75 YEARS OF PROGRESS

ESTABLISHED 1945

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

INTRODUCTION

This book celebrates the contributions made by the Riverside County Flood Control and Water Conservation District during its 75 years of safeguarding the lives and property of its citizens. It is by no means a comprehensive history, but nonetheless highlights the more significant triumphs and challenges of the many people who have contributed to making the District the respected organization it is today.

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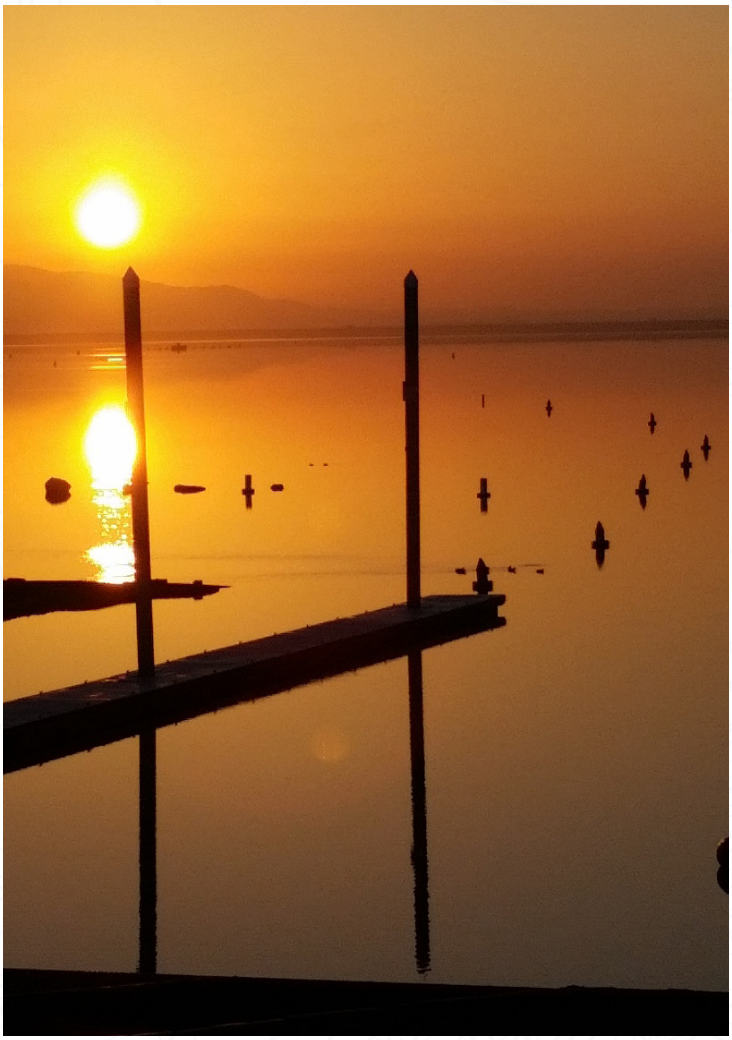


THE DISTRICT'S BOARD OF SUPERVISORS

The Riverside County Board of Supervisors serves as the District's ex-officio legislative body in accordance with the District Act. The District's management and staff have been privileged to serve a long line of outstanding elected Board members. Our accomplishments are due in large part to the Board's leadership and vision, and the flexibility given to District staff to align the pursuit of our mission to manage stormwater in service of safe, sustainable, and livable communities with that vision.

Kevin Jeffries
First District

Karen Spiegel
Second District, Chair,
Riverside County Flood
Control and Water
Conservation District
Board of Supervisors

2020

Chuck Washington
Third District

V. Manuel Perez
Fourth District

Jeff Hewitt
Fifth District, Vice-Chair
Riverside County Flood
Control and Water
Conservation District
Board of Supervisors

HONORING GENERAL MANAGER-CHIEF ENGINEERS

The District's 75 years of accomplishments are due in large part to the expert planning, hard work, and unwavering dedication of the District team. Each General Manager-Chief Engineer contributed their own style of leadership. These leaders encouraged and challenged the District team to innovate, reach for new goals and expertly serve the complex needs of our communities, thus, promoting the overall excellence that has become the hallmark of the District.

Max Bookman
1946-1950

John W. Bryant
1953-1978

Kenneth L. Edwards
1978-1995

David P. Zappe
1996-2003

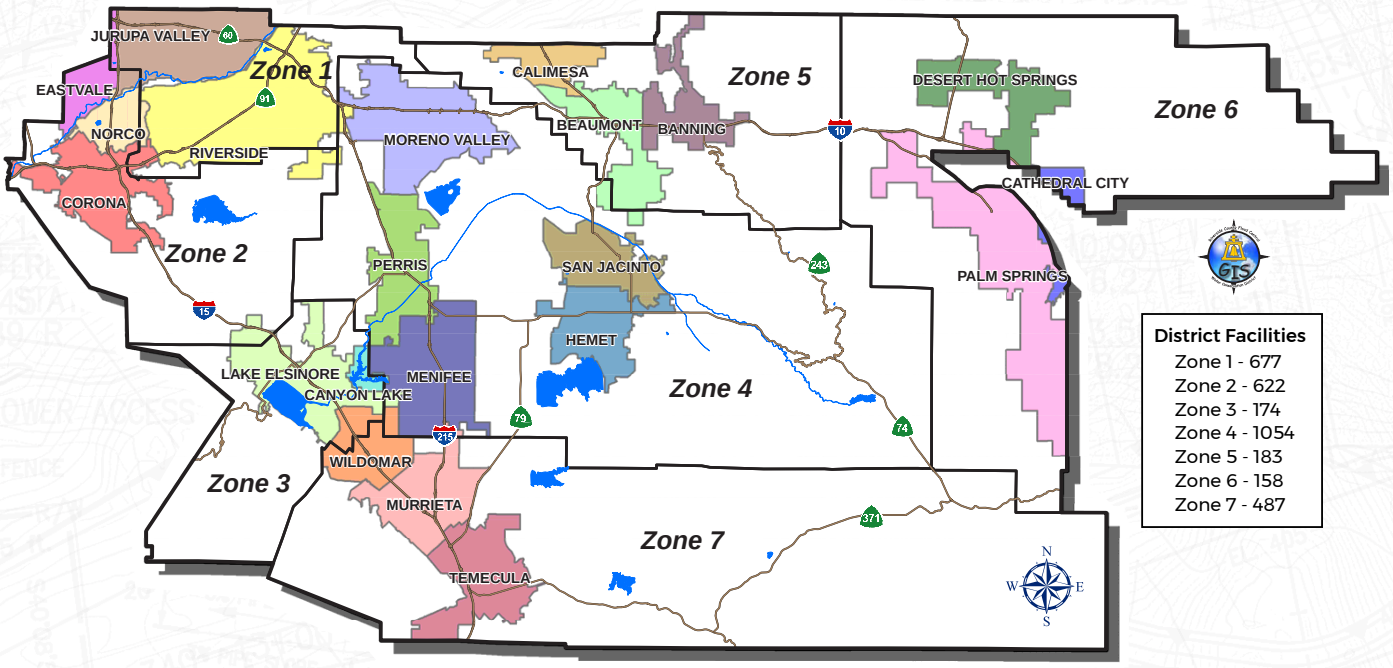
Warren D. "Dusty" Williams
2003-2016

Jason E. Uhley
Appointed in 2016

DISTRICT ZONE BOUNDARIES

The District is divided into seven geographically defined funding zones. The District collects tax revenues within both the unincorporated and incorporated portions of each zone. The revenue generated in each zone must be spent on projects that benefit that respective zone.

This map shows the total amount of District facilities that have been constructed since its inception in each respective zone.



CELEBRATING 75 YEARS OF PROGRESS TIMELINE

The timeline below shows the major milestones in terms of major projects completed and implementation of new programs adopted throughout the last 75 years since the District's birth.

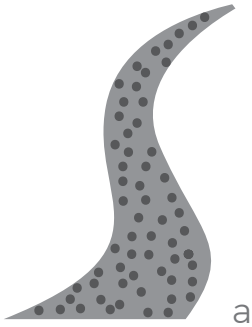
1930	1938	*Ravaging Floods*
1940	1945	*District's Genesis*
1950	1956	*Santa Ana River Levees*
1960	1962	*San Jacinto River Levee*
	1965	*November Floods*
	1969	*January/February Floods*
1970	1970	*District's 25th Anniversary, CEQA Adopted*
	1978	*February/March Floods*
1980	1980	*February Floods, Riverside County Joined NFIP*
	1986	*Santa Ana River Mainstem*
	1988	*Global Positioning System Adopted*
1990	1990	*First NPDES Permit Issued*
	1991	*Tahquitz Creek Project*
	1992	*Geographic Information System*
	1993	*Murrieta Creek Flooding*
	1994	*Lake Elsinore Outlet Channel, Oak Street Channel*
	1995	*District's 50th Anniversary*
	1999	*Seven Oaks Dam Completed*
2000	2000	*Murrieta Creek Project, Phase 1*
	2004	*MSHCP Adopted*
	2006	*Gavilan Hills Mitigation Project*
2010	2010	*December Floods*
	2011	*District's LID Facility Project*
	2013	*Day Creek Channel System Completed*
	2015	*Arroyo del Toro Channel*
	2016	*Eagle Canyon Dam, Romoland MDP Line A, CRS Class 7 Certification*
	2018	*Meadowview Stream Restoration Project, Implementing Drone Program, Holy Fire*
	2019	*February Floods, Eastvale ADP Completed*
2020	2020	*District's 75th Anniversary*

DISTRICT

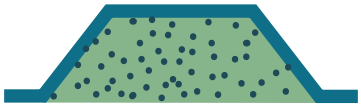
The District strives to be a leader in stormwater management, achieve extraordinary results for Riverside County residents, be the home of high-quality teams, and return value to our community.

The District's inventory of constructed projects now includes:

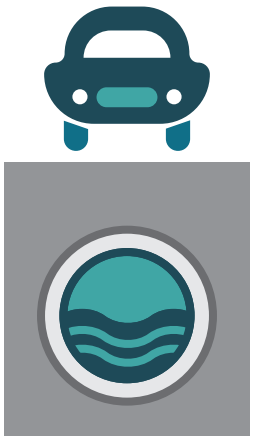
281
miles of channels



289
miles of access roads



28
miles of levees



380
miles of underground storm drains

80
flood control dams, flood retention basins, debris basins

MOST EXPENSIVE CONSTRUCTION PROJECT

$27.4M
Romoland Line A, A-2 & Briggs Road Basin in 2016

LEAST EXPENSIVE CONSTRUCTION PROJECT

$40.9K
South Norco Line SB (Basin) Stage 3 in 1998

ACCOMPLISHMENTS

The District has...

helped remove **2,500 structures** and **2,700 acres** from designated FEMA floodplains since 2008

documented **3,981 flood complaints** from the public since the 1970s

documented **5,294 floodplain inquiries** since 2012

The District has been awarded the **Government Finance Officers Association (GFOA) Certificate of Achievement for Excellence in Financial Reporting** for

28 Consecutive years

1900-1938

***ABOVE**: San Jacinto River flood waters inundating Perris, California in the devastating 1927 flood.*

THE EARLY 20TH CENTURY

Western Riverside County was viewed by its early pioneers as a land of great opportunity but history reveals that there were shortcomings in this "land flowing with milk and honey". Devastating floods that took lives and destroyed property had their way virtually uncurbed during the first half of the twentieth century. In the days of the early settlement of the County, the pioneers suffered damage to their property and took the loss as a part of pioneering. As the County prospered and property became more developed and roads and bridges were constructed, the damages from flooding increased. Citizens began to form coalitions to fight back against the forces of nature by establishing districts meant to combat flooding with the aid from the County, State and Federal Governments.

