

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

REPORT ON

MASTER DRAINAGE PLAN

FOR THE

RECHE CANYON AREA

ZONE ONE

MARCH 1984

**KENNETH L. EDWARDS
CHIEF ENGINEER**

RIVERSIDE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT
Riverside, California

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PURPOSE

The main purpose of this plan is to provide all-weather access for the residents of the Reche Canyon area. In addition, increased protection from flooding should be afforded both existing and future development in the Canyon.

The Reche Canyon Area consists exclusively of an unincorporated area of Riverside County. The master plan boundary is roughly the Riverside County Line to the north, the rugged hills which surround the canyon to the east and west and the northern portions of the Sunnymead and Moreno Master Drainage Plan boundaries to the south.

It should be noted by the reader that this report is a master plan and should be read and interpreted with this in mind. Simply stated, this plan is an overview; a study of the drainage and flooding problems which exist in a specific geographical area and conceptual solutions to those problems. As stated elsewhere in this report, the selection of the facilities proposed 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 and restrictions existing at the time of design. Similarly, the sizing information shown on the plates included in this report and on the enclosed map is preliminary. A more detailed analysis performed at the design stage will determine final sizing.

BACKGROUND

The problems of flooding and erosion in the Reche Canyon Area have long been recognized. Reche Canyon Road, the primary and in many cases the sole access to many properties in the canyon, is aligned along the canyon floor. It is often traversed and damaged by floodwaters and debris, which can severely impair and at times completely sever access for residents. Heavy debris production results when the highly erosive soil is aggravated by frequent burns over much of the watershed.

Residents of the Canyon have long sought assistance from this District and from the Riverside County Road

Department in preserving their access through the Canyon. The Master Drainage Plan for the Reche Canyon Area arose from the need for a framework of drainage improvements which would lend itself to stage construction.

SCOPE

The drainage area encompassed by this plan is approximately 7 square miles in size (see boundary map, page 7). The watershed consists primarily of rather steep hillsides which drain toward the canyon floor. The canyon slopes generally to the northwest. The extent of the studies establishing this master plan includes:

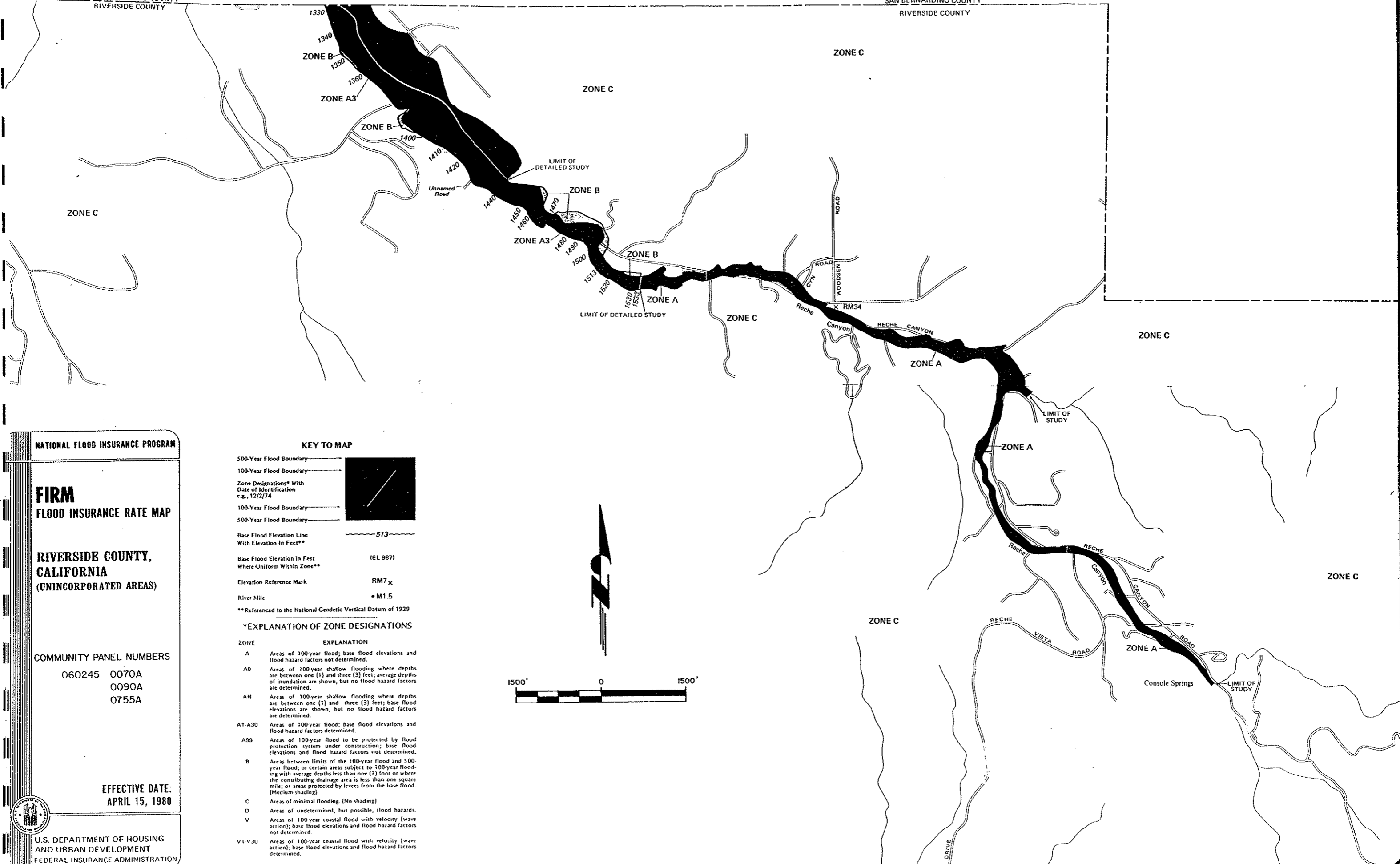
1. Determination of the quantity and points of concentration of storm runoff in the area.
2. Preparation of a drainage boundary map.
3. Determination of the location, size and capacity of the proposed drainage structures.
4. Investigation of alternatives as a basis for selecting the most economically 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 Reche Canyon Area. This plan consists primarily of open channel systems and levees adjacent to Reche Canyon Road. Also included are a series of roadway culverts, wing dikes and a storm drain.

