

**RIVERSIDE COUNTY FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
RIVERSIDE, CALIFORNIA**

REPORT ON

**MASTER DRAINAGE PLAN
FOR
THE SUNNYMEAD AREA**

ZONE FOUR

October 1978

**KENNETH L. EDWARDS
CHIEF ENGINEER**

REVISIONS
TO
SUNNYMEAD MASTER DRAINAGE PLAN

Several changes have been made in the Sunnymead Master Drainage Plan since its adoption in October 1978. Some of the proposed facilities have been constructed, while others have been added, deleted, or modified. The revised map at the rear of this report reflects all of the changes made to date. Neither the narrative, the cost sheets, nor the plates contained within this report, however, have been changed to conform with the revised map. Therefore, when discrepancies are discovered the information shown on the map should be accepted as valid. If there are any questions regarding this master drainage plan, please feel free to contact the Riverside County Flood Control and Water Conservation District.

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MAP

Sunnymead Master Drainage Plan	Envelope
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PURPOSE

The purpose of this report is to investigate and evaluate the drainage problems of the Sunnymead area and to develop the most economical drainage plan which considers both the natural environment and economy of the area.

The Sunnymead watershed is a rapidly developing section of Riverside County located east of the City of Riverside. The watershed is roughly bounded by Frederick Street on the west, March Air Force Base on the southwest, Lateral "A" of the Perris Valley Storm Drain on the south and Lassalle Street on the east. The northerly watershed boundary is a divide within the Box Springs Mountains.

The plan presented herein will provide adequate protection to the community when implemented and serve as a guide for the long term construction scheduling of the primary drainage facilities. The plan will also act as a planning guide for the location and sizing of local drainage facilities to be constructed by developers and others within the area.

SCOPE

The drainage area covered by this plan consists of approximately 27 square miles, and ranges from extremely flat valley terrain, to foothills with steep slopes. The extent of the studies establishing this master plan include:

1. Determination of the quantity and points of concentration of storm runoff in the area.
2. Preparation of a drainage area map.

3. Determination of the location, size and capacity of the proposed drainage structures.
4. Investigation of alternate routes and methods as a basis for selecting the most economical plan.
5. Preparation of preliminary design plans and supporting cost estimates.

GENERAL DISCUSSION

This report provides a Master Drainage Plan for the Sunnymead area. The plan consists of several retention basins, open channels and a network of underground storm drains. This proposed system will carry storm runoff through this rapidly developing area to an outlet at the upper terminus of the Perris Valley Storm Drain.

During periods of runoff, floodwaters, silt, and other debris impact a wide area of prime agricultural land and the developing community, causing property damage and leaving roads and highways impassable. Subdivision activity within the plan area has increased dramatically within the last several years. With this rapid rate of development, the drainage problems of the area are being compounded due largely to the increase in runoff created by urbanization thus requiring the attendant need for greater degrees of flood protection.

The Master Drainage Plan presented herein provides the most economical method of collecting and conveying storm runoff through the study area to outlet into the Perris Valley Storm Drain. The proposed drainage structures will also provide an outlet for local drainage facilities built by developers and others as growth occurs in the area. When completed, the facilities will provide the area with improved drainage and protection from the once in 100 year flood.

CRITERIA

All underground storm drains proposed in this plan are intended to collect local urban runoff and with few exceptions, are located either in existing or proposed street rights of way. Runoff from a 10 year frequency storm is allowed to accumulate in the streets until it reaches the top of an 8-inch curb. At this point, the plan proposes the initiation of an underground drain which intercepts and conveys the entire 10 year storm runoff to an outlet downstream. Flows exceeding the 10 year frequency storm will generally be carried within street rights of way and the combination of both the street and the underground storm drain provides 100 year protection.

Open channels are proposed when the discharge is large and the construction and right of way cost for a channel prove to be less than the costs of an underground storm drain. Where open channels are provided, they are designed to carry the runoff from a 100 year frequency storm.