RIGHT: *Pictured is the old steel bridge over the Santa Ana River which collapsed during high flood flows on January 19, 1916. Two 50-foot spans in the center of the bridge were washed downstream and the loss was estimated at $30,000. In this storm, ranches south of Corona suffered heavy damage when the dam failed at Lee Lake in Temescal Canyon.*

ABOVE: *In March 1938, the Santa Ana River overtopped its banks and flooded a portion of northeast Riverside. Note the high water mark on the trees.*

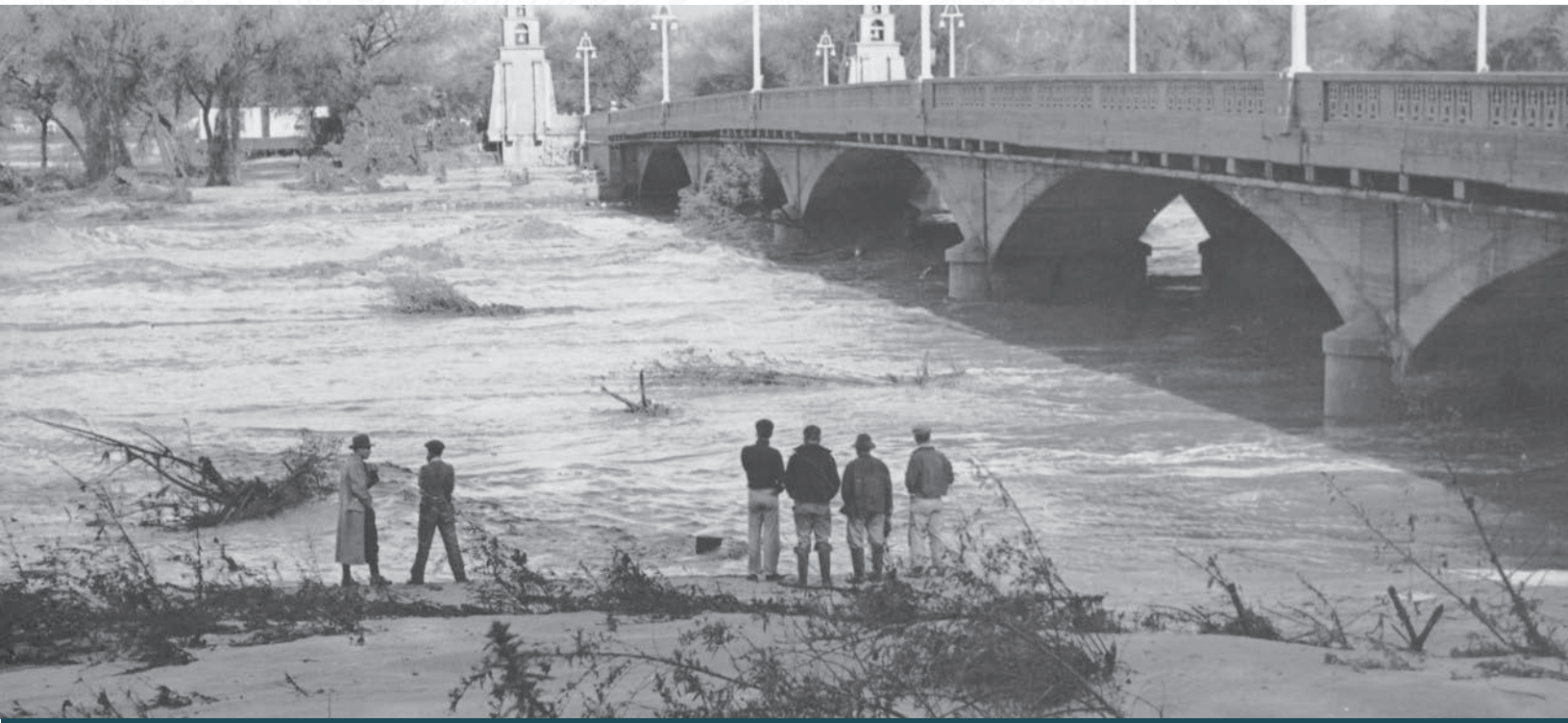
Riverside County weathered many significant storms in its formative years, but it received a wake up call in March 1938. Storms of the past had been limited in their areas of impact and losses had been primarily to agricultural lands and to roads and bridges. Losses had been measured in the tens of thousands of dollars. However, 1938 was different. Nearly all the bridges across the Santa Ana River were swept away, including the Pedley (Van Buren) Bridge, Riverside Bridge, and the Norco Bridge.

The City of Riverside was particularly hit hard by the uncontrolled Santa Ana River, forcing people from their homes in the northern sector of the city. The desert was similarly devastated by the raging Whitewater River. The result was numerous fatalities throughout the County and damages approached a staggering $2 million. That would be equivalent to $35,690,833 today.

BATTLING FLOODS AT HOME

1945

The ravaging floods in 1938 made it painfully clear that the Riverside County government did not have an adequate program for flood protection. In June 1944, as World War II continued to be waged in Europe and the South Pacific, the Riverside County Board of Supervisors decided to wage a war against flooding. San Bernardino County, with the creation of its own flood control district in 1939, provided a blueprint that served as a guide for Riverside County. The process in Riverside County began in June 1944 with each Supervisor appointing three representatives to a group that became known as "the Committee of 15". They were tasked with deciding how to best conduct this local war on flooding.



***ABOVE**: Downstream view of the Mission Bridge over the Santa Ana River during the 1938 floods.*

BELOW: *Mr. Fulmor recognized the need for flood control in the early 1940s and strongly recommended formation of a flood control district to develop plans and construct flood control facilities.*

In 1944, at one of the meetings of the Committee of 15, County Surveyor A. C. Fulmor presented a comprehensive and visionary report. In that report, he made the following observations:

1. *As a general law county "The power of the Board of Supervisors to do work of this kind (flood control) is pitifully inadequate."*
2. *The County focus is on protecting roads and public property, not private property.*
3. *Water conservation is an absolute necessity.*
4. *The Federal Flood Control Act of 1938 provides funding through the United States Army Corps of Engineers (USACE) that the County should pursue. The USACE, however, finds it difficult to work with those counties not having a flood control district.*
5. *A flood control district will provide the opportunity to collect data and guide future planning.*

***ABOVE**: Santa Ana River flooding in March 1938 showing vehicles trapped by floodwaters in northwest Riverside. People were forced from their homes. It was this storm which made it apparent that measures must be taken to start a flood prevention program.*

The Committee, working with the Board of Supervisors, found legislative sponsors which collectively began formulating the District Act. Opposition to inclusion in the proposed district arose in the southwest portion of the County. Signatures were gathered on protest petitions circulated in the communities of Temecula, Murrieta, Wildomar, Elsinore, Anza, and Sage. Despite this opposition, the Board supported the inclusion of this area, and on July 7, 1945, barely a year after the formation of the Committee of 15, AB 892 was approved by the Legislature and signed into law and thus, the Riverside County Flood Control and Water Conservation District was born.

THE DISTRICT IS BORN

1946

Mr. Max Bookman, hired in April 1946 as the District's Chief Engineer and first employee, ushered in the formative years. By July 1946, Mr. Bookman had recruited a secretary, an associate civil engineer, and an engineering aide. Total payroll for July was $1,310. By the end of 1946, six temporary laborers had been hired as a maintenance force at $0.90 each per hour.

Mr. Bookman emphasized the District's water conservation responsibilities. He instituted a groundwater level monitoring program and took over the San Jacinto River Spreading Grounds from Fruitvale Mutual Water Company. Mr. Bookman also began a data gathering system of rain and streamflow gaging stations, and started bank erosion control using apricot tree cuttings placed between wire fences along the San Jacinto River.

***LEFT**: Standing on the Mission Boulevard Bridge reviewing project plans for the Santa Ana River Levees, Riverside, are representatives of the State Water Resources Control Board, U.S. Army Corps of Engineers, Metropolitan Water District, State Engineer Hyatt, County Supervisor Pittman, and (far right) the District's first Chief Engineer, Max Bookman.*

ABOVE: *In 1947, limited funding meant limited flood control facilities. Erosion control along the banks of the San Jacinto River was first accomplished by placing apricot tree trimmings contained by wire fencing.*

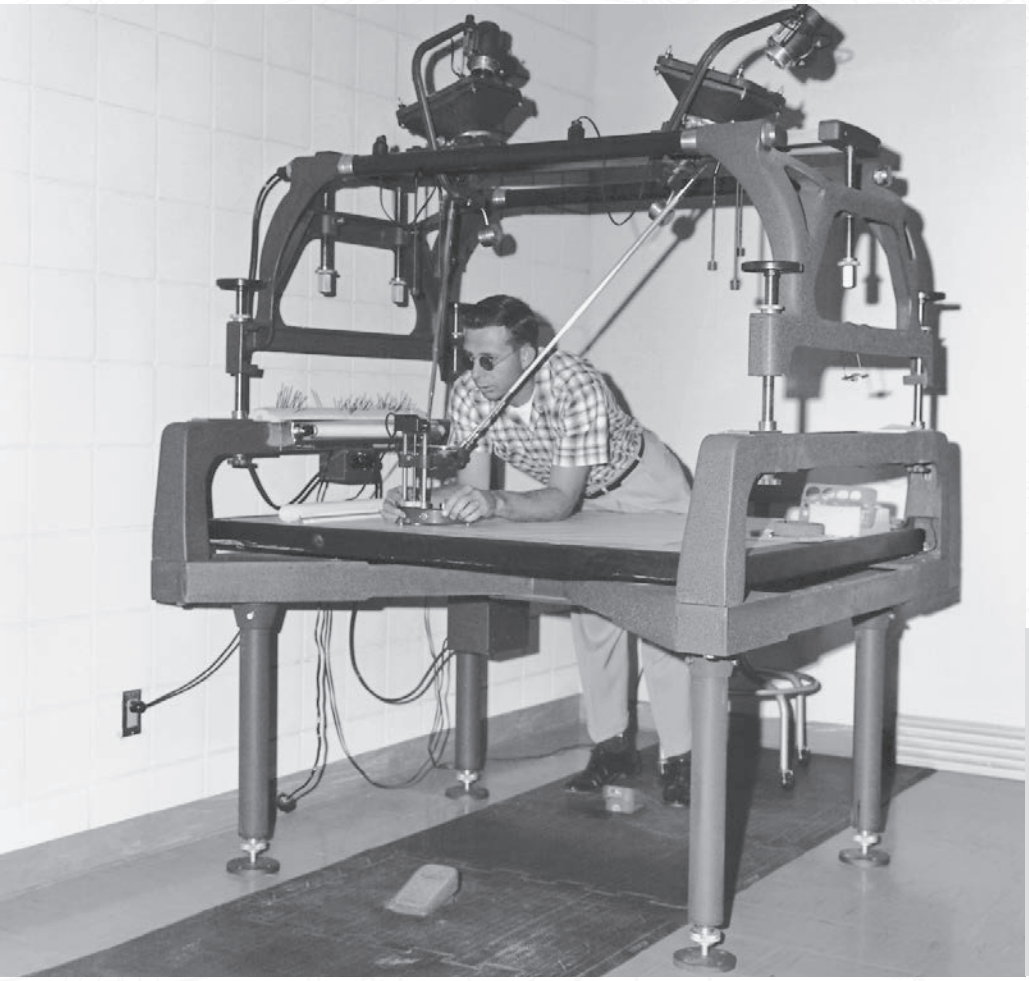
LEFT: *Little San Gorgonio Creek Spreading Grounds, typical of several facilities operated by the District. Minor storm flows are turned out of the main stream into basins where the water percolates to groundwater. This facility is still in use conserving floodwater.*

1953

Mr. John Bryant was then recruited as the District's Chief Engineer from the Region 6, Bureau of Reclamation office in Billings, Montana in July 1953. His first priority was to construct a series of six earth fill dams in the hills south of the city of Riverside to manage hazardous flood waters. Harrison and Woodcrest Dams were completed in 1953, and all six were in place by 1960. In addition, Pigeon Pass Dam above Sunnymead in Moreno Valley was completed in 1957.

1955

County Ordinance 460 made the District responsible for ruling on the level of flood protection to be provided on new subdivisions. Riverside County became the first in the state to require 100-year flood protection on new land divisions. Since then, 100-year flood protection has become standard throughout the state and the nation and was also adopted in the National Flood Insurance Act of 1968. To facilitate its responsibilities under Ordinance 460, the District embarked upon an ambitious program of mapping its entire area by using the new technology known as photogrammetry.



LEFT: *Kelsh Plotter—Initial machine used to launch the District's "in-house" photogrammetric mapping program in 1957. Topographic maps produced covered one square mile each at 1"= 200' and 4' contour interval.*

1956

The Santa Ana River levees through the city of Riverside became the first federally funded District project in 1956. The levees were designed to protect the city from severe flood damage similar to what was experienced in the floods of 1938. The project increased the budget from $890,000 in 1955-56 to $3,440,000 in 1956-57.

