

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

MASTER DRAINAGE PLAN

FOR THE

GOOD HOPE AREA

ZONE FOUR

MAY 1982

**KENNETH L. EDWARDS
CHIEF ENGINEER**

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CONTENTS

	<u>Page</u>
Purpose	1
Scope	1
General Discussion	2
Criteria	3
Hydrology	3
Existing Facilities	4
Recommended Improvements	4
Retention Dams	7
Open Channels	8
Underground Storm Drains	8
Road Culverts	8
Alternates	9
Conclusions	10
Recommendations	11

TABLE

Number

I Culvert Summary	12-13
II Good Hope Master Drainage Plan - Cost Summary	14

PLATES

Preliminary Plan and Profile Drawings	1-24
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MAPS

Assumed Land Use Map	5
Drainage Boundary Map	6
Master Drainage Plan Map	Envelope

PURPOSE

The purpose of this report is to investigate and evaluate the drainage problems of the Good Hope area and to develop an economical drainage plan which provides flood protection for both existing and future development.

The Good Hope area is located westerly of the City of Perris along Highway 74. The study area is bounded by natural divides on the north, east and west. The easterly half of the study area is made up of gentle rolling hills and valley terrain. The westerly half of the study area is predominantly rugged foothills. The south boundary of the plan is Highway 74 and Mountain Avenue.

The plan presented herein, along with the preservation of select natural watercourses, will provide adequate flood protection to the community. 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.

It should be noted by the reader that the cover of this report clearly states it is a master plan, and therefore, should be read and used with this in mind. Simply stated, this plan is an overview; a study of the drainage problems that exist in a specific geographical area, and a conceptual solution to those problems. As stated elsewhere in this report, the selection of the facilities presented in this plan is based on engineering and economic considerations and is by no means the only solution.

The alignment and location of the facilities proposed in this Master Drainage Plan are general; precise facility locations will be dictated by conditions existing at the time of design. Similarly, the sizing information shown on the enclosed map is preliminary. A more detailed analysis performed at the design stage will determine final sizing.

SCOPE

The drainage area covered by this plan is approximately 11.9 square miles in size. The terrain ranges from the moderate slopes of the surrounding foothills to the gently sloping valley. The extent of the studies establishing this master plan includes:

1. Determination of the quantity and points of concentration of storm runoff in the area.
2. Preparation of a drainage boundary map. (Page 6)
3. Determination of the location and size of the proposed drainage structures.
4. Investigation of alternate routes and methods as a basis for selecting the most economically and engineeringly sound plan.
5. Preparation of preliminary plan and profile drawings and supporting cost estimates.

GENERAL DISCUSSION

This report provides a Master Drainage Plan for the Good Hope area. The key elements of the plan include three retention dams, a control levee, numerous open channels and several storm drains. Also included in the plan is an analysis of existing and needed road culverts in the area.

At present, during periods of runoff, flood waters, silt and other debris emanating from the mountains and hills surrounding the area impact the developing community, causing property damage and leaving roads and highways impassable. Continued development of the area will only serve to worsen the situation and necessitate a greater need for flood protection.

The Master Drainage Plan presented herein provides an economical method of collecting and conveying storm runoff through the study area. 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.

Recognizing that access is a major concern to the residents of Good Hope, this report addresses the problem by providing adequate culvert capacity at major street crossings. Responsibility for implementation of the recommended culvert improvements lies with the Riverside County Road Department.

CRITERIA

All underground storm drains proposed in this plan are intended to collect local urban runoff and, with few exceptions, are located in existing street rights of way. Open channels are proposed when the discharge is large and the construction and right of way costs for a channel prove to be less than the cost of an underground storm drain. Storm drains and open channels are designed to carry the runoff from a 100 year frequency storm.

The primary intent of the retention dams proposed in this plan is to reduce peak flow rates; that is, the outflow is much less than the inflow. The benefit of this concept is that the facilities needed downstream can be significantly reduced in size and cost. In addition to the lesser flow rates, the dams also serve as a means of collecting and directing flows into a single, confined outlet. The retention dams are designed to safely pass the 100 year storm through the outlet pipe and the 1000 year storm over the spillway.