At present, during periods of runoff, flood waters heavily laden with silt and other debris impact the Canyon community, causing property damage and often times leaving Reche Canyon Road impassable, and the residents cut off from essential services. The extent of flooding that could be expected from a 100 year frequency storm impacting the Reche Canyon area has been determined by the Federal Insurance Administration (FIA). A reproduction of the 100 year flood plain, as mapped by the FIA is shown on page 3 .

As development expands throughout the Canyon, so will drainage problems, thereby necessitating a greater need for flood protection. Future development will also be dependent upon the Canyon's dwindling groundwater supply. The Master Drainage Plan presented herein provides an economical method of containing and conveying storm runoff through the study area. When completed, the proposed facilities will provide the area with a high level of protection without



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

**RIVERSIDE COUNTY,
CALIFORNIA**
(UNINCORPORATED AREAS)

COMMUNITY PANEL NUMBERS

060245 0070A
0090A
0755A

EFFECTIVE DATE:
APRIL 15, 1980



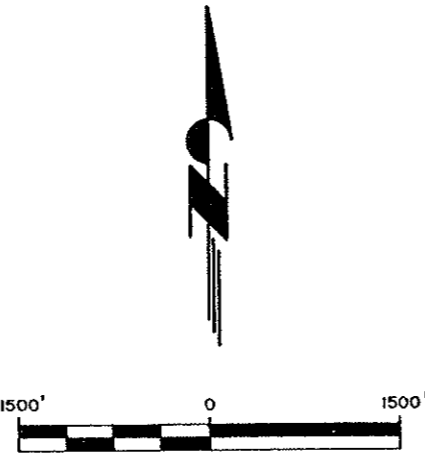
U.S. DEPARTMENT OF HOUSING
AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

KEY TO MAP

- 500-Year Flood Boundary
- 100-Year Flood Boundary
- Zone Designations* With Date of Identification e.g., 12/2/74
- 100-Year Flood Boundary
- 500-Year Flood Boundary
- Base Flood Elevation Line With Elevation In Feet**
- Base Flood Elevation In Feet Where Uniform Within Zone**
- Elevation Reference Mark
- River Mile

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.



significantly affecting recharge of the subterranean water table.