The alignments of all drains and channels are based on hydraulic efficiency, the ability to drain tributary areas, and economics.

HYDROLOGY

The hydrology for the plan was developed by two methods; namely, the rational method and the synthetic unit hydrograph method.

The rational method was used to determine the 10 year frequency design discharge generated in watersheds smaller than 160 acres. Ten year discharges for larger watersheds were generated using the synthetic unit hydrograph. All street systems were rated for these flows and all drain lines were sized according to these discharges.

The synthetic unit hydrograph method was used to determine the 100 year peak flows in the open channels and to determine the storage volume requirements for the retention basins and Pigeon Pass Dam.

Methodology and supportive data for the rational and synthetic hydrology can be found in "The Riverside County Flood Control and Water Conservation District Hydrology Manual" dated April 1978. It should be noted that the Sunnymead-Moreno intensity-duration curve was used for the rational hydrology computations, and that assumptions for future land use are based on a map entitled "Moreno Valley General Plan : 1990" adopted 18 October 1977, by the Riverside County Board of Supervisors.

EXISTING FACILITIES

There are several major drainage facilities existing within the Sunnymead Master Drainage Plan area. They are: (1) Pigeon Pass Dam, (2) Sunnymead Storm Channel, (3) Pigeon Pass Channel, and (4) Perris Valley Storm Drain, Lateral A. All of these facilities were built under the direction of the Riverside County Flood Control and Water Conservation District and are maintained by the District. Minor drainage facilities have been constructed in conjunction with development and are incorporated into the plan where possible.

Pigeon Pass Dam - This earthfill dam was built in 1957 and has a tributary drainage area of 7.66 square miles. The dam has 912 acre-feet of storage volume to the spillway, which is concrete lined and 120 feet wide at the crest. The outlet pipe is 30 inches in diameter and discharges a peak of 120 cfs in a 100 year frequency storm.

Sunnymead Storm Channel - This concrete lined channel was built in five stages over the period 1962 through 1968, and is shown on the Master Drainage Plan map as the existing portion of Line B. The trapezoidal channel varies from a 2-foot bottom, 5-foot deep to a 14-foot bottom, 7-foot deep section. The discharge in the upper reaches is 500 cfs and is 2100 cfs in the lower reaches.

Pigeon Pass Channel - Pigeon Pass Channel is shown on the Master Drainage Plan as the existing downstream extension of Line H. This concrete trapezoidal channel was built in 1966 and has a 10-foot bottom and is 5-foot deep with a design discharge of 830 cfs.

Perris Valley Storm Drain, Lateral A - This leveed earth channel was built in 1955; it is designated as Line A on the Master Drainage Plan map. The bottom width is 28 feet; the channel depth below natural ground is 6 to 7 feet; and the levee height varies from 3 to 5 feet. Lateral A serves as an outlet for the existing wash along Heacock Avenue and for a complex drainage system at March Air Force Base.

RECOMMENDED IMPROVEMENTS

The recommended improvements discussed below are shown on the enclosed map found at the back of this report. Supporting data for all proposed facilities is available for review at the Riverside County Flood Control and Water Conservation District's office.

Costs shown on the enclosed map include right of way and 30% for engineering administration and contingencies.

Line A - Perris Valley Storm Drain, Lateral A - The proposal for Line A includes concrete lining the existing channel section on its current grade and alignment, and constructing the ultimate bridges

at Heacock Street, Indian Street and Perris Boulevard. The resultant trapezoidal channel will have a 28-foot bottom, 11-foot depth and a capacity to convey 5900 cfs.

Line B - Sunnymead Channel - This proposed channel is a continuation of the existing Sunnymead Channel, which now terminates at Alessandro Boulevard. Line B is incorporated as part of the Specific Plan for Heacock Avenue adopted by the Riverside County Board of Supervisors in December 1969 and will extend from Alessandro to its confluence with Line A. Line B is one of the two major outlets for the entire plan, the other being Line M - Kitching Street Channel.