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

Road culverts are sized to pass at least the runoff from a 10-year frequency storm and in some cases the 100-year runoff. The plan only addresses the culvert needs at major roadways on an approximate one-half mile grid. At present, many of the more local streets are not county maintained and are too numerous to be addressed at this time. Further discussion of the criteria used in the road culvert study can be found under "Recommended Improvements - Road Culverts" on page 12.

HYDROLOGY

Two methods of hydrology were used in this plan to determine design discharges. For smaller tributary areas, up to 500 acres in size, the Rational Hydrology Method was used. The Synthetic Unit Hydrograph Method was generally used for larger areas. The design discharges used in sizing all future facilities in the study area should be determined by one of these two methods.

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.

Usually, future land use assumptions used in District prepared master drainage plans are based on County and/or local general land use plans. In the Good Hope area, however, the only adopted land use plan currently in use is the "General Plan - Riverside County Land Use, Recreation, Major Transportation Routes" dated 1966. This plan shows land use designations that are far too general for our purpose. Therefore, it became necessary to generate a more defined land use plan. The map on page 5 of this report shows the assumed future land use patterns that were used throughout this plan. Derivation of the map was based upon: 1) District aerial photos dated 4/10/80 and, 2) the County Assessor's books. Generally, existing land use was the primary factor considered in making land use assumptions for the future. For example, if an area is currently predominantly 5 acre single family residential with a few 2 1/2 acre lots, future land use was assumed to be 2 1/2 acre single family residential. In most cases conservative densities were selected. If future development varies substantially from the indicated assumptions, revisions of the drainage plan may become necessary. If, however, development continues as predicted, with only minor deviations from the assumptions made by this report, the runoff quantities and facility sizing should be adequate.

EXISTING FACILITIES

Currently, the District does not operate or maintain any flood control facilities within the study area. The only drainage facilities currently existing are those road culverts and roadside ditches which have been installed and are maintained by the Riverside County Road Department. Pertinent culvert data can be found on Table I on page 12 .

RECOMMENDED IMPROVEMENTS

The recommended improvements discussed briefly below are shown on the enclosed map found at the back of this report. Preliminary plan and profile drawings for the proposed dams, control levee, open channels and storm drains can be found following the text of this report.

Supporting data for all proposed facilities is available at the Riverside County Flood Control and Water Conservation District office. Costs shown on the enclosed map include right of way and 30% for engineering, administration and contingencies (see Table II, Cost Summary, page 14).

Before any design is undertaken it should be noted that during preparation of preliminary plan and profile drawings, a utility search was not undertaken. Such a search may discover utilities that will necessitate minor alignment or size changes to the proposals within, or utility relocation.

RETENTION DAMS

As was stated earlier, the primary intent of a retention dam is to reduce peak flow rates through the use of temporary storage, and thereby effect a reduction in the size and cost of the downstream outlet works. All three dams proposed in this plan are sized to safely pass the 100 year frequency flow through an outlet pipe. The spillway, "over the embankment" type for the Lopez and De Prad Dam and "through the abutment" type for the Marshall Dam, is capable of passing the 1000 year flow with an approximate freeboard of two feet. By virtue of their embankment height and storage capacity, both the Marshall and Lopez dams are jurisdictional and will be closely scrutinized by the Division of Safety of Dams of the State Department of Water Resources prior to and during their construction.

The Marshall Retention Dam has the distinction of being the largest dam in the plan with a contributing drainage area of five square miles. Because of the steep slopes and dense cover throughout much of the drainage area, it was felt that debris should be considered in the sizing of the basin site. Calculations determined the debris potential to be approximately 70 acre-feet. This capacity has been provided within the basin in addition to the required flood storage. No debris capacity has been provided at the other two dam sites.