CRITERIA

Improvements proposed for the main wash along Reche Canyon Road and to the roadway itself are referred to as the Reche Canyon Improvement. These facilities are initiated at points where the 100 year flood plain impinges upon or threatens the existing roadway. Full channelization of flows is proposed only in areas where the utilization of levees or road realignments is impractical.

Facilities such as open channels and levees are generally considered the only economical means of transporting large flood flows for any appreciable distance. These facilities are designed to convey projected runoff and debris from a 100 year frequency storm.

An underground storm drain is provided to collect and convey storm flows through an area when topographic constraints or existing development preclude the economical construction of an open channel facility. The proposed storm drain system (Line A), is located in street right of way and is designed to collect and transport runoff from a 100 year frequency storm with allowances for debris transportation.

Roadway culverts are designed to convey storm runoff beneath street improvements. These culvert facilities may incorporate wing dikes into their design to contain and direct flows toward the culvert.

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

HYDROLOGY

Two methods of hydrology were used in this plan to determine design discharges. For smaller tributary areas, up to approximately 200 to 400 acres in size, the Modified Rational Hydrology Method was used.

The Synthetic Unit Hydrograph Method was applied to all other drainage areas within the watershed. The design discharges used in sizing any future appurtenant facilities within the study area should be determined by one of these two methods.

Methodology and supportive data for rational and synthetic hydrology can be found in the "The Riverside County Flood Control and Water Conservation District Hydrology Manual" dated April 1978.

As a result of frequent burns, soil characteristics, and anticipated flow velocities, debris transportation is foreseen as a major problem throughout the Canyon. In determining a bulking factor for design flow rates, "The U.S. Army Corps of Engineers' Method of Estimating Debris Storage Requirements for Debris Basins" (Tatum 1963), as well as "The Report on Debris Reduction Studies for Mountain Watersheds", Los Angeles County Flood Control District, 1958, was used. A peak bulking factor of 65 percent was applied to all 100 year frequency storm flow rates in determining the sizing of proposed facilities.

All discharge rates were determined on the basis of projected ultimate development. Future land use assumptions were based primarily on the following:

Land Use Element of the
Moreno Valley General Plan: 1990 - Riverside County
Planning Department
October 18, 1977

A review of recent subdivision activity and aerial photography was used to supplement the aforementioned document in predicting future land use patterns. A map depicting these assumed land use patterns can be found on page 6. If development varies substantially from the indicated assumptions, revisions of the drainage plan may become necessary.

