

RIVERSIDE COUNTY FLOOD CONTROL  
AND WATER CONSERVATION DISTRICT  
Riverside, California

Revised  
Report On  
MASTER DRAINAGE PLAN  
FOR  
THE CITY OF RIVERSIDE  
(Monroe Area-System B)  
Zone One

October 1979

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REVISED  
MONROE  
MASTER DRAINAGE PLAN  
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## PURPOSE

The purpose of this report is to revise the "Master Drainage Plan for the City of Riverside, (Monroe Area)" that was developed in 1966 for the Riverside County Flood Control and Water Conservation District by the firm of Koebig and Koebig of Los Angeles. The intent of this revision is to reinvestigate and evaluate the drainage problems of the "System B" area studied in that plan and to develop the most economical drainage plan that considers the natural environment, ultimate land use, and economy of the area.

Located in the southwestern section of the City of Riverside, this developing area is bounded by the Atchison Topeka & Santa Fe Railroad tracks on the northwest, Washington Street on the northeast, Jackson Street on the southwest, and contributing areas of the foothills on the southeast.

When implemented, the plan presented herein will provide adequate protection from the 10 year frequency storm 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 6.8 square miles, and ranges from mildly sloping valley terrain, to citrus covered foothills with steep slopes. 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 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 Revised Master Drainage Plan for a portion of the Monroe Area. The plan consists of two retention basins, a section of open channel and a network of underground storm drains. The proposed system will carry storm runoff through this developing area and into a large retention basin located at the corner of Monroe Street and the A.T.&S.F. railroad tracks. Released from this basin into existing facilities downstream, the runoff will eventually outlet into the Santa Ana River.

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 impassable. The substantial subdivision activity within the last several years has added to the drainage problems of the area by creating an increase in runoff and thus an attendant need for a greater degree of flood protection.

The Revised Master Drainage Plan presented herein provides the most 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.

#### 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 the curbs. 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.

Open channels, which are also designed for the 10 year storm, are proposed when the construction and right of way cost for a channel prove to be less than the cost of an underground storm drain.

The alignments of all drains and channels are based on hydraulic efficiency, the ability to drain tributary areas, future land use, 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 300 acres. Ten year discharges for larger watersheds were generated using the synthetic unit hydrograph, as were 100 year frequency discharges for the retention basins.

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. The Riverside intensity-duration curve was used for the rational hydrology computations, and assumptions for future land use were based on the "Revised Arlington Heights Plan and Growth Management Program" of February 1979.

It should be noted that two District dams, Prenda and Woodcrest, intercept and retain flows from the east that normally would pass through the Monroe Area.

No discharge from either facility, however, was included in the calculations of runoff developed downstream. This is in accordance with this District's policy of outlet gates being closed during a storm.

#### EXISTING FACILITIES

The Monroe Retention Basin and Railroad Lateral (see map at the rear of this report) are respectively scheduled for construction in late 1979 and the Fall of 1980. Both projects are funded by the 1970 Zone I Bond Issue and are currently being designed. Although an integral part of this Revised Master Drainage Plan, neither project will be discussed in detail in this report.

Since several storm drains do exist in the area, much care and attention was given to maximize their usage when beneficial to the ultimate network of future proposed facilities. The existing storm drains are shown on the map at the rear of this report and described as follows:

1. A 42 inch diameter RCP along the southerly side of Lincoln Avenue from Tropicana Drive to a junction at Monroe Street.
2. A 42 inch diameter RCP in Monroe Street extending from Victoria Avenue to a junction at Lincoln Avenue.
3. A 57 inch diameter RCP in Monroe Street extending some 360 feet from the junction at Lincoln Avenue to just below the crossing of the Riverside Water Company Canal. This line presently outlets into a concrete lined ditch which runs along the easterly side of Monroe Street from the canal to the crossing of the A.T.&S.F. Railroad tracks.
4. A 24 inch diameter RCP that begins at the northernmost corner of Continental Drive and extends about 300 feet along the southerly side of the canal and empties into the 57 inch diameter RCP in Monroe Street. This line was built in conjunction with the development of Tract 8266.
5. A 42 inch diameter RCP that begins at the corner of Copenhagen Road and Toronto Road and extends some 280 feet to outlet into an arch culvert that runs under the railroad tracks at Monroe Street. This line was built in conjunction with the development of Tract 7675-1.
6. A 45 inch diameter RCP that begins approximately 560 feet above Lincoln Avenue. Running between Collingwood Street and Sonora Place, this line presently ends at Lincoln Avenue where it empties into a roadside ditch.

The 42 inch diameter RCP in Lincoln Avenue along with the 42 inch and 57 inch diameter RCPs in Monroe Street were constructed as a condition of approval of Tract 4356. The lines in Monroe Street were sized in accordance with the Koebig & Koebig drainage plan of

1966, and will be incorporated as a part of Line F in this revised plan. The 45 inch diameter RCP above Lincoln Avenue, built in conjunction with Tract 2942, was constructed on the alignment proposed by Koebig & Koebig for the upper reaches of the Railroad Lateral. When completed under the bond issue, the Railroad Lateral will include this section of 45 inch diameter RCP.

A 30 inch diameter steel line now exists in Lincoln Avenue from Irving Street to Monroe Street. Under this proposed plan a total of 90 cfs will have to be conveyed along this reach to Line F in Monroe Street. Since this steel line has a maximum carrying capacity of only 30 cfs, the complete removal and replacement of the line with a larger facility was determined to be the best approach.

#### RECOMMENDED IMPROVEMENTS

The recommended improvements discussed below are shown on the enclosed map found at the rear 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 and contingencies.

#### DUFFERIN RETENTION BASIN

Located above the Gage Canal about 250 feet south of Dufferin Avenue, this basin is located at the same site proposed by Koebig & Koebig in 1966 for a similar facility. With a natural drainage area of over 350 acres, this basin will receive a maximum inflow of approximately 180 cfs and discharge slightly less than 40 cfs in the 10 year event. In the 100 year frequency storm, the maximum inflow will be 320 cfs and the outflow slightly less than 300 cfs.

#### Line A

Line A will intercept the runoff coming down Hill Street and carry those flows westerly along Victoria Avenue to the upper end of the Railroad Lateral. As a 400 foot extension to the Railroad Lateral, Line A will collect the flows that would otherwise cross Victoria Avenue at Hill Street.

#### Line A-2

Line A-2, the second longest line in this plan, has a contributing drainage area of over 400 acres. From its beginning near Madison Street, Line A-2 will parallel the A.T.&S.F. Railroad tracks as a trapezoidal channel with a 2 feet bottom width. Two thousand feet downstream it will go underground, cross under the tracks, and follow a course parallel to Jefferson Street and 300 feet to the east. Before reaching Lincoln Avenue, Line A-2 will cross into Jefferson Street itself and continue on until emptying into the

Railroad Lateral at Evans Street. Line A-3 will run down Lincoln Avenue westerly from Grace Street to Jefferson Street. The runoff at Grace Street and Lincoln Avenue need to be conveyed to Line A-2 by this line because of the limited carrying capacity of Lincoln Avenue as it approaches Jefferson Street.

#### Line B

Line B will begin as the outlet of the Dufferin Retention Basin, run westerly