To assure containment of major flood flows in the established watercourse northwest of Marshall Retention Dam, the construction of Marshall Control Levee is proposed. This facility will provide protection for properties easterly of the levee site and deliver all flows to the basin. Under present conditions one mobile home will have to be relocated to accommodate full utilization of the basin site.

OPEN CHANNELS

The open channels proposed in this plan are both trapezoidal and rectangular concrete facilities. The right of way required for the channels will generally be of sufficient width to accommodate the channel and one or two maintenance roads with appropriate fencing. At several locations compacted fill levees are used to direct natural flows into downstream channels or storm drains. They are generally 6 feet or less in height and are not intended to store flood flows for a sustained period of time. Bridges or box culverts are proposed at all major road crossings and are of sufficient length to accommodate ultimate street widths.

UNDERGROUND STORM DRAINS

The underground drains proposed in the plan are precast reinforced concrete pipe (RCP) ranging in size from 42 inches to 72 inches in diameter. Storm drains are generally used where flow rates are not too high; in undulating terrain; and where the alignment can take advantage of an existing or proposed street, thus eliminating right of way acquisition costs. In some cases, where special circumstances dictate, a drain may be a reinforced concrete box (RCB), but this is a more expensive alternate and avoided when possible.

ROAD CULVERTS

The terrain in Good Hope is quite hilly and traversed by many small watercourses. The road system in the area, layed out in a typical grid pattern, is subject to many watercourse crossings. The Riverside County Road Department has installed pipe culverts at many of these crossings. The District has, with the encouragement and cooperation of the Road Department, attempted to analyze the adequacy of the existing culverts and the need for additional culverts. The criteria listed below was the basis for the analysis.

1. No culverts are proposed for drainage areas less than 50 acres.
2. Only those roads on an approximate 1/2 mile grid were considered. The exclusion of all other roads does not suggest that they are free from culvert needs, but due to the limited funding available at this time it was felt that only the major County maintained roads could be addressed.

3. Culverts are sized to convey the 10 year frequency flow under the roadway. The balance of flow in the 100 year storm is assumed to pass over the roadway and continue downstream in the same watercourse.

Exceptions:

- a. All roads with an ultimate right of way width greater than 88 feet, have culverts sized to convey the 100 year frequency flow under the roadway.
 - b. If the 10 year storm flow rate exceeds 500 cfs, the culverts are sized to carry the 100 year flow.
4. Sizing of culverts is based upon maximizing available head and the assumption of inlet control.
 5. Culverts are assumed to extend to the ultimate right of way width of the road.
 6. Credit is given to the flow capacity of most existing culverts with the assumption that they will remain in service.

A complete culvert summary is provided in Table I on Page 12, and culvert locations are shown on the map found at the rear of the report.

ALTERNATES

This proposed plan, as with all District master drainage plans is the cumulation of the best alternatives explored. This section will attempt to briefly discuss the alternatives that were studied and eventually disregarded in favor of the facilities shown on the enclosed map.

One major consideration in the development of this plan was whether or not flood retention was a viable alternative. Preliminary sizing and costs were developed for an alternative that assumed collection dikes at the Lopez and De Prad sites and a debris dam at the Marshall site. These facilities would provide no peak reduction. These facilities themselves would be less costly than the retention dams proposed in the plan, however, the downstream channel systems would be much larger and more costly than their counterparts in the recommended plan. The cost comparison showed the retention alternative to be approximately \$450,000.00 cheaper than the other alternative. Aside from the cost savings, the retention alternative better lends itself to stage construction.

Construction of the dams alone, even without the downstream channel works, will provide some relief to the downstream properties, particularly in the more severe storms.

An unlined trapezoidal channel was considered for Line A from Ellis Avenue to near Highway 74. Pursuing this alternative would have required increasing the channel bottom width from 14 feet to 40 feet and the channel right of way from 70 feet to 135 feet. This unlined section would require several drop structures to reduce the channel gradient sufficiently to lower the velocity to an acceptable 6 feet per second. The substantial increase in road crossing costs attendant with this alternative and the increase in annual maintenance costs led to its exclusion.

