canal Diversion Channel (Partly complete)
17. Dreamy Draw Dam (1973)
18. Old Cross Cut Canal (1975) (Restudy)
19. Indian Bend Wash (1985)
20. Guadalupe Dam (1975)
21. East Maricopa Floodway (Partly complete)
22. Buckhorn-Mesa Projects:
    - Spook Hill Dam (1979)
    - Signal Butte Floodway (1984)
    - Signal Butte Dam (1987)
    - Pass Mountain Diversion (1987)
    - Bull Dog Floodway (Partly complete)
    - Apache Junction Dam (Partly complete)
23. Powerline Dam (1967)
24. Vineyard Dam (1968)
25. Rittenhouse Dam (1969)
26. Powerline Floodway (1968)
27. Skunk Creek Channelization (Partly complete)
28. New River Channelization (Partly complete)
29. Cave Creek Channelization (Partly complete)

JUNE 30, 1988

ORGANIZATIONAL CHART

POSITIONS AND PAY GRADES



AUTHORIZED POSITIONS – 159

JUNE 1988