The Pigeon Pass Automatic Rain Gauge was installed in 1956 and provides the District's longest running Auto Rain Gauge Record spanning 64 years. The original internal mechanical measuring parts have been replaced with a modern electronic tipping bucket gauge while maintaining the worn exterior facade. This gauge, along with many more throughout Riverside County, continues the District's rainfall record legacy.

LEFT: *This is the District's longest running Auto Rain Gauge. Notice the initials in the concrete dated September 14, 1956.*

1957

By 1957, staff growth prompted a move from the courthouse to 2,300 square feet of rental space in the Schacker Building, a block away at 9th and Orange Streets located in downtown Riverside. The District became the first public agency to set up an in-house division of photogrammetry to produce maps using aerial photography. The average cost for contracted work had been $1,000 per square mile (per map). The new division was able to produce one square mile of mapping for $355.

ABOVE: *An aerial photo of the acquired property that would become the District's home since the early 1960s. This photo features the District grounds in 1968.*

1960

In constructing Highway 60 through Riverside, the State Division of Highways severed about 15 acres off the north end of Fairmount Park golf course, which became surplus property. The District purchased the 15 acres of surplus property, bounded by Highway 60, Market Street, and the Santa Ana River levee, for a modest $28,000. Armed with this choice of land, the District proceeded to design and put out to contract a 10,500 square foot office building. In doing so, the District was to have the first home of its own.

1961

District workloads increased substantially between 1957 and 1961, requiring a staff increase from 14 in 1957 to 55 in 1961. The newly completed office building was occupied in February 1961.

ABOVE: *Slope-paving on Bautista Creek Channel, June 1961. Bautista Creek Channel was a major project for the District and helped manage a major flooding problem in the Hemet area.*

ABOVE: *Placing rock "revetment" on the San Jacinto River Levee during its construction by the U.S. Army Corps of Engineers in 1961.*

1962

The San Jacinto River Levee project was designed and constructed by the U.S. Army Corps of Engineers and consisted of five miles of levee along Bautista Creek and the San Jacinto River in Zone 4. The District provided funds for right of way, utility relocations, and bridges. These local costs were reimbursed to the District by the state.

The District began using electronic distance measuring (EDM) devices in 1962, significantly expediting District survey work. An EDM could accurately measure one mile or 20 miles in just minutes. With conventional methods, a similar measurement would take hours, and if the line of sight needed clearing of brush and trees, it could take days.

LEFT: *Bautista Creek Channel was designed and constructed for the District by the U.S. Army Corps of Engineers (USACE), reaching completion in 1962. The channel has a design flood capacity of 16,500 cubic feet per second (imagine 16,500 basketballs heading your way in one second) and carries flood waters safely around the city of Hemet.*

1963

The District maintenance force was originally headquartered on County Road Department property in San Jacinto, and much of its work in the early years was along the San Jacinto River in Zone 4. A 50' x 100' concrete "tilt up" building was then erected at the District headquarters in Riverside, and the maintenance function moved to that site.

On October 18, 1963, Orange County Water District filed a lawsuit against virtually all Santa Ana River Basin water users upstream of Prado Dam, with the exception of the San Jacinto River Basin tributary to Lake Elsinore. Exercising its authority and water conservation responsibilities, the District provided legal and engineering representation for more than 200 public and private water users within its boundaries. In addition, the District established and supervised the "water defense office" in Riverside. It was the distribution center and repository for water suit data on behalf of all upper Santa Ana River basin defendants.

Four and a half years later, in February 1968, upper basin interests filed a cross complaint against Orange County water users. Finally on April 17, 1969, the suit was settled, providing for an annual minimum Santa Ana River flow through Prado Dam in terms of quantity and quality.

The Water Defense Office closed on June 30, 1969, with 4,149 parties, defendant and cross defendant, having been named and served. Thus was concluded the most massive lawsuit in California water history, with the District having played a significant role in defense of its area water interests.

1964

During the March 1938 flood event, major flooding from Tachevah Creek occurred through downtown Palm Springs. In 1964, Tachevah Dam was constructed to control flood waters originating from this steep mountainous watershed above the city. The project, constructed by the U.S. Army Corps of Engineers at a cost of $1.2 million, was partially funded by the District and the State, and is maintained by the District.

ABOVE: *Tachevah Dam, Palm Springs. This earth fill dam which was constructed by the U.S. Army Corps of Engineers in 1964 protects the northern and downtown areas of Palm Springs.*

ABOVE: *The District's first computer, an IBM 1620, was put to use in 1964. All major engineering and surveying calculations were shifted to the new machine.*

Faced with increasing workloads, the District purchased its first full fledged computer, an IBM 1620, in November. It had 20,000 bytes of mass storage. All major calculations in engineering and surveying were quickly shifted to the new machine. A water surface profile calculation, which previously took about one week to complete, could now be done in less than a day. Two years later, the District bought its second digital computer, trading in the 1620 for an IBM 1130. The 1130 was faster, had more storage (100,000 bytes of mass storage), and cost less. District staff developed extensive engineering software to do hydraulic, hydrologic, and structural computations utilizing the 1130.

1965

FLOODS OF 1965

Southern California experienced the most significant rainfall and flooding since 1938. Two major storms occurred November 13-19 and 21-26, with the second storm causing significant runoff due to saturated soils. Cottonwood Creek overflowed Interstate 10, east of the Highway 111 junction, and all traffic was stopped for several hours. The lack of all-weather bridges and flooding of major roads resulted in Coachella Valley communities being isolated for a period of time. Several lives were lost as people tried driving across streams at "dry" weather crossings. Cars were swept away, some with passengers inside. Most District facilities were put to their first real test and performed well. The floods of 1965 did demonstrate the need for major flood control improvements throughout the District.

Photo: Whitewater River, at Indian Avenue, Palm Springs

1967

The topographic (contour) maps produced by photogrammetry were in such demand by private engineers involved in new land development that it was necessary to expand the photogrammetry division to keep up with the demand. The District's planning, design, and subdivision processing requirements for topographic maps were increasing, and other County departments were making increased use of District topographic maps.

Initially recommended by the U.S. Public Health Service in 1951 and subsequently by the Santa Ana Regional Water Quality Control Board and the State Department of Water Resources, the non reclaimable industrial wastewater line from the upper Santa Ana Basin area to the Pacific Ocean was investigated, planned, and preliminarily designed by the District in the late 1960s. The pipeline carries away saline mineral wastewaters which would otherwise diminish groundwater quality. Though ultimately built by other agencies, the project stands essentially as envisioned and planned by the District and has facilitated significant industrial development upstream from Prado Dam.

ABOVE: *June 11, 1966 signing of non-reclaimable pipeline project preliminary plan agreement.*

LEFT: *At its construction in 1968, Wide Canyon Dam east of Desert Hot Springs was the largest of the District dams. Wide Canyon Dam is 2,225 feet long, 67 feet high, and contains 664,000 cubic yards of earth and rock fill. Several times in its history, Wide Canyon Dam has prevented flooding downstream mainly from flash flooding in the summer time.*

1968

Wide Canyon Dam, east of Desert Hot Springs, was constructed to manage flood flows from a large drainage area prone to producing flash floods. At the time of its construction, it was the largest of the nine flood control dams built by the District.

WHEN IT RAINS, IT POURS

1969

Two storm periods in January and February of 1969 produced flood peaks in the Santa Ana River at Riverside greater than any in the previous 31 years. The 11-day storm period, January 19-29, produced more than seven inches of rainfall in Riverside. This was noteworthy as the annual average rainfall for the previous 89 years was 11 inches. Total storm precipitation at Lake Arrowhead was 42 inches, with 29 inches in the form of rain.

The resulting peak flow at Riverside Narrows was 41,000 cubic feet per second on January 25th. Prado Dam experienced a peak in flow of 77,000 cfs on January 29th. Above-normal rainfall occurred throughout western Riverside County, causing significant flood damage. The earthen fill section of the northbound lane of Van Buren Boulevard Bridge over the Santa Ana River washed out on January 28th. The Mira Loma area and the Temescal Creek area in Corona each suffered some $2,000,000 in damages. Included was complete severance of East 6th Street and the washout of 1,300 feet of Pacific Electric railway track in Corona.

ABOVE: *Flooding of the Brockton Arcade area of Riverside in February 1969.*

On January 26th, President Richard Nixon declared Riverside County, along with 35 other California counties, a disaster area.

The six District dams around the south and east sides of Riverside stored the greatest amount of flood waters since their construction. Consequently, the extent of flood damage to the city of Riverside was reduced. Other District facilities such as levees, storm drains and channels generally performed well and prevented much potential damage.

ABOVE: *The Oak Street Channel overflowed its banks, inundating surrounding areas, including the 91 Freeway through Corona in February 1969 contained by wire fencing.*

Following nearly nine inches of January rainfall in Riverside and some $15,000,000 in flood damage in the County, repair work proceeded in most areas. The Van Buren Boulevard fill section was restored to traffic use by mid-February, as was the East 6th Street crossing of Temescal Creek in Corona. Between February 5th and 23rd, the Santa Ana watershed soils, still draining January storm moisture, received yet another 3.6 inches of rainfall at Riverside and more than 25 inches at Big Bear Lake, typical of the upstream, higher elevation areas. When an additional 5.72 inches fell in Riverside from February 24th through 26th, the rainfall total at Riverside for January and February rose to 18.19 inches.

ABOVE: *Cabazon was in shambles and several hundred of the town's residents were evacuated by helicopter in some of the flooded sections.*

February storm flows caused much more damage than those in January. The January rainfall had rendered watersheds saturated and surface materials loose. This scenario encouraged damaging flows for longer periods and resulted in increased volumes of debris. The January-February 1969 storms resulted in $40,000,000 in damage to public and private property in Riverside County. The County suffered greater damage than 32 of the 35 “disaster” counties in California.

Both southerly concrete spans of the Van Buren Boulevard bridge over the Santa Ana River collapsed. The river also washed out part of the River Road (Auburndale) bridge downstream in Corona. Temescal Creek again severed East Sixth Street as well as Hamner Avenue and River Road near Corona. Other flood damage areas included Oak Street Channel, Corona; San Jacinto River, Lakeview; Salt Creek at Goetz Road; Little San Gorgonio Creek at the spreading basins, Vineland Street and Cherry Valley Boulevard; Noble Creek at Cherry Valley Boulevard, Beaumont Avenue and 14th Street; San Gorgonio River at South Cabazon; Tahquitz Creek at Sunrise Way, Palm Springs; and Murrieta Creek, Temecula.

RIGHT: *The Van Buren Boulevard bridge in Riverside collapsed into the roiling torrent of the Santa Ana River during the February floods.*

ABOVE: *Aftermath of the storm of February 1969 flooding on Temescal Creek impacting Magnolia Avenue and the Pacific Electric Railroad tracks in Corona. This problem was corrected by the construction of Temescal Creek Channel.*

LEFT: *Churning floodwaters of the Santa Ana River resemble ocean waves as they attack the Market Street bridge in the city of Riverside.*

1970-1971

ABOVE: *Placing 102" diameter reinforced concrete pipe on 7th Street in Riverside, looking westerly from the 91 freeway. The Box Springs Drain was a major 1970 bond issue project.*

The citizens of Zone One had been dramatically awakened to the power of flood waters during the 1969 storms. They approved, by a strong majority, a $30,000,000 bond issue for flood control improvements in November 1970. The bond issue was the first in District history.

Armed with the bond funds and higher tax revenues, the District forged ahead with the design of major Zone One projects. Combined bond monies and pay as you go funding was projected to be $38,000,000 for a 15-year program. In order to expedite the design work, staff increased to 100 and was supplemented by contracting with private engineering firms for additional design capability. As a result, early construction of several large projects was accomplished, and considerable cost savings was achieved through avoiding higher-than-anticipated inflation rates in the later years of the program.

The California Environmental Quality Act (CEQA) was adopted in 1970 and requires public agencies to assess and disclose potential environmental impacts of proposed projects. The District has completed numerous environmental assessments and Environmental Impact Reports for projects ranging from entire Master Drainage Plans to various storm drains, channels, and basins.