The proposed plan includes the use of rectangular channel downstream of Highway 74. This more costly form of channelization seems to be the only reasonable alternative through this area that is circumscribed by hilly terrain and heavily congested commercial usage.

That portion of the watershed that lies westerly of Post Road, and most specifically Santa Rosa Road, has serious drainage problems that severely affect the roadway. Unfortunately, the District does not have adequate mapping in this area to attempt addressing the needs along this reach of roadway.

In short, the Master Drainage Plan for the Good Hope area as presented herein is the coalescence of the best alternatives explored.

CONCLUSIONS

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

1. The Good Hope area has experienced serious flooding problems in the past. As this area continues to develop, 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 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, contingencies, and administration is estimated to be \$8,736,000.

RECOMMENDATIONS

It is recommended that:

1. The Master Drainage Plan as set forth herein be approved 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,

TABLE I
Master Drainage Plan for the Good Hope Area

CULVERT SUMMARY

Culvert Number	Drainage Area	Design Peak Flow Rate	Existing Facility	Recommended Improvement	Total Cost
①	123 Ac.	148 CFS	1-21" CMP	Extend Existing 21" CMP Install 65"x40" CMPA	\$ 9,000
②	143	160	1-24" CMP	Extend Existing 24" CMP Install (3) 50"x31" CMPA	17,000
③	571	410	(2)-24" CMP	Extend (2) Existing 24" CMP Install Double Cell 8'Wx4.5'H RCB	44,000
④	453	430	1-24" CMP	Remove Existing 24" CMP Install Double Cell 8'Wx4'H RCB	41,000
⑤	69	65	1-18" CMP	Extend Existing 18" CMP Install 43"x27" CMPA	5,000
⑥	385	460	1-43"x27" CMPA	Extend Existing 43"x27" CMPA Install (3) 65"x40" CMPA	26,000
⑦	70	125	-	Install (2) 50"x31" CMPA	10,000
⑧	550	1200*	1-36" CMP	Remove Existing 36" CMP Install Double Cell 12'Wx5'H RCB	65,000
⑨	263	430*	1-18" CMP	Remove Existing 18" CMP Install 12.5'Wx5'H RCB	36,000

TABLE I (Cont.)

Culvert Number	Drainage Area	Design Peak Flow Rate	Existing Facility	Recommended Improvement	Total Cost
(10)	290 Ac.	310 CFS	-	Install (4) 58"x36" CMPA	\$ 24,000
(11)	68	55	1-29"x18" CMPA	Extend Existing 29"x18" CMPA Install 29"x18" CMPA	5,000
					<u>\$282,000</u>

* Denotes 100 Year Design Peak Flow Rate

° Includes 30% for Engineering, Administration & Contingencies

TABLE II

MASTER DRAINAGE PLAN

for the

GOOD HOPE AREA

COST SUMMARY

FACILITY	CONSTRUCTION COST*	RIGHT OF WAY	MASTER PLAN COST
Line A	\$2,486,000	\$ 145,000	\$ 2,631,000
Lateral A-1	311,000	7,000	318,000
Lateral A-1A	111,000	-0-	111,000
Lateral A-2	159,000	4,000	163,000
Lateral A-3	788,000	65,000	853,000
Lateral A-3A	390,000	4,000	394,000
Lateral A-4	149,000	17,000	166,000
Line B	473,000	22,000	495,000
Line C	434,000	8,000	442,000
Line D	315,000	30,000	345,000
De Prad Retention Dam	385,000	163,000	548,000
Lopez Retention Dam	658,000	136,000	794,000
Marshall Retention Dam	808,000	295,000	1,103,000
Marshall Control Levee	70,000	21,000	91,000
Subtotal	\$7,537,000	\$ 917,000	\$8,454,000
Culverts	\$ 282,000	-0-	\$ 282,000
Total	\$7,819,000	\$ 917,000	\$8,736,000

* Includes 30% for engineering, administration and contingencies