Line B-1 through Line B-16 are storm drains that outlet into Line B, the largest of which is 54-inches in diameter. A large portion of the older residential area, south of Highway 60, is drained by Lines B-5 through B-12. Lines B-13 through B-16 drain a relatively steep area north of Ironwood Avenue and east of Perris Boulevard.

Line C - Line C is a small, 3-foot bottom, trapezoidal channel that outlets into Line A. It is located in the most southerly portion of the plan and drains an area that the General Plan shows as 1 acre, single family development.

Two storm drains, Lines C-1 and C-2, extend upstream of Line C. Their sizes range from 48 to 33 inches in diameter.

Line D - Line D is similar to Line C in that it is a small, 3-foot bottom, trapezoidal channel outletting into Line A. The area drained is predominantly 1 acre development adjacent to Indian Street in the most southerly portion of the plan.

Storm drain Line D-1 extends upstream of Line D in Indian Street to a point 1320 feet upstream of Iris Avenue.

Line E - Line E is a 2-foot bottom trapezoidal channel that outlets into Line B. This east-west channel is one half mile long and ends at the intersection of the future Gentian Avenue and Indian Street. A large storm drain, Line E-2, extends north from this point to drain a large residential area. Line E-1 drains an existing tract north of Line E.

Line F - Fredrick Street Channel - Line F is an open trapezoidal channel with a 5-foot bottom and 6.5-feet deep where it outlets into Line B at Brodiaea Avenue. Line F parallels the California Aqueduct from Cottonwood Avenue to just south of Alessandro Boulevard. Joint use will be made of the Aqueduct's 100 foot wide easement for the Line F maintenance road. The channel will be located on property adjacent to the Aqueduct's easement.

Line F serves as an outlet for several storm drains that drain an area between Fredrick Street and Graham Street south of Highway 60.

Line F also serves as an outlet for the Fredrick Street Retention Basin. Line F, a 3-foot bottom trapezoidal section, continues a short distance upstream of the basin before becoming a storm drain. Lines F-8 through F-11 drain a very steep watershed that is ultimately conveyed to the Fredrick Street Retention Basin. Portions of these drains are sized for 100 year frequency discharges to assure their conveyance to the basin.

Fredrick Street Retention Basin - This basin, located between Hemlock Avenue and Highway 60 and just east of Fredrick Street, was proposed because of the inability of an existing 7'W x 4'H RCB to convey the 100 year discharge, 550 cfs, under the freeway. The peak outflow from the basin is 132 cfs, which can easily be conveyed by the RCB.

Line G - This 2200-foot long trapezoidal channel outlets into the existing Line B - Sunnymead Channel just downstream of Bay Avenue.

Line G-1, a 66-inch storm drain, outlets into the upstream end of Line G and from there makes its way north to a culvert under Highway 60.

Line H - Line H is the upstream continuation of the existing Pigeon Pass Channel. A short portion of Line H lies between Highway 60 and Sunnymead Boulevard where it acts as the outlet for the Indian Street Retention Basin. The major portion of Line H connects Pigeon Pass Dam to the Indian Avenue Retention Basin. This trapezoidal channel has a 5-foot bottom and a 5-foot depth.

Storm drain Lines H-1 through H-3 drain a one-half square mile area immediately north of Highway 60, between Indian Street and Perris Boulevard. Lines H-4 through H-6 outlet into the Line H channel and drain an area from west of Heacock Street to Indian Street.

Line H-7 and H-10 and laterals H-8 and H-9 drain the uppermost portions of the plan and outlet into Pigeon Pass Dam. This constitutes a diversion of the natural flows but allows the facilities downstream to be greatly reduced in size. The diversion of the flows has no significant effect on

the performance of the Pigeon Pass Dam. The lower reaches of Lines H-7 and H-10 are sized for the 100 year discharge and are respectively 78-inch and 72-inch diameter pipes.