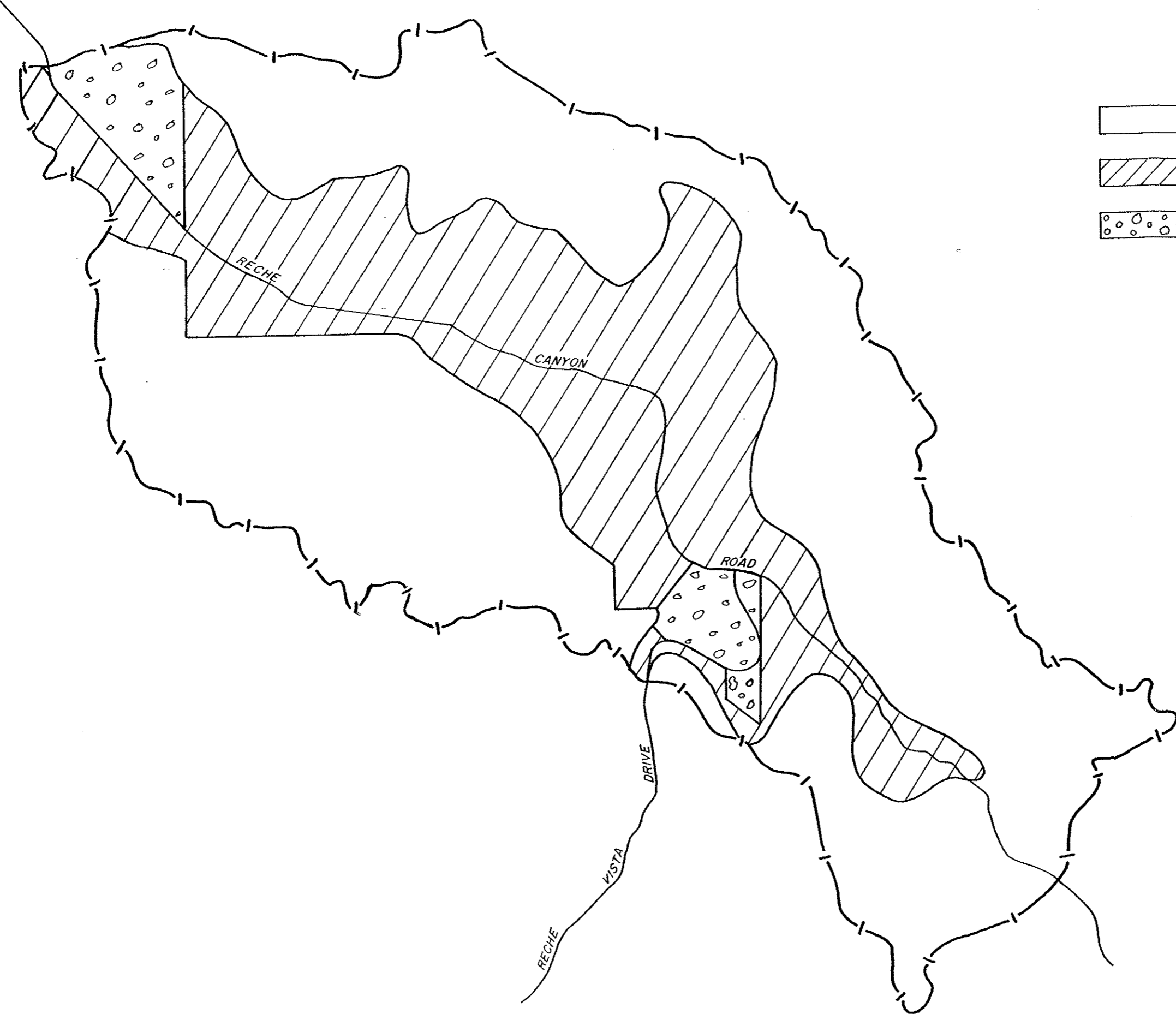
EXISTING FACILITIES


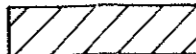
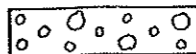
Presently, the only flood control improvements in the Canyon are a few minor roadway culverts constructed by the County Road Department or by residents. These culverts are generally undersized and afford protection to the roadway and private drives against only minor flows.

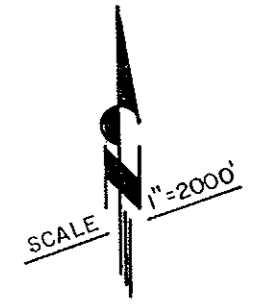
RECOMMENDED IMPROVEMENTS

The recommended improvements discussed briefly below are shown on the enclosed Master Plan Map found at the back of this report, as well as on the preliminary plan and profile plates. The map not only shows proposed alignments and facility types, but also pertinent preliminary size information as well as design flow rates. 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 31% for engineering, administration and contingencies (see Table I, Cost Summary page 11).

During the preparation of plan and profile drawings of proposed facilities, information was gathered on all telephone and high pressure natural gas lines throughout the Canyon. Further research at the design phase may show