ABOVE: *For many years, the District was a major monitoring agency for groundwater levels and quality. Shown is a chemist in the water analysis laboratory operated on District grounds in Riverside. Water samples collected by staff were analyzed in-house to ensure the groundwater was not becoming polluted.*

RIGHT: *Intricate formwork was required to construct a major junction structure and manhole access on the Box Springs Drain project in downtown Riverside.*

1975

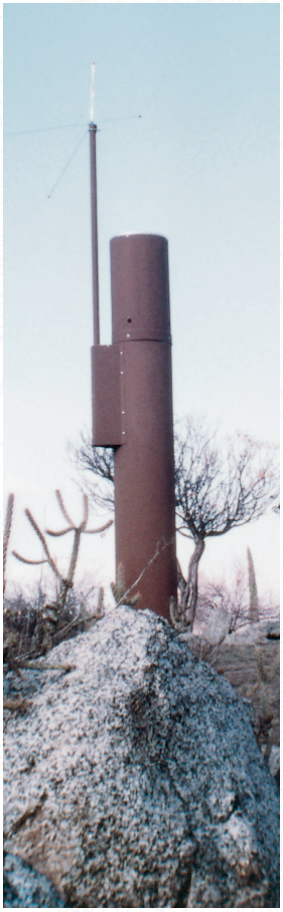
The District was the principal collector of basic hydrologic data since its inception. In the early 1960s, it used automatic devices to continuously record rainfall and stream flow at specific sites. In July 1975, a telemetered flood warning system was initiated. Thirteen remote stream flow gages using radio equipment (some solar powered) reported storm flow events to District headquarters. In addition, flow recorders began to be used in improved District flood control channels.

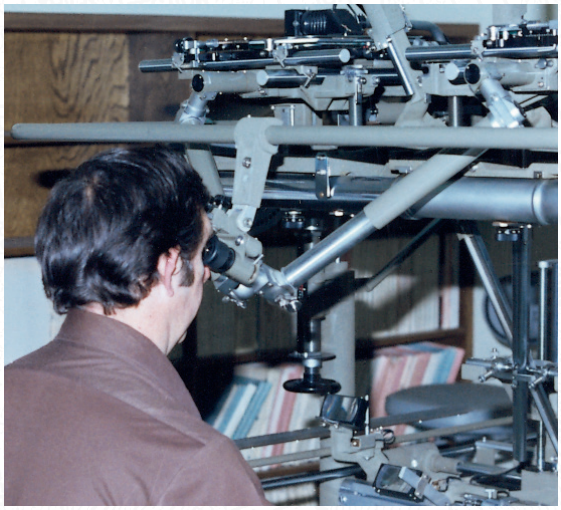
1976

Acquisition of a flatbed graphics plotter completed the District's automated mapping process, completely eliminating hand drawn ground contours, a tedious and expensive activity. Visitors from Europe, U.S. Geological Survey, CIA, Caltrans, State Department of Water Resources, and others came to view the automated mapping process. The District's photogrammetrist was called upon to give system presentations throughout the United States and Canada.

1977

The total monies expended for District constructed projects through 1977 was $42,000,000, with Zone One bond issue projects being 70% completed in only 40% of the programmed construction period. Therefore, major flood protection facilities were in place sooner than anticipated at a cost savings, due to the reduced impact of inflation. Two of these major projects in Riverside were Arlington Channel, Stage 1 and Magnolia Center Storm Drain, Stages 2 and 3.





ABOVE: *Arlington Channel was a major construction project for the District. It was in the planning stage for many years until construction funds became available through the passage of the 1970 bond issue. With its completion, development in southwest Riverside was able to proceed.*

OPPOSITE LEFT: *Alert Warning System. A remote gauging station reports rainfall data and in some instances is capable of also reporting stream depth of reservoir elevation data to the District's Hydrology Section Alert computer.*

OPPOSITE TOP RIGHT: *Digital information from the Santoni 2C was converted to contours by computer, thus, allocating automated plotting of the contours, elimination hand drawing. The technician is seen here adjusting pressurized ink pens that draw the interrelated information.*

OPPOSITE BOTTOM RIGHT*: The District's Santoni 2C Stereoplotter was the first mapping system in the nation to produce a digital topographic map with an orthophoto base. The digital information was recorded on magnetic tape in real time.*

ABOVE: *Magnolia Center Storm Drain, another 1970 bond issue project, drains a highly urbanized area in Riverside. Construction of an open channel was not practical and, therefore, the system is all underground. Shown here is a section of reinforced concrete box culvert being formed and reinforcing steel being placed.*

1978

In 1978, Assistant Chief Engineer, Kenneth L. Edwards, was appointed Chief Engineer. He had joined the District in 1962, coming from the Los Angeles District of the U.S. Army Corps of Engineers.

The appointment followed the spring retirement of John W. Bryant, who had served 25 years as Chief Engineer. During Mr. Bryant's tenure, staff grew from 14 to 110, and design and construction were completed on nine dams along with countless miles of channels, levees, and underground storm drains. His appearances before Congressional committees in Washington resulted in receipt of nearly $13 million in federal funds to assist in financing projects within the District.

The voters of the State of California approved Proposition 13, which amended the State Constitution to, in part, limit the maximum ad valorem property tax to one percent of the value of real property, and future bonded indebtedness was

ABOVE: *Woodcrest Dam Spillway. In February 1978, the dam filled to capacity, overflowing the emergency spillway, the only such event to occur to any District dam to date.*

severely limited. The passage of Proposition 13 had an immediate impact upon local government financing. By virtue of the formula distributing the one percent property tax collected, the District suffered a 60 percent reduction in projected property tax revenue for Fiscal Year 1978 79. At the same time, Riverside County and the District experienced a most phenomenal growth period beginning in 1978. Such fast growth, coupled with the revenue limitation, placed a significant strain on the District to provide adequate service to the public. In order to cope with the demands of growth, the County, urged by the District, levied fees on new development for flood control and drainage purposes.

The storms of February/March 1978 caused extensive damage throughout the County. Flood damage occurred in Wildomar, Winchester, Corona, Murrieta, Cherry Valley, Lakeview Nuevo, Calimesa, San Jacinto, Hemet, Palm Springs, and Desert Hot Springs. The Oak Street Channel in Corona experienced flooding similarly to 1969. Also, in February 1978, the District's Woodcrest Dam, south of Riverside, filled and overflowed the emergency spillway. The overflow was relatively small and caused no damage, but the reservoir spilling was the first and only such event to occur at a District dam to date. Alessandro Dam, southeast of Riverside, had filled but did not spill. Total flood damages in 1978 exceeded $9 million, equivalent to over $37,000,000 in today's dollars.

1979

A 1977 wildfire burned a significant portion of the Oak Street Channel watershed in Corona, generating a massive amount of sediment and debris during the 1978 winter storms. Congress then authorized funding for a debris basin at the upper end of Oak Street Channel, and the District completed construction in 1979 in cooperation with the Soil Conservation Service at a cost of $1.5 million.

LEFT: *Flooding in the vicinity of State Street (Highway 74) and Ramona Expressway on February 21, 1980 as a result of the breach of the San Jacinto River Levee.*

1980

FLOODS OF 1980

Following a storm in January 1980, the February 1980 storms were record-breaking in many County areas. The Palm Canyon Wash Levee, constructed in the 1950s, was briefly breached with floodwaters undermining the concrete face toe protection on February 21, 1980. The District quickly responded with heavy equipment and closed the breach, containing the flood flows within the stream. The Smoke Tree Estates development, as well as other commercial and residential properties along East Palm Canyon Drive, were protected from potential catastrophic damages. Also, on February 21, a section of the San Jacinto River Levee immediately downstream of Bautista Creek Channel collapsed. An estimated flow of 25,000 cubic feet per second had undermined the rock toe revetment and coursed its way through a mobile home park and portions of the city of San Jacinto. Floodwaters were several feet deep and caused extensive damage.

Other than these two levee failures, the District's facilities performed well and prevented millions of dollars in damages. The city of Riverside was spared from damages and flooding like that experienced in 1969, due to protection from the completed 1970 bond issue projects.

Photo: Palm Canyon Wash, near South Barona Road, Palm Springs.

The floods of 1980 did, however, demonstrate a need for additional flood control and drainage improvements throughout other parts of the County, where widespread flooding in western Riverside County accounted for at least ten deaths and more than $70 million in property damage, equivalent to over $234,000,000 in today's dollars.

Riverside County joined the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) on April 15, 1980. Participation in the NFIP makes residents of the unincorporated parts of Riverside County eligible to purchase flood insurance and allows the opportunity for the County to receive federal aid in disasters/emergencies. The District administers the NFIP for the unincorporated area of Riverside County with the exclusion of the Coachella Valley Water District's jurisdiction. The development of a flood management ordinance was a critical step in order to participate in the NFIP as it requires new construction and/or substantial improvement within a floodplain to follow strict guidelines which minimizes damage to residents and their property.

ABOVE: *The Oak Street Channel Debris Basin put to its first test in February 1980. The dam and basin was constructed in 1979. (Looking downstream in direction of flow toward the City of Corona)*

NAVIGATING ECONOMIC CHALLENGES

1982

Responding to reduced funding from property taxes brought on by Proposition 13, the District placed a funding issue on the November 1982 ballot. It asked the voters to consider a flood control benefit assessment to fund critically needed projects in all Zones. Only the voters in Zone 6 approved the assessment, which would generate annual revenues for construction of new facilities and would sunset after 15 years. Over the period, an additional 25 million dollars would be raised which, when added to available tax revenues, would provide for significant flood control project improvements in the Palm Springs, Cathedral City, and Desert Hot Springs areas.

Constructed in 1982, the Monroe Retention Basin, better known locally as Don Derr Park, is used by the citizens of Riverside as they enjoy the soccer and baseball fields on the basin's floor. Restrooms and electrical equipment are

ABOVE: *Cathedral City and Canyon in 1946 before channel improvements. Note that floodwaters meandered all over the cone and throughout the city.*

ABOVE: *Cathedral City is now protected from stormwaters by channelization on each side of the canyon.*

on high ground while backstops and bleachers, designed to "get wet" occasionally, occupy basin bottom sites. A similar well used facility, the Anza Retention Basin (Don Lorenzi Park), is also located in Riverside.

Retention basins are designed to take the "peak" off flood flows, as opposed to dams which can store the design flood for later release. The basins are dry most of the time and, therefore, may be put to other uses between storms.

1983

The booming development growth during the 1980s required substantial staff increases. To accommodate the growth, mobile office units were moved onsite to provide additional work space.

ABOVE: *Monroe Flood Retention Basin (Don Derr Park), Riverside. Built in 1982, it is one of several joint-use District basins. Dry most of the time, this basin provides excellent sports and recreation facilities.*

1984

The District initiated a sophisticated flood warning system known as Automated Local Evaluation in Real Time (ALERT). It consisted of 15 rain and stream gauges in the San Jacinto River and Murrieta Creek watersheds, which reported the occurrence of rain or stream flow to the Storm Center at the office.

The first analytical stereo plotter was acquired. Driven by a computer and storing mapping data in digital form, it allowed subsequent drawing on a graphics plotter. Fast and highly accurate, the analytical stereo changed District mapping for the better.

ABOVE: *The Zeiss C120 Analytical Stereoplotter was a step closer to a totally automatic topographic mapping process. It was driven by an onboard computer and corrected for distortions in the aerial camera and film. The C120 combined each photo pair into a stereoscopic image and correlated the image to ground survey points to produce a digital topographic map.*

1985

The U.S. Army Corps of Engineers completed a Reconnaissance Study of a project to improve the Lake Elsinore Outlet Channel. The project would reduce lake flooding levels such as the ones that occurred in 1980. The estimated non-federal share of the project costs would be in excess of four million dollars.

THE DIGITAL AGE

1986

The District's boundary extended to include the city of Palm Springs, territory that was previously within the Coachella Valley Water District's boundary.

ABOVE: *The Santa Ana River Mainstem Project was authorized by Congress in 1986. This $1.4 billion project includes the raising of Prado Dam and Oak Street Drain in Corona.*

The District developed a critical drainage infrastructure plan in the Lake Elsinore area. This infrastructure was proposed to be funded by issuing an eight million dollar bond secured by a benefit assessment on all properties draining into the lake. The Board of Supervisors and the Lake Elsinore City Council approved the plan and the Zone Three voters approved the bonds in November 1986.

Surveying took another giant leap forward with the introduction of the Total Station. It combined theodolite, distance measurer/angles, and a mini digital computer in a single, compact instrument all at a new level of cost effectiveness.

Congress authorized $1.4 billion for the Santa Ana River Mainstem Project, which provided for the construction of Seven Oaks Dam, Mill Creek Levee, Oak Street Channel, raising Prado Dam, and Orange County Channel improvements for Santiago Creek and the river from Imperial Highway to the Ocean.