Indian Street Retention Basin - This is the largest of the three proposed retention basins, with a storage volume of 80 acre-feet. The need for this basin became apparent when it was found that the existing triple 6'W x 4'H concrete box at the upper end of Pigeon Pass Channel could not pass the 100 year discharge of 1135 cfs. Also contributing to the necessity of the basin was the fact that the existing Line B - Sunnymead Channel, downstream of its confluence with the Pigeon Pass Channel, could not accommodate the total discharge being delivered. With the proposed basin and its 300 cfs outflow the triple box functions well and the existing Line B Channel has adequate freeboard to allow inflow from Line G and storm drain Lines B-5 thru B-12.

Line J - This small trapezoidal channel conveys 230 cfs to Pigeon Pass Dam from a drainage area west of Pigeon Pass Road. Without the channel the flows from the watershed are forced south along Pigeon Pass Road and away from the dam.

Line K - Line K is a 2-foot bottom, 3-foot deep channel located just north of Highway 60 on Kitching Street. At present the drainage area is a relatively steep, undeveloped parcel of land. Future development will be single family, $\frac{1}{2}$ acre, according to the General Plan. Line K outlets into a freeway collector channel, which in turn outlets into the existing Line B - Sunnymead Channel just upstream of Highway 60 at Perris Boulevard.

Line L - Line L is by far the largest channel section in the plan. It is a 70-foot bottom, 9-foot deep trapezoidal section with a design discharge of 11,350 cfs. Downstream of the Line M confluence, the drainage area tributary to Line L is 28 square miles, 22 of which lie east of the plan boundary in the Moreno Valley area. For this reason 23 percent of the Line L cost, downstream of Line M, is apportioned to the Sunnymead Master Drainage Plan with the remaining 77 percent to be incorporated into the future Moreno Master Drainage Plan. The same procedure was used for the upstream portion of Line L where only 3 percent of the cost of this reach is attributable to the Sunnymead Master Drainage Plan.

Line M - Kitching Street Channel - This channel and its extensive storm drain system constitutes the backbone of the eastern half of the Sunnymead Master Drainage Plan. From its confluence with Line L the channel extends northerly, adjacent to Kitching Street, 2.7 miles to its terminus at Bay Avenue. The average section is a 12-foot bottom, 7-foot deep trapezoidal channel conveying 2650 cfs.

Storm drain Lines M-1 through M-17 drain an extensive area west of Kitching Street. Most of the east-west streets in this area have very little grade and therefore require relatively large pipes. The lower end of Line M-11 is an 8'W x 4.5'H concrete box on a slope of .0015.

Line N - Lasselle Street Channel - Line N is a small trapezoidal channel adjacent to Lasselle Street and outlets into Line L at its upstream terminus.

Lines N-1 through N-5 are storm drains that convey runoff to Line N from an area bounded by Kitching and Lasselle Streets and Brodiaea and Gentian Avenues.

Line P - This trapezoidal channel begins at the upper terminus on Line M and extends northwesterly to the intersection of Perris Boulevard and Cottonwood Avenue.

Lines P-1 through P-7 reach out into a watershed that is predominantly an older, well developed area and convey their runoff to Line P.

Line Q - Line Q is in a relatively steep, undeveloped watershed and serves as the outlet for the Lasselle Street Retention Basin.

Storm drain Lines Q-1 and Q-2 along with Line R contribute directly to Line Q, downstream of Highway 60. Line Q-3 is a large storm drain that outlets into the Lasselle Street Retention Basin and extends northerly, approximately one mile, through a very rugged watershed.

Lasselle Street Retention Basin - When initial studies for the Sunnymead Master Drainage Plan began, Line M-18 extended north of Highway 60 to the proposed upstream limit of Line Q-3. This longer length and larger drainage area required some very large pipe sizes toward the downstream end of Line M-18. As an alternative, a basin north of the highway was studied and was found to be a more economical solution than the upstream extension of Line M-18. The regulating effect of the basin will also reduce the size of all downstream facilities.