-  NATURAL
-  2 1/2 & 5 Ac. SINGLE FAMILY
-  1 Ac. SINGLE FAMILY

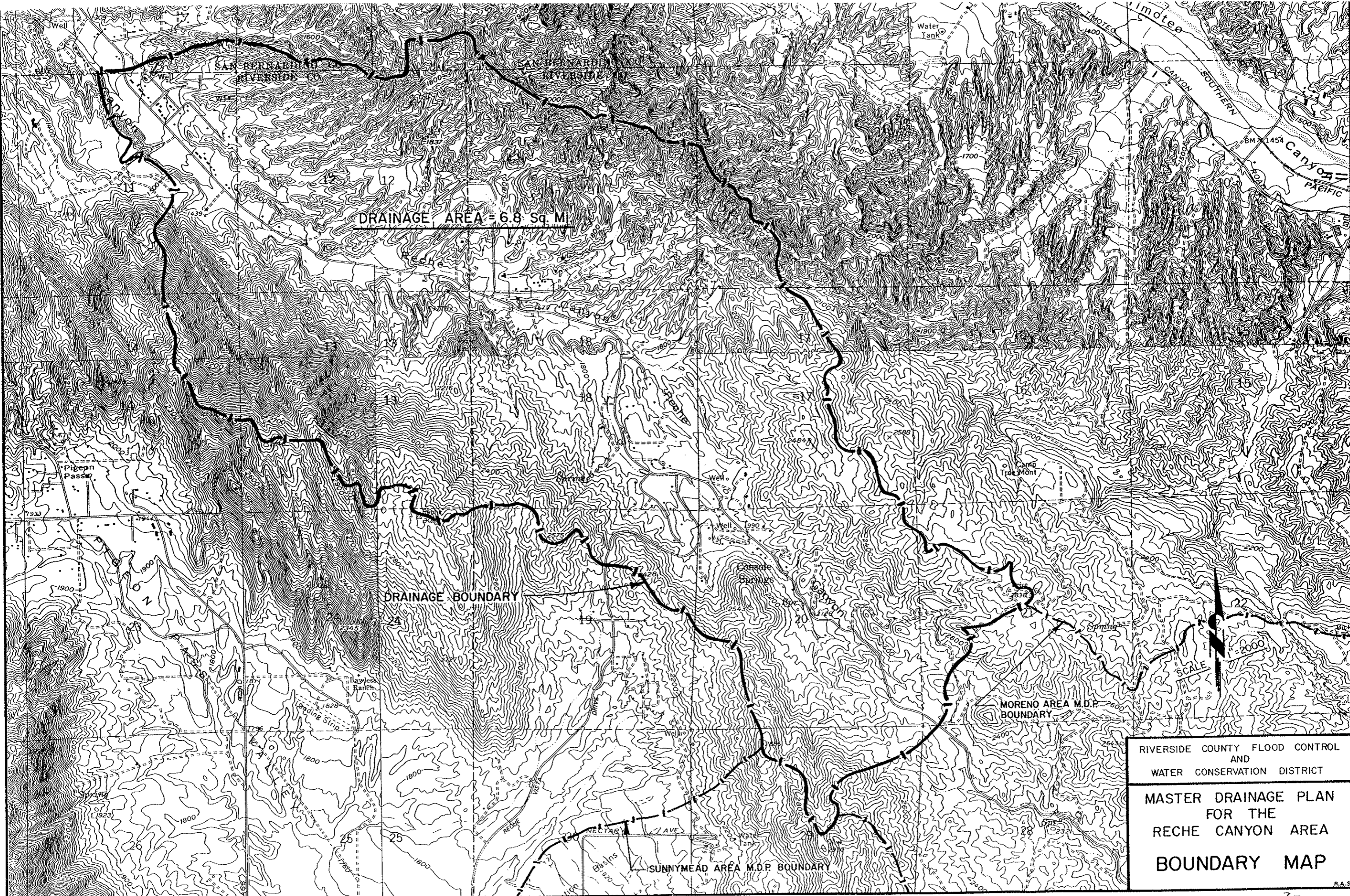


RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

MASTER DRAINAGE PLAN
FOR THE
RECHE CANYON AREA
ASSUMED

LAND USE MAP

R.A.S.



DRAINAGE AREA = 6.8 Sq. MI

DRAINAGE BOUNDARY

MORENO AREA M.D.P. BOUNDARY

SUNNYMEAD AREA M.D.P. BOUNDARY

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

MASTER DRAINAGE PLAN
FOR THE
RECHE CANYON AREA
BOUNDARY MAP

R.A.S.

additional utilities which will necessitate minor alignment and/or size changes, or utility relocations.

The majority of those facilities which serve to protect Reche Canyon Road have been planned in four individual reaches (see Master Plan Map). Each is separate and can be constructed independent of the other reaches without compromising its effectiveness. Several culvert improvements are included which may also be constructed independently of one another.

It should be noted that the County has not adopted a specific plan for Reche Canyon Road. Therefore, final design of all proposed facilities adjacent to the roadway should be coordinated with the County Road Department.

OPEN CHANNELS

The open channel facilities proposed in this plan are to be concrete lined. In general, these channels will be of trapezoidal cross section. The trapezoidal channels included in this plan range in size from 2 to 15 feet in bottom width and from 4.5 to 8.5 feet in depth. Several reaches of concrete lined channel of rectangular cross section are proposed when available right of way is limited.