LEFT: *Introduced in 1986, the "total station" survey instrument automatically measured distances and angles and stored data, thus, enabling a digital computer to economically produce maps, cross sections, profiles, and land boundaries on a graphic plotter.*

1987

The District purchased a Computer Aided Design and Drafting (CADD) system and the personal computer (PC). The combination of the PC and CADD provided a powerful tool, augmented by a broad array of commercial and District developed software to support computer aided design and drafting directly on computer screens, rendering hand drafting virtually obsolete. Complex hydrologic, hydraulic, structural, survey, and earthwork quantity computations were done in seconds, and evaluation of alternatives was accomplished with ease.

It was now possible to extract topography and cross sections from three dimensional "digital terrain models" (DTMs) and layout proposed designs superimposed on screen electronically.

The Temescal Creek Channel improvement project through Corona was completed in January 1987 for $7.5 million. District funding was augmented by Caltrans and Corona redevelopment monies.

1988

The District, along with the Riverside County Surveyor and with the support of the National Geodetic Survey, adopted the Global Positioning System (GPS) developed by the U.S. military. The system uses satellites in establishing precise ground position both horizontally and vertically.

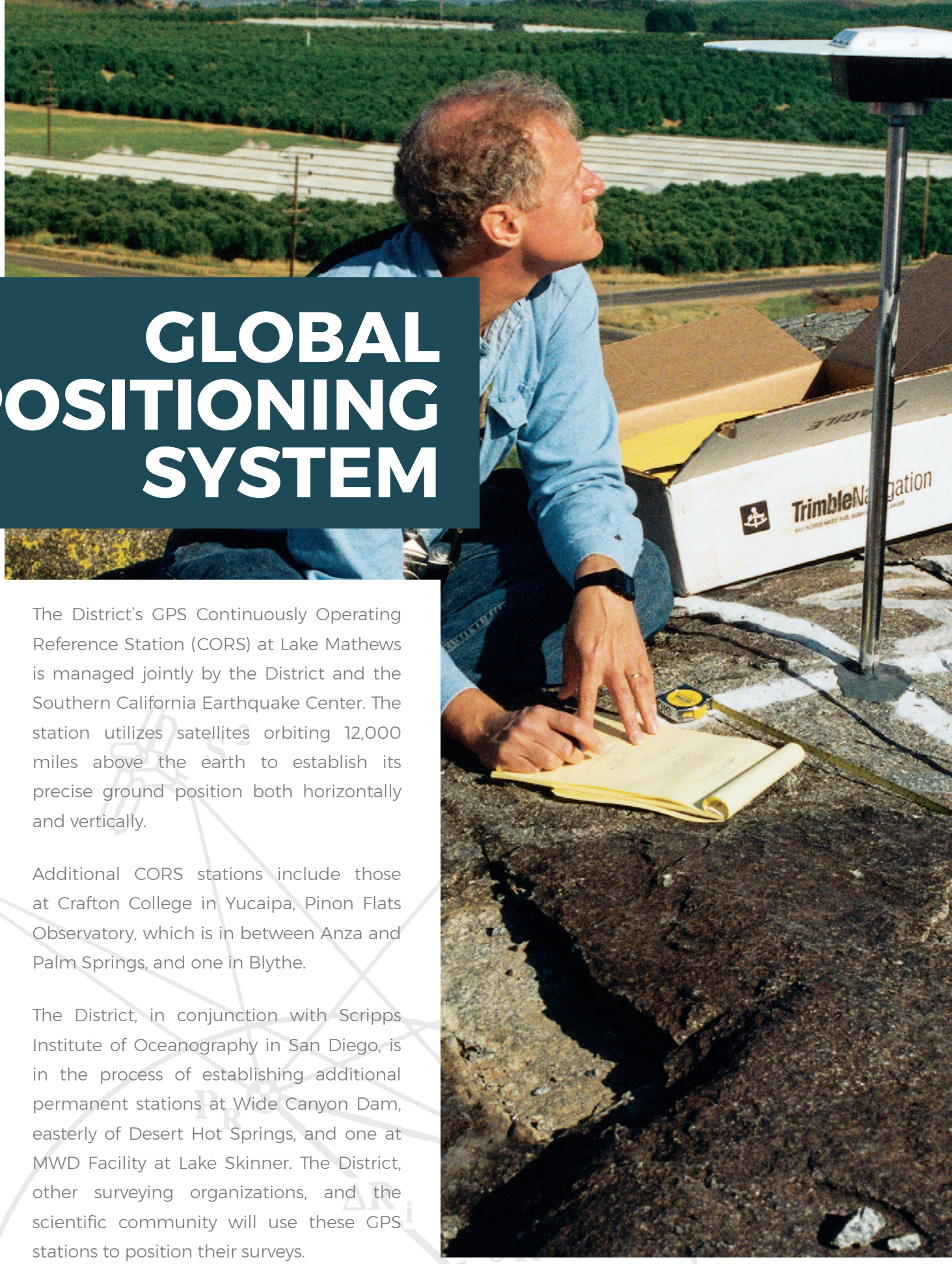
The District joined the University Navstar Consortium and the California Institute of Technology to do a GPS survey over a 7,000 square mile area.

During this time, the U.S. Army Corps of Engineers completed a detailed project report for the Lake Elsinore Outlet Channel and provided funding to commence construction plans.

ABOVE: *The integration of engineering, drafting, surveying, and mapping began in 1987 with the purchase of a Computer Aided Design and Drafting (CADD) system, a highly efficient engineering tool.*

LEFT: *Temescal Creek Canyon Channel in Corona at the Magnolia Avenue crossing. Note the intersection of the smaller Main Street Channel with Temescal Creek Channel on the right side of the photograph.*

GLOBAL POSITIONING SYSTEM



The District's GPS Continuously Operating Reference Station (CORS) at Lake Mathews is managed jointly by the District and the Southern California Earthquake Center. The station utilizes satellites orbiting 12,000 miles above the earth to establish its precise ground position both horizontally and vertically.

Additional CORS stations include those at Crafton College in Yucaipa, Pinon Flats Observatory, which is in between Anza and Palm Springs, and one in Blythe.

The District, in conjunction with Scripps Institute of Oceanography in San Diego, is in the process of establishing additional permanent stations at Wide Canyon Dam, easterly of Desert Hot Springs, and one at MWD Facility at Lake Skinner. The District, other surveying organizations, and the scientific community will use these GPS stations to position their surveys.

1990

The District attained an all-time high of 196 employees.

The design and construction of a new, more adequate, 33,000 square foot office building began, and both phases were completed in 1993.

The District implements the goals of the National Pollutant Discharge Elimination System (NPDES) which were instituted in the 1987 Clean Water Act. The District began monitoring the quality of stormwater runoff.

LEFT: *Two new office buildings, totaling 60,000 square feet, were completed in May 1991 and 1993 on the existing site purchased in 1960. Location is on Market Street by the 60 Freeway in Riverside.*

1991

In the Palm Springs area, Tahquitz Creek held a major flood threat. The District improved the flood protection in the creek by constructing a 100 acre-foot debris basin and two miles of natural and grass lined channel used as a golf course and bike and equestrian trails. The final construction cost was $12.2 million.

ABOVE: *Tahquitz Creek Debris Basin. The dark area just below the spillway is a stilling basin where some of the energy of flood waters coming over the dam is dissipated, thereby, minimizing erosion of the outlet.*

1992

The District began using the Geographic Information System (GIS) to spatially reference sets of data that can be retrieved and analyzed through desktop computers. It will be used to inventory and research existing and proposed facilities relative to underlying land characteristics such as property lines, ownerships, soil types, rainfall rates, and environmental traits.

ABOVE: *Significant rainfall during the first half of January 1993 that saturated the watershed, followed by a very intense storm on January 16, resulting in devastating flooding along Murrieta Creek. Flood damages in the cities of Murrieta and Temecula approached $10 million ($18 million in today's value), with considerable additional damage downstream at Camp Pendleton Marine Base in San Diego County.*

1993

FLOODS OF 1993

Starting on January 5, 1993, over ten inches of rain fell over two weeks in western Riverside County. The flooding from the rain took seven lives and caused more that $10 million in public property damage.

Murrieta Creek flowed at a record 25,000 cubic feet per second (cfs), overflowed its banks, and flooded Old Town Temecula at depths up to five feet. This resulted in $6 to $7 million in property damage. On February 3rd, President Clinton declared the County a disaster area.

Photo: Murrieta Creek, Old Town Temecula.

1994

The U.S. Army Corps of Engineers started construction of the Lake Elsinore Outlet Channel, which included enlargement and improvement of the outlet channel from Lake Elsinore to Riverside Drive, five new bridges across the channel, and a debris basin and channel in Wasson Canyon. The project was completed and dedicated at a ceremony in Lake Elsinore in October 1994.

This project limits the 100-year lake flood elevation to 1265.8 feet (NAVD 88), which is 5.7 feet less than the pre-project condition and frees up about 207 acres of land for valuable lake front development.

FAR LEFT: *Lake Elsinore Outlet Channel with its beginning at the lake in upper part of the picture. Note several street crossings (bridges) over the channel.*

LEFT: *Lake Elsinore Outlet Channel looking downstream toward Riverside Drive and Temescal Creek.*

Oak Street Channel was completed as part of the federal Santa Ana River Mainstem project. This project was particularly challenging as it used micro-tunneling under the 91 Freeway and the railroad without interrupting traffic. This method had only been used a few times in the United States, with both projects successfully completed utilizing this unique method. The final cost was $23 million, of which the U.S. Army Corps of Engineers contributed $13 million.

ABOVE: *Construction inside the Oak Street Channel culvert under the 91 Freeway in Corona. This structure was constructed using micro-tunneling techniques.*

ABOVE: *Construction inside the Oak Street culvert under the 91 Freeway in Corona.*

1995

The Chief Engineer, Kenneth L. Edwards, retired in December of 1995 after serving the District for 34 years. Under his guidance, the District experienced phenomenal growth in staff and projects completed. Beginning his tenure concurrently with passage of Proposition 13 (limited increases in property tax) presented a real challenge. The District suffered a 60 percent reduction in projected property tax revenue for Fiscal Year 1978-79. In spite of this funding limitation, the rapid rate of development, schedules of fees levied on private developers, and special assessments provided monies to construct about $230 million in flood control facilities during his term as Chief Engineer.

LEFT: *Salt Creek Channel was designed with gentle side slopes and a soft bottom to accommodate its use as a golf course, while maintaining a capacity to carry a 100-year flood. Channels like this are built in order to allow for recreational use purposes and to allow percolation of stormwater into the aquifer when used as a flood control channel.*

THE MODERN AGE

1996

Twenty-seven years after initially joining the District as a junior engineer, David P. Zappe was appointed Chief Engineer in March 1996. Mr. Zappe is a prime example of one "rising through the ranks". In hindsight, Mr. Zappe's tenure as Chief Engineer seemed to coincide with the worldwide tech boom. While eBay™ and Google™ were becoming household terms, the District was busy building an arsenal of technology that enabled its staff to do their jobs better, faster, and more accurately, ultimately, allowing the District to improve its public services at a reduced cost, while concurrently becoming a leader in mapping southern California.

ABOVE: *The District, in 2009, prior to the Low Impact Development Demonstration project implementation. Source: Google Earth*

The District began scanning aerial photography into digital imagery for map-making and scanned over 1,700 photos from the 1995 western Riverside County GIS flight which commenced its large-scale database and the District's first step into the digital age.

The District also began gathering survey data 24 hours a day, every day, using Global Positioning System (GPS) to assist the National Geodetic Survey with their Continuously Operating Reference Stations (CORS). The CORS network is a multi-purpose cooperative endeavor involving government, academic, and private organizations. The sites

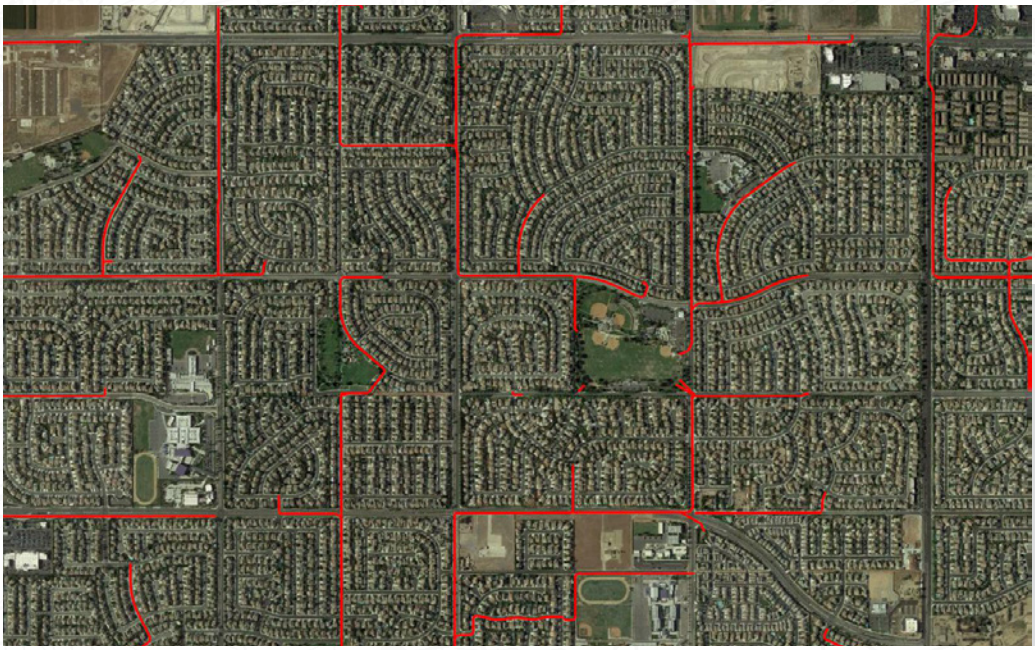
are independently owned and operated. Each agency shares their data with the National Oceanic and Atmospheric Administration (NOAA), who in turn analyzes and distributes the data free of charge.

After many years in the making, the Salt Creek MDP was adopted. The MDP covers an 8.2-mile reach of Salt Creek between the city of Hemet and Winchester. The drainage area is approximately 89 square miles, and the cost of implementing the MDP was approximately $13.5 million.

After record rainfall in 1993 and substantial flood damage in the Temecula/Murrieta area, in 1996, the District, in conjunction with the U.S. Army Corps of Engineers (USACE), completed construction of the Murrieta Creek MDP Line F and Line F-1, at a cost of the $1.9 million. Furthermore, a Letter of Map Revision (LOMR) was obtained from FEMA for this project the following year, which resulted in flood insurance rate reductions for many residents of the Old Town Temecula area.

1997

Construction of the Whitewater River Right Bank Levee, Stage 2 project was completed in November. The project included construction of 6.7 miles of levees on the right bank from Indian Avenue to Avenue 34. Subsequently, the District's Floodplain Management Section completed a LOMR (Letter of Map Revision) which removed hundreds of residents from FEMA's previously mapped floodplain and in turn reduced the cost of flood insurance for those residents.



LEFT: *Eastvale 2020. This shows the fully developed city of Eastvale. The red lines delineate the drainage infrastructure installed to protect the community from flood hazards.*

1998

The Eastvale MDP was adopted by the Board of Supervisors in 1998 and was later updated in 2002. The MDP drainage area is approximately eight square miles and collects flows from local runoff then transports them to the Santa Ana River and Cucamonga Creek. In 2019, the District closed out the Eastvale ADP, making it the first drainage plan to be fully completed.

1999

After over 30 years in the making, the Seven Oaks Dam was completed after a monumental collaboration between the District, the U.S. Army Corps of Engineers, and the Counties of Riverside, Orange, and San Bernardino. At the time it was constructed, Seven Oaks ranked as the sixth tallest dam in the U.S.

ABOVE: *Pictured is Seven Oaks Dam, a major feature of the Santa Ana River Mainstem Project, that provides the necessary flood protection for millions of people and developed lands within Orange, Riverside and San Bernardino Counties.*

2000-2001

ABOVE: *This is a rare sight as Seven Oaks Dam does not usually retain substantial water, other than during large storm events. This photo was taken in 2010 when the Corps was conducting routine testing of the facility.*

District employees were connected to the World Wide Web to conduct research and development. Little did we know that the internet would become such a valuable resource not only for internal use, but also for keeping the public apprised of District projects, notices, and services provided.

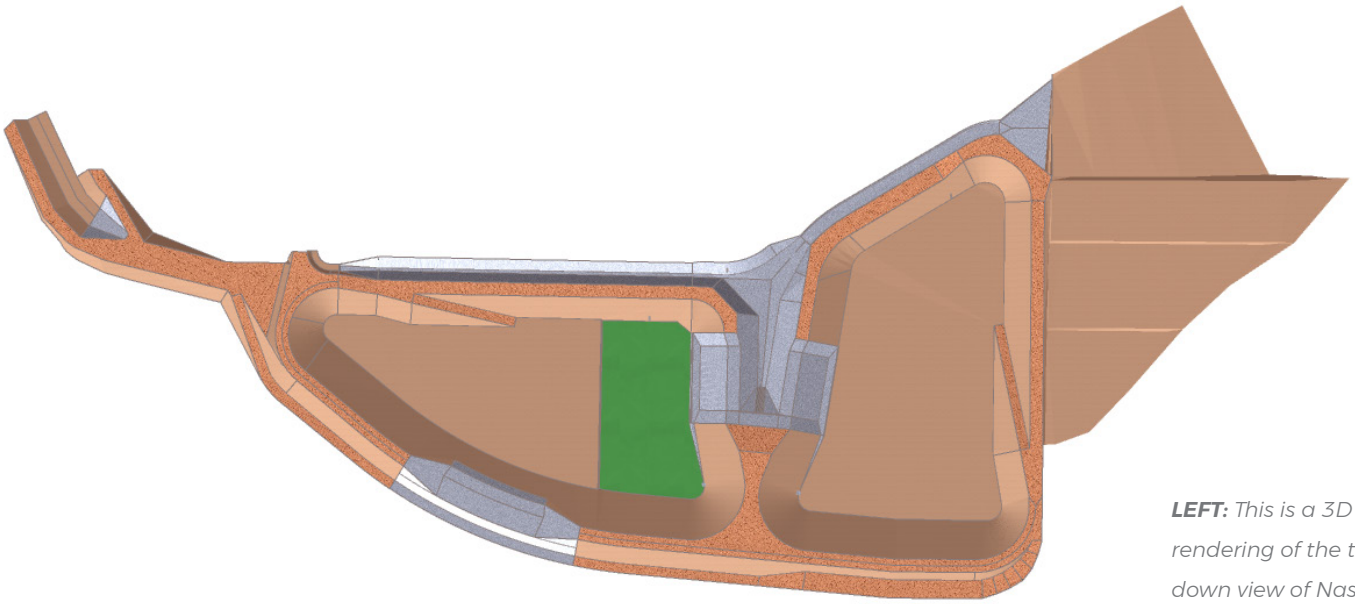
The District completed the Compton Avenue Storm Drain Phase 2 project. This project was the District's one and only project designed using the "International Metric System".

ABOVE: *The Corps conducting a routine test of the outlet structure at Seven Oaks Dam.*

2003

Warren D. "Dusty" Williams took over as General Manager-Chief Engineer in January 2003. Dusty was another long-timer that worked his way up the ranks from student intern and Junior Engineer all the way to the Chief Engineer position. At the time of his appointment in 2003, Dusty had been with the District for 28 years.

Under Dusty's leadership, the District has been integral in shaping federal, state, and local policy related to levee safety and flood risk management. He has a long-standing history of taking on the tough issues, such as helping the politicians on Capitol Hill understand that the arid southwest is not the same as the Mississippi floodplain, and that it is critical to have flexibility in the regulations to account for such.



LEFT: *This is a 3D rendering of the top down view of Nason Basin, located in Moreno Valley.*

The District completed the construction of Nason Basin in Moreno Valley. The 16-acre basin reduces the 100-year flows by more than 70%, and among others, protects a high school and the County hospital from large storm events.

2004

This was a busy time for the District, local municipalities, and other government agencies. Housing and private development projects were moving much faster than the Cities and local agencies could keep up with, including the District. In 2004 alone, 439 land development cases were reviewed by the District for stormwater and drainage compliance, while 317 were approved.

ABOVE: *District office entrance, construction completed in 2009.*

Relentless storms in 1993 caused Murrieta Creek to overtop its banks, and the city of Murrieta and Old Town Temecula were severely flooded, causing millions of dollars in damages. Subsequently, in 2000, Congress authorized the Murrieta Creek Flood Control, Environmental Restoration, and Recreation Project with an estimated total cost of $90 million. The project is a joint effort between the U.S. Army

Corps of Engineers with the District as the Local Sponsor. The project includes a 270-acre multi-purpose detention basin, of which 160 acres will be dedicated to environmental restoration and 50 acres dedicated for a sports park. The project was planned to be constructed in multiple phases over several years. The Corps completed construction of Phase I from Temecula Parkway to 1st Street in 2004, and completed a majority of Phase 2A construction in 2017. The District will continue to work diligently to secure federal funding to complete the construction of the remaining portions of the Murrieta Creek Project.

The 1983 San Sevaine Channel Master Plan was completed in full when Stage 7 was constructed. The San Sevaine Channel system begins in the San Gabriel Mountains in San Bernardino County and ends at the Santa Ana River in Riverside County. The completed channel system provides 100-year flood protection for public roads and schools, the Union Pacific Railroad, multiple utilities, and substantial residential, commercial, and industrial developments.

To address the conservation of listed species on a regional basis and to streamline endangered species permitting, the Western Riverside County and the Coachella Valley Multiple Species Habitat Conservation Plans were issued 75-year take permits in 2004 and 2008, respectively. The District is a permittee under both MSHCPs and provides financial contributions toward regional habitat conservation through mitigation payments based on a percentage of project construction costs. Some District lands with habitat also provide a portion of the conserved lands to help conserve species within these plans.

***ABOVE**: San Sevaine Channel draining to the Santa Ana River. Source: Google Earth, May 4, 2015.*

2005

In October, the District's staff played an integral role in the 1st Annual California Stormwater Quality Association (CASQA) Conference in Ontario, California. The District continued to be active in the association in dealing with statewide stormwater issues.

2006

The 2.7-mile County Line Channel, located in the Eastvale area along the San Bernardino-Riverside County Line, was completed in January. The project was a collaborative effort by the District, San Bernardino County Flood Control District, the City of Ontario, and the Santa Ana Regional Water Quality Control Board. The County Line Channel significantly reduces the water pollution and facilitated the construction of a comprehensive drainage network for then-future City of Eastvale.

The District completed the Gavilan Hills/Smith Road Dam and Debris Basin. The $4.5 million project included 3,600 feet of concrete rectangular channel and a debris basin at the upstream end. This was one of the District's first major projects using soil cement. This project is significant not only because it reduces the flood risks for downstream residents, but it also retains sediment that would otherwise end up polluting Lake Mathews. Furthermore, this project included an extraordinary 20-acre onsite mitigation project that was required to offset the environmental impacts of building the dam. The Gavilan Hills mitigation project took 10 years from conception to completion, and in 2014 was deemed a "model mitigation project" by the Santa Ana Regional Water Quality Control Board.

The District also expanded its maintenance facility with a much-needed garage to house operation and maintenance equipment. The $1.2 million expansion nearly doubled the overall amount of square footage available for equipment repairs and storage.

ABOVE: *Gavilan Hills/Smith Road Dam and Debris Basin in the background; The California poppies were planted as part of the onsite wetlands creation mitigation.*

2007

The District joined the Santa Ana Watershed Project Authority for the "One Water, One Watershed" (OWOW) program. The OWOW program focuses on "integrated water management" for the Santa Ana River through collaboration of the tri-county stakeholders into one team committed to providing water for sustainable economic growth, exceptional quality of life, and a healthy environment.

2009

The District began to automate level-monitoring devices at District dams, which allows the District's Storm Center to remotely monitor water levels behind the dams during severe storm events.

ENVIRONMENTAL CHALLENGES

The environmental regulatory arena has become one of the primary considerations in the planning and implementation of District projects. From the beginning of a project that could affect native habitat, alternatives and avoidance/minimization need to be evaluated for feasibility. If avoidance is not feasible, compensatory mitigation options could be very costly and need to be considered and included in project budgets when needed. Such environmental laws and permits that the District must comply with in order to construct their flood control infrastructure include:

- The California Environmental Quality Act (CEQA)
- Federal Clean Water Act Section 404
- Section 401 of the Clean Water Act
- Section 1600 of the Fish and Game Code
- California Endangered Species Act of 1970
- Federal Endangered Species Act of 1973

The District has completed various types of projects with many types of regulatory challenges. Some of the most significant projects with such challenges include the construction of Murrieta Creek Phases 1 and 2A and Norco Bluffs in cooperation with the U.S. Army Corps of Engineers. The Homeland-Romoland MDP Line A system was one of the largest District construction projects and had to address nesting burrowing owls during construction.