The resulting Lasselle Street Retention Basin is on a 10 acre site and has 49 acre-feet of below ground storage volume. The inflow from the .70 square mile drainage area is 465 cfs; outflow is 47 cfs.

Line R - Line R is a 6-foot bottom channel that extends 1600 feet east of Line Q parallel to and south of Highway 60.

Lines R-1 through R-3 convey the discharges generated on the north side of Highway 60 to a pair of existing 54-inch culverts which carry the flow under the highway and outlet into Line R.

Line S - Line S is somewhat parallel to and very similar to Line Q. After confluencing with Line Q, Line S extends upstream in a north-easterly direction to its end at Highway 60 where it joins an existing 5'W x 4'H box culvert. The terrain through which the channel traverses is relatively steep and, as yet, undeveloped.

Line S-1 and S-2 are two short storm drain laterals contributing to Line S.

Line T - The drainage area for Line T is a very long, narrow shape beginning north of Highway 60 and extending south to Cactus Avenue. Proposed improvements begin at Eucalyptus Avenue as Line T-1, and extend southerly to Bay Avenue where the drain changes to a 8'W x 4'H box culvert and continues south to Republic Avenue.

Line T extends south of Republic Avenue to Cactus Avenue as an open trapezoidal channel and outlets into a large roadside ditch that drains easterly to Line B - Sunnymead Channel. The ditch is on March Air Force Base property and is maintained by the Base.

ALTERNATIVE STUDIES

The normal procedure when generating a Master Drainage Plan is to prepare several complete and separately distinct alternates, any one of which could suffice as the Plan. Normally each successive alternate is an improvement on the previous alternate.

The final choice is usually based upon cost, benefit and sound engineering judgement.

The generation of the Sunnymead Master Drainage Plan did not follow this normal progression of successive alternates for several reasons. First, time was of the essence. Development is occurring very rapidly and with no plan available continuity is lacking. Second, the mere size of the plan is such that successive alternate plans could not be generated without tremendous effort and consumption of time. For these reasons, as the plan progressed, alternates were explored on a line by line basis and decisions made. The alternates studied are far too numerous to enumerate here, however, several alternates are discussed in the "Recommended Improvements" section of this report. The Sunnymead Master Drainage Plan, as set forth herein, is the coalescence of the best alternates investigated.

CONCLUSIONS

Based on the studies and investigations made for this report, it is concluded that:

1. The Sunnymead area has experienced serious flooding problems in the past. As this area converts from primarily agriculture to more urban uses, these damages are expected to increase. A more orderly growth pattern can safely occur with the construction of these proposed facilities.
2. A drainage system is required to safely convey storm runoff through the area with the least interruption to public services. The Master Drainage Plan presented in this report is such a system and is the most economical and environmentally balanced of the alternatives studied.

3. The proposed plan lends itself to stage construction as funds become available.
4. The total cost of the recommended improvements, including right of way, engineering and contingencies (June 1978) is estimated to be \$33,552,000.

RECOMMENDATIONS

It is recommended that:

1. The Master Drainage Plan as set forth herein be adopted by the Riverside County Flood Control and Water Conservation District's Board of Supervisors as part of the overall master plan for the County.
2. The Master Drainage Plan as set forth herein be used as a guide for all future developments in the study area and that such developments be required to conform to the plan insofar as possible.
3. The right of way required for the plan be protected from encroachment.
4. The Sunnymead Area Drainage Plan, prepared by the Riverside County Flood Control and Water Conservation District, be adopted as the primary means through which funding may be procured for implementation of the plan and that other funding sources be investigated and adopted so as to complete the plan at the earliest possible date.