UNDERGROUND STORM DRAINS

The underground storm drain detailed in this plan, Line A, consists of reinforced concrete pipe (RCP). The drain is proposed within existing street right of way.

For outletting purposes, the storm drain requires a small earthen daylight channel to return the discharge to its natural flow state. Rock riprap will be provided at the storm drain outlet to help reduce flow velocities to approximate those of the natural watercourse, and to minimize erosion.

ROADWAY LEVEES AND WING DIKES

The levees proposed within this plan are referred to as "roadway levees" since they are situated primarily within road right of way. The levee's configuration allows it to be incorporated into the roadway design. These levees range from 2 to 8 feet in height above existing pavement, and have 4 inch thick concrete slope protection. This concrete paving is extended an average 9 feet below flowline to protect against scour damage.

Wing dikes are included in the plan to collect and direct flows toward inlet facilities. These dikes range from 3 to 6 feet in height and are constructed of compacted fill with concrete slope protection.

Included in the plan are an appropriate number of slab bridges and levee ramps to provide residents adequate access across flood control facilities. Most of these crossings will be shared by two or more property owners and may incorporate a common access road parallel to the improvement. The specific configuration chosen for all roadway levees is designed for ease of access and for maximum safety.

ALTERNATIVES

In developing this Master Drainage Plan, a study of alternative solutions was undertaken and their hydraulic and economic feasibility assessed.

Due to the magnitude of debris production throughout the Canyon, the feasibility of a debris dam was studied. This alternative was deemed unsuitable, however, due to the existence of the Reche Canyon Fault which extends the length of the Canyon.

Several approaches were taken in attempting to provide all-weather protection for Reche Canyon Road. Roadway realignments, elevated roadways with slope protection, roadway levees, and channelization were all viewed as possible methods of preserving access through the Canyon. The decision to fully channelize flows in specific areas was made only after all other alternatives were determined to be unsuitable.

Line A, the only storm drain facility proposed, was initially sized for 10 year frequency flows. Since the existing street system is not adequate to convey flows in excess of the storm drain's capacity, the system was designed for full 100 year capacity.

In addition to those alternatives discussed above, a number of other minor alternatives were explored and eventually disregarded for either being too costly or for not providing an adequate level of protection.

In short, the Master Drainage Plan for the Reche Canyon area is a coalescence of the best alternatives explored.

CONCLUSIONS

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

1. The Reche Canyon Area has experienced serious flooding problems in the past. As the area continues to urbanize, flooding 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 and to provide all-weather access to residents. The Master Drainage Plan herein presents the system that is the most economical and engineeringly sound 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 \$4,927,000.

RECOMMENDATIONS

It is recommended that:

1. The Master Drainage Plan for the Reche Canyon area, 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 Riverside County Road Department incorporate the proposal of this plan into any future studies or design works within their purview. And further, that they support any and all efforts toward implementation of the plan, including but not limited to financial support.
3. Final design of all proposed facilities adjacent to the roadway should be coordinated with the County Road Department.
4. The Master Drainage Plan be used as a guide for all future development in the study area and that such development be required to conform to the plan insofar as possible.
5. The right of way required for the plan be protected from encroachment.

TABLE I

MASTER DRAINAGE PLAN FOR THE RECHE CANYON AREA

COST SUMMARY

FACILITY	CONSTRUCTION COST	31% ENGINEERING & ADMINISTRATION	RIGHT OF WAY	MASTER PLAN COST
Reche Cyn. Improvement				
Reach 1	\$ 953,000	\$ 295,000	\$ 32,000	\$ 1,280,000
2	897,000	278,000	30,000	1,205,000
3	222,000	69,000	10,000	301,000
4	650,000	202,000	26,000	878,000
Line A	272,000	84,000	1,000	357,000
B	74,000	23,000	4,000	101,000
C	187,000	58,000	32,000	277,000
Culvert 1	22,000	7,000	-	29,000
2	74,000	23,000	3,000	100,000
3	6,000	2,000	-	8,000
4	6,000	2,000	-	8,000
5	266,000	82,000	3,000	351,000
6	6,000	2,000	-	8,000
7	6,000	2,000	-	8,000
8	6,000	2,000	-	8,000
9	6,000	2,000	-	8,000
TOTAL	\$3,653,000	\$1,133,000	\$141,000	\$4,927,000