The burrowing owl is a State species of concern and protected by federal and state nesting bird laws. The District has incorporated various burrowing owl avoidance and minimization measures into projects starting with the Lakeview Dam construction in 1993, various Perris Valley projects, and maintenance projects from Day Creek Channel to the Cabazon Channel repairs.

ABOVE: *District staff conduct observations along the Santa Ana River for compliance with environmental regulations.*

ABOVE: *The California Endangered Species Act of 1970 and the Federal Endangered Species Act of 1973 created protections for listed endangered/threatened species that include prohibiations against take without a permit. These laws protect numerous listed animals, plants and insects. Burrowing owl avoidance/minimization measures along with the Multiple Species Habitat Conservation Plans (MSHCPs), have helped these species stay off the endangered species lists.*

2010

FLOODS OF 2010

In December, southern California received record rainfall and severe flooding. The damages in Riverside County were severe—Mockingbird Canyon Road washed out at several locations, the Corona Main Street dam spillway overtopped; and the spillway at Sycamore Dam (built in the 1950s) overtopped for the first time ever.

As a result of the December storms, President Obama declared the County a "major disaster area" which made federal funds available for the District to do emergency work and repair or replacement of infrastructure damaged by flooding and debris and mud flows.

Photo: Mockingbird Canyon Road, Unincorporated Riverside County

Since 2010, the District has worked aggressively toward obtaining flood insurance discounts for residents under the National Flood Insurance Program's Community Rating System (CRS). CRS is a voluntary incentive program that recognizes and encourages local floodplain management practices that exceed FEMA's minimum national requirements.

LEFT: *The 2010 storm led to flooding throughout parts of the city of Riverside. The top left photo shows Monroe Street flooding due to the underground storm drain carrying excess stormwater; this street is adjacent to the dual use Monroe Retention Basin (Don Derr Park) featured here. This bottom left photo shows how the basin is utilized during major storms to prevent flooding while serving as a recreational park during the dry season.*

2011

The District started to bounce back and made significant progress in 2011 with the completion of multiple construction projects such as Calimesa Avenue L Storm Drain, Stage 1; Palm Canyon Wash Levee and Channel Restoration; Menifee/Hawthorn Storm Drain, Stage 1; and many others. In addition, the District, in conjunction with the U.S. Army Corps of Engineers, completed construction of the Santa Ana River Below Prado Reach 9 .

The District released its Low Impact Development (LID) Design Manual in 2011. This was a huge effort to provide public agencies and private developers water quality best management practices using the latest science and the best available technology.

LOW IMPACT DEVELOPMENT FACILITY

The District's 15-acre headquarters was retrofitted in 2011 with Low Impact Development (LID) features and water conservation measures as part of a demonstration and testing project in a semi-arid climate funded by the District with Proposition 13 grant support from the State Water Resources Control Board and the Santa Ana Watershed Project Authority. The LID project promotes sustainable design and contributes to basin water banking, stormwater capture and management, stormwater quality enhancement, and water conservation using LID Best Management Practices (BMPs) based on the District's 2011 LID BMP Design Manual.

The project also incorporates monitoring elements into the design of the site, and the District's headquarters serves as a regional LID demonstration and education facility for developers, regulators, environmentalists, students, and other interested stakeholders, and is available for public tours. Indeed, since 2011, over 99 separate tours have been given to parties from universities and high schools, agency staff, elected officials, and delegations from Korea, China, and Brazil.

The District retrofitted the bioretention basin BMP (pictured) in March 2018 to improve pollutant removal and volume reduction using engineered soil media, a reconfigured inflow and ponding design, and more resilient plant species. Monitoring of the bioretention basin following the retrofit shows improved pollutant removal and volume reduction.

The LID facility, which has garnered awards from the American Society of Civil Engineers, California State Association of Counties, and California Stormwater Quality Association, is unique in the state, being designed specifically to facilitate accurate analysis of LID BMP effectiveness for water quality, hydrology, and water conservation.

ABOVE: *The Infiltration Basin (also known as Lake Smithhammer) located on-site is an example of a LID BMP.*

ABOVE: *LID Bioretention Basin; this is one of the most commonly used LID BMPs in southern California and elsewhere. The structure in the background is the LID Data Collection Center.*

2012

Realizing that there is power in numbers, the District helped establish an informal coalition with six other counties (Santa Barbara, Ventura, Los Angeles, Orange, San Diego, and San Bernardino) to focus on issues unique to southern California. The established coalition began aggressively lobbying for funding support and legislative action, such as provisions for "levees" that are more representative of our region, as opposed to applying the same standards needed to protect New Orleans, Sacramento, or the Midwest.

ABOVE: *Day Creek Channel in Jurupa Valley*

2013

The District completed the Day Creek Channel system, which conveys a 100-year flow of 10,000 cubic feet per second and provides flood protection from the San Gabriel Mountains (in San Bernardino County) to the Santa Ana River.

Upon completing the Day Creek Channel system, the District worked closely with FEMA to update the related Flood Insurance Rate Map (FIRM) which, in turn, removed 127 homes from the floodplain. Effective November 2013, those homeowners were no longer required to purchase flood insurance, although they could still voluntarily purchase insurance at a much lower rate.

Late in 2013, the District commenced construction on the Arroyo Del Toro Channel in Lake Elsinore. The project was unique in that there was an above-average potential to encounter human remains during construction because of its location adjacent to an existing cemetery. Therefore, the District used specially-trained cadaver dogs prior to breaking ground to locate any human remains and also hired a qualified archeologist to monitor the site. The District was pleased to report that no human remains were found, and the Arroyo Del Toro Channel was completed in 2015.

ABOVE: *The Arroyo Del Toro project in Lake Elsinore required special handling and help from cadaver dogs due to the potential to find human remains near the project site.*

The District also began preparing dam inundation studies as part of an effort to create Emergency Action Plans. These plans will allow for orderly evacuation procedures to keep the public safe from harm. As an upgrade from previous inundation studies performed in the 1970s, two-dimensional modeling is used to provide more accurate inundation limits.

2014

The Murrieta Creek Phase II groundbreaking took place in December, and the District celebrated with the U.S. Army Corps of Engineers and elected officials.

2015

After more than 20 years from conception to completion, the $11 million Eagle Canyon Dam and Debris Basin project commenced construction in 2013. This facility provides flood protection to dozens of properties in Cathedral City. Historically, during periods of heavy rainfall, mud and debris would funnel down Eagle Canyon and damage property located immediately downstream of the canyon, such as events in July 2008 and more recently in August 2012. This project has included substantial environmental and regulatory involvement because of the potential to adversely impact Waters of the U.S. and habitat for endangered species such as bighorn sheep.

The Lakeland Village MDP was adopted in early 2015. The Lakeland Village drainage area encompasses approximately 13 square miles and includes 16 separate watersheds. The plan intended to collect storm flows emanating from all 16 watersheds and convey them safely to Lake Elsinore. The estimated cost to construct the MDP is approximately $48 million.

The Moreno MDP was revised and encompasses the eastern portion of the city of Moreno Valley and portions of the surrounding unincorporated Riverside County lands. The drainage area is approximately 21 square miles, and the MDP facilities include approximately 30 miles of channels and storm drains and five basins. The estimated cost of implementing the Moreno MDP is $160 million.

ABOVE: *Eagle Canyon Dam Spillway undergoing construction.*

PROTECTING WATER QUALITY IN OUR WATERSHEDS

As the population of our watersheds increases along with the footprint of the developed area, surface runoff is increasingly impacted by pollutants and flooding problems. The Clean Water Act serves to mitigate the discharge of pollutants through the National Pollutant Discharge Elimination System (NPDES) by requiring permits for such discharges. Separate NPDES permits regulate discharges from District application of aquatic herbicides and District construction projects and land disturbance activities. In addition, NPDES permits regulate discharges of stormwater from the interconnected system of City, County, and District pipes and channels that provide flood control protection for the urban landscapes of Western Riverside County.

NPDES permits place limits on what can be discharged, establish monitoring and reporting requirements, and require implementation of practices and programs to protect water quality. Fundamentally, NPDES permits translate the Clean Water Act's protection and restoration goals into regulatory requirements that are specific and appropriate to the nature of the discharge. For operators of municipal storm drain systems, NPDES permit requirements focus on management of the urban landscape through inspections of industrial, commercial, and construction sites; public education and outreach; drainage infrastructure cleaning and maintenance; and conditioning public and private land development projects to incorporate landscaping and features protective of water quality.

ABOVE: *The water quality monitoring team conducting sampling at a site in the Santa Ana River watershed.*

Three NPDES permits authorize municipal stormwater discharges in the Santa Ana River, Whitewater River, and Santa Margarita River watersheds. As the designated Principal Permittee under these permits, the District leads the required

ABOVE: *The Whitewater River Watershed showing water imported from the Colorado River.*

compliance programs through cooperative agreements with the county and city Permittees. The District engages in rule-making processes, develops policy and programmatic guidance, provides training and implementation support, conducts public education and outreach activities, and conducts environmental monitoring on behalf of all the Permittees to ensure NPDES permit compliance.

The first generation municipal stormwater permits in Riverside County were issued in 1990. Successive renewals have produced increasingly complex permit requirements. The most recent permit renewals introduced waterbody- and pollutant-specific management obligations: nutrients in the Santa Margarita River and San Jacinto River watersheds; and fecal indicator bacteria in the Middle Santa Ana River watershed. The District is implementing several projects to divert dry weather flows to the sanitary sewer system to reduce bacteria in the Santa Ana River. The District looks to continue leading the practice of urban stormwater management in Riverside County in support of the goals of the Clean Water Act, with compliance approaches appropriate for communities of Western Riverside County.

PASSING OF THE TORCH

2016

Warren "Dusty" Williams retired in April 2016 after 39 years of outstanding service to the District. He was devoted to protecting public health and safety from unconfined flooding and was committed to using stormwater runoff capture and recharge to offset the need to import water. His service included working with a variety of organizations where he participated as a local, state, and national leader in flood control management as well as environmental/regulatory issues.

Jason E. Uhley was appointed as the District's sixth General Manager-Chief Engineer in May 2016. In his 24-year career at the District, he previously served roles in the Watershed Protection, Regulatory, Planning, and Design and Construction Divisions. He now works with the Board of Supervisors, staff, and District partners to steer the District to strategically face evolving 21st century water resource challenges.

The District received a Class 7 certification from FEMA for going above and beyond the minimum National Flood Insurance Program (NFIP) standards. A Class 7 indicates that unincorporated Riverside County residents are eligible to receive a 15% discount on their flood insurance premiums.