TABLE I

SUNNYMEAD MASTER DRAINAGE PLAN

COST SUMMARY

STORM DRAINS

LINE DESIGNATION	COST *	LINE DESIGNATION	COST *	LINE DESIGNATION	COST *
A-1	\$291,000	H-5	\$277,000	Q-2	\$ 60,000
B-1	299,000	H-6	282,000	Q-3	784,000
B-2	210,000	H-7	836,000	R-1	545,000
B-3	134,000	H-8	53,000	R-2	50,000
B-4	135,000	H-9	148,000	S-1	90,000
B-5**	235,000	H-10	798,000	S-2	189,000
B-6	169,000	M-1	65,000	T-1	740,000
B-7	268,000	M-2	495,000		
B-8	411,000	M-3	105,000		
B-9	90,000	M-4	923,000		
B-10	98,000	M-5	123,000		
B-11	79,000	M-6	120,000		
B-12	126,000	M-7	86,000		
B-13	597,000	M-8	170,000		
B-14	109,000	M-9	132,000		
B-15	110,000	M-10	142,000		
B-16	291,000	M-11	1,095,000		
C-1	124,000	M-12	202,000		
C-2	255,000	M-13	145,000		
D-1	416,000	M-14	162,000		
E-1	111,000	M-15	88,000		
E-2	806,000	M-16	141,000		
F-1	184,000	M-17	112,000		
F-2	361,000	M-18	809,000		
F-3	100,000	M-19	64,000		
F-4	69,000	M-20	66,000		
F-5	336,000	N-1	77,000		
F-6	27,000	N-2	519,000		
F-7	322,000	N-3	77,000		
F-8	276,000	N-4	74,000		
F-9	428,000	N-5	77,000		
F-10	86,000	P-1	143,000		
F-11	147,000	P-2	593,000		
G-1	813,000	P-3	120,000		
G-2	264,000	P-4	16,000		
H-1	557,000	P-5	16,000		
H-2	126,000	P-6	131,000		
H-3	207,000	P-7	28,000		
H-4	191,000	Q-1	67,000		
				TOTAL	
				STORM DRAIN	\$21,893,000

TABLE I (CONT'D.)

SUNNYMEAD MASTER DRAINAGE PLAN

COST SUMMARY

OPEN CHANNELS AND
RETENTION BASINS

LINE DESIGNATION	OPEN CHANNEL	CONSTRUCTION*	RIGHT OF WAY	TOTAL COST
A	Perris Valley Storm Dr. Lateral A	\$1,865,000	-	1,865,000
B	Sunnymead Channel	1,795,000	221,000	2,016,000
B-5**	Oldtown Channel	64,000	3,000	67,000
C	-	136,000	21,000	157,000
D	-	140,000	21,000	161,000
E	-	200,000	22,000	222,000
F	Fredrick Street Channel	1,062,000	92,000	1,154,000
G	-	142,000	15,000	157,000
H	-	338,000	39,000	377,000
J	-	126,000	16,000	142,000
K	-	61,000	10,000	71,000
L	-	1,722,000	191,000	363,000***
M	Kitching Street Channel	1,890,000	41,000	1,931,000
N	Lasselle Street Channel	194,000	24,000	218,000
P	-	233,000	28,000	261,000
Q	-	477,000	63,000	540,000
R	-	80,000	13,000	93,000
R-3	-	19,000	3,000	22,000
S	-	527,000	63,000	590,000
T	-	222,000	27,000	249,000
TOTAL OPEN CHANNEL COST				\$10,656,000
RETENTION BASIN DESIGNATION		CONSTRUCTION *	RIGHT OF WAY	TOTAL COST
FREDRICK STREET RETENTION BASIN		60,000	72,000	132,000
LASSELLE STREET RETENTION BASIN		455,000	97,000	552,000
INDIAN STREET RETENTION BASIN		189,000	130,000	319,000
TOTAL RETENTION BASIN COST				\$1,003,000
TOTAL COST OF PLAN				\$33,552,000

* Costs include 30% for engineering, administration and contingencies.

** Line B-5 consists of both open channel and storm drain. The cost shown above pertains to the open channel reach. The storm drain cost is shown on sheet 15.

*** For explanation of cost see page 10, Line L.