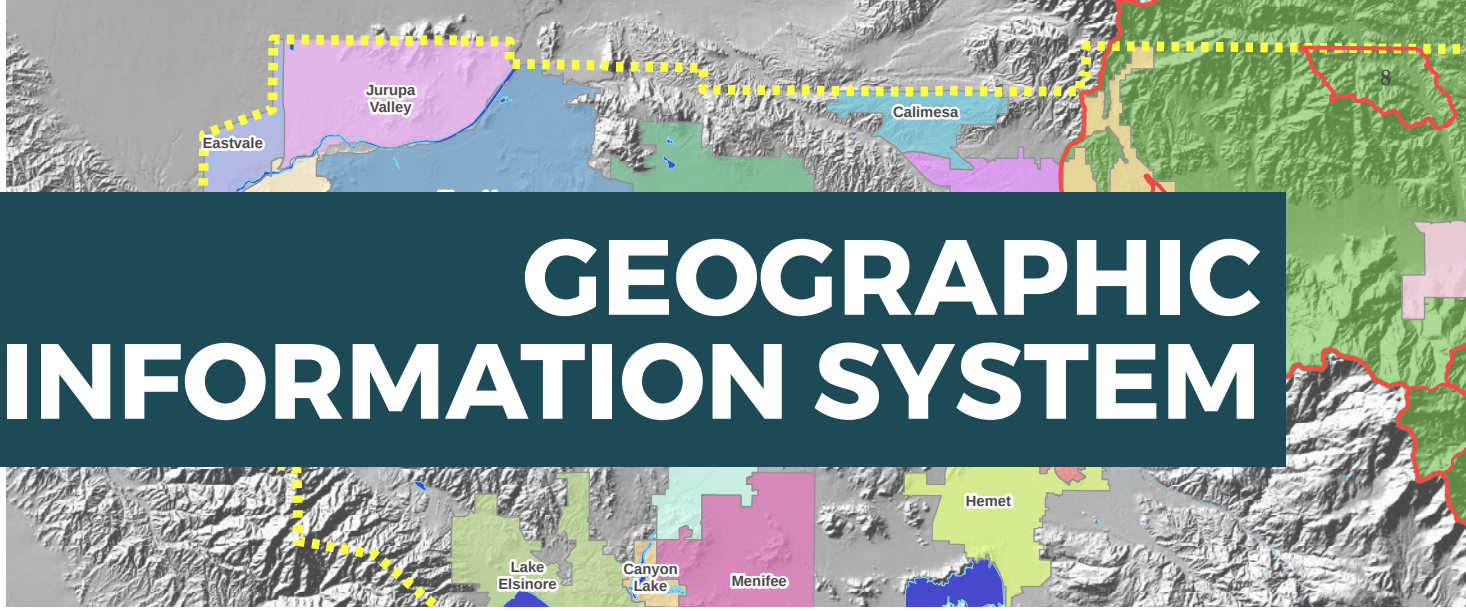
The District's most expensive Capital Improvement Project to date includes three major facilities: Romoland MDP Lines A, A-2, and Briggs Road Basin, along with a small portion of a fourth line (Line A-3). This is the longest single project undertaken by the District and cost $27.4 million to help protect the community from flooding.

That same year, Eagle Canyon Dam and its outlet system, Palm Springs MDP Line 43/43A, was completed. The project entailed the installation of approximately

3,900 feet of underground storm drain. The storm drain system conveys flows from Eagle Canyon Dam into the District's North Cathedral Canyon Channel, keeping water from flowing into the street and impacting businesses and residents. The District revised the FEMA flood insurance rate maps in the local area immediately downstream of the dam which reduced flood insurance premiums for the residents.

The Eagle Canyon was named an Outstanding Civil Engineering Project of the Year for the entire state of California by the American Society of Civil Engineers. Eagle Canyon Dam was the first major dam built in Riverside County since Diamond Valley Reservoir and was recognized for the unique challenges faced including but not limited to complex geotechnical issues, including previously unknown faults that needed to be addressed during construction and for it being sited on a historic illegal dumping/shooting range that required environmental clean-up.

ABOVE: *This photo shows Eagle Canyon Dam's spillway shortly after construction. The spillway was constructed through a hillside of fractured rock and an inactive seismic fault. To stabilize the hillside prior to the construction, tie-backs were installed.*



GEOGRAPHIC INFORMATION SYSTEM

The District has been developing its Geographical Information System (GIS) for over 30 years. The GIS team provides a variety of services including creation and data editing, research, analysis, application development, mobile solutions, and map production. Data and applications are developed to provide helpful geographic information for internal, external, and countywide agencies. The data layers completed include the District facilities, flood zones, and many others.

GIS is a computer-based technology that combines geographic features with attribute data to visualize, explore, query, edit, and analyze geographical information. The most valuable aspect is being able to analyze information spatially while servicing as a decision-support tool for analysis of real-life decisions regarding emergency disaster areas, floodplains, water quality, and environmental. GIS provides the ability to create full-color custom maps and graphics based on a collection of data along with aerial photography.

GIS is the central component of a strategic framework that connects spatial and non-spatial data across different information systems. GIS has evolved to become a core infrastructure technology. GIS is more than mapping as it enables the District to create new value by leveraging the power of place and analytics in support of decision-making and operations. This creates broader knowledge and understanding within the District organization for all levels of decision-making.

GIS technology provides the base from which vast amount of information can be stored, maintained, and analyzed with endless capabilities.

ABOVE: *The photo shows an example of the various types of maps that the GIS group creates utilizing interconnected data that is visually displayed.*

ABOVE: *Water quality at Canyon Lake continues to improve as a result of multi-agency partnerships to fund the application of alum treatments to the lake.*

2017

An intense September thunder storm came after the recent completion of Eagle Canyon Dam. The dam protected Palm Canyon Drive and safely conveyed the water to North Cathedral Channel.

Impressive improvements to the clarity and quality of Canyon Lake waters continue to result from the multi-agency partnership funding the application of alum treatments to neutralize excessive nutrient levels in the lake and, therefore, reduce the significance of algal blooms on the lake.

The District's collaboration with Beaumont-Cherry Valley Water District launched a joint effort to construct Beaumont MDP Line 16. Line 16 would recharge approximately 500 acre-feet of stormwater annually into the groundwater aquifer and reduce flooding in the Cherry Valley community.

Santa Margarita watershed stakeholders continued to develop the Water Quality Improvement Plan (WQIP) that is intended to address the adverse impacts that arise from urban runoff. The District, the Cities of Wildomar, Murrieta, and Temecula, as well as other regional stakeholders worked together in developing water quality priorities, goals, and strategies for the plan.

2018-2019

ABOVE: *The 2018 Holy Fire destroys nearly 35,000 acres of mountainous terrain above the Lake Elsinore area. This marks one of the most significant wildfires in Riverside County's recent history and placed numerous District facilities under eminent threat of debris flows.*

A Letter of Map Revision was processed after Romoland MDP Line A. Line A was the biggest construction project in District history, and the improvements removed 1,500 acres of FEMA floodplain meaning residents no longer needed to pay flood insurance.

Meadowview Stream Restoration Project was the District's first project of this kind. The project improved the stability of a natural watercourse, restored the habitat, and provides flood protection with a non-structural approach. It was a cooperative effort with the Homeowners Association, Natural Resources Conservation Service (NRCS), and Fish and Wildlife.

ABOVE: *The District partnered with other agencies to clean up the debris in Lake Elsinore after the 2019 storms. This photo shows a remote controlled bulldozer cleaning debris from a low clearance box culvert.*

This project was selected as the Outstanding Civil Engineering—Environmental Engineering Project award through the American Society of Civil Engineers, San Bernardino and Riverside Counties Branch.

The District purchased a highly specialized mapping drone, a Microdrone MD4-1000DG. This drone's advanced on-board positioning system now allows the Surveying and Mapping Division to greatly reduce cost and turnaround time while simultaneously increasing safety and productivity.

The summer months of 2018 brought new and unfamiliar challenges to the District. Challenges not in the traditional sense of managing stormwater, but preparation in the aftermath of the devastating Cranston and Holy fires that occurred throughout July and August. High temperatures and dry drought related conditions led to the destruction of nearly 35,000 acres of mountainous terrain above thousands of county residents. In response, the District worked to prepare for the winter months by implementing emergency projects in anticipation of any potential mud and debris flows. The subsequent wet season put the District to the test by producing several record storm events. Ultimately, preemptive efforts resulted in damage to less than a dozen properties downstream of burn scars due to the diligent response by various Riverside County agencies including the District. The damages inflicted by these storms highlight over $1 billion of drainage infrastructure that still needs to be constructed in Riverside County.

While the focus was on post-fire recovery and record storm events, the District still managed to push forward on scheduled work. Notable accomplishments include the mapping of nearly 60 square miles of the Holy Fire burn scar which was used to aid in emergency preparation and risk mapping. There were new tools vital to the Cranston and Holy Fire responses that were developed including the Storm Center Rainfall Dashboard and installation of cameras at various District facilities that were used to activate storm patrols and issue emergency evacuations. The District successfully completed the acquisition and remediation of the Pinto property which for decades was used as an illegal landfill and has since been cleaned and removed as a threat to the local watershed. The Public Education Strategy Taskforce (PEST) was established during this year. The Eastvale Area Drainage Plan (ADP) was the first one to be closed out as it was fully developed with the planned drainage infrastructure.

The District's efforts before and during these winter months received local, state, and national recognition from peer groups including: the American Society of Civil Engineers, the National Association of Flood and Stormwater Agencies, the California State Association of Counties, and the National Association of Counties. Notable awards received in 2019 include the National Association of Counties – Information Technology: Monitoring and Response Tools for Post-Wildfire Debris Flow Management, and American Public Works Association 2019 – Stormwater Project of the Year: Heacock Channel.

ABOVE: *District Operations and Maintenance crews assist with the installation of a new real-time rain gauge to assist in emergency planning and safety evacuations in the Holy Fire area.*

FLOODS OF 2019

Having experienced extreme drought for many years prior, the drought abruptly ended with the occurrence of several notable storm events that significantly impacted the District. The most significant of these storms was a 200-year, 12-hour storm event which occurred on February 14, 2019, the Palm Springs area seeing five inches of rain.

The Whitewater River experienced flows over 600% above the historical average and Palm Canyon Wash recorded the largest flow in nearly four decades. This storm was strong enough to mobilize a 5-year old mountain burn scar above Palm Springs, causing the Tahquitz Debris Basin to reach capacity and overtop the emergency spillway. This single event prompted the declaration of a federal disaster, causing over $70 million in property damage, and prompted the evacuation of more than 60,000 residents.

Photo: Tahquitz Debris Basin, Palm Springs

DRONE TECHNOLOGY UTILIZATION

In February 2018, the District's Surveying and Mapping Division officially launched its UAV (drone) program with the purchase of "Frankie", a 1-meter wide, highly specialized, mapping drone. Built by Microdrones in Germany, Frankie is capable of mapping over 140 acres in a single flight. Frankie's onboard GPS and inertial measurement unit allow for high accuracy post-processing of flight trajectories which, in turn, allows the District to complete mapping projects with minimal field work. This technology significantly reduces cost, while simultaneously increasing response time and delivery turnaround.

In the aftermath of the Holy Fire in the second half of 2018, Frankie proved to be an extremely reliable and useful tool. With nearly daily flights, the District was able to quickly and accurately map areas of concern for emergency flood control measures. Once the rain arrived, Frankie was then used to consistently map a series of debris basins in order to keep tabs on the amount of debris and ash that was flowing from upstream watersheds. This information also proved valuable to research teams studying the effects of upland wildfires on downstream communities.

The District's fleet has since expanded to include three more drones, including a DJI Inspire 2, which is used to create beautiful site documentation videos. As an early adopter of this technology and with strong community outreach, the District's UAV program is now looked upon as one of leaders in the drone surveying field in southern California.

ABOVE: *The District embraced the rise of drone technology and utilized it to obtain data that otherwise would have been difficult to obtain. The drones have flown over 1,000 miles and mapped over 35,000 acres (55 square miles) to date in western Riverside County.*

ABOVE: *Drone flight over Mount Rubidoux in the city of Riverside.*

LOOKING FORWARD

Three-quarters of a century after coming into being on July 7th, 1945, the District can look back proudly at its accomplishments, its reputation, and its resolve to provide the highest quality service to our communities. Our mission drives us to not only protect the safety of our residents through effective and sustainable stormwater management techniques but to also manage our infrastructure in ways that also promote sustainable and livable communities through dual-use partnerships with our sister agencies. Whether it is through our partnerships with local water districts to develop and enhance local water supplies or our partnerships with local cities and parks departments to promote dual-use parks, trails, or even habitat restoration, we work diligently to maximize the value of our projects to our communities.

Our greatest challenges lie ahead. Much work remains to be done. Our promise to you is to strive to be a leader in the field of stormwater management, to achieve extraordinary results for our customers, to be the home of high quality teams, and to return maximum value to our community. We look forward to demonstrating that commitment to you in the years to come.

JASON E. UHLEY
General Manager-Chief Engineer

ACKNOWLEDGMENTS

The development for the District's 75th Anniversary Book could not have been done without, first and foremost, the support of the District's management team. It was an incredible milestone to document and bridge together the pivotal achievements of the District beginning with the content that was featured in the 50th Anniversary Book and the 70th Anniversary content authored by Joan Valle. The consolidation of the 75th Anniversary Book would not have been possible without the following individuals who dedicated their time and effort:

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ADDITIONAL NOTES:

Front Cover shows photos of the 1927 flooding of the San Jacinto River and photos taken during the construction phase of Eagle Canyon Dam. The Table of Contents features photos (clockwise from large main photo) of Mount Rubidoux, Mystic Lake, and Lake Elsinore. Back Cover shows photo of Chino Basin Levee. Eagle Canyon Dam plans were utilized for the background images.

SGA Marketing designed the layout of the District's 75th Anniversary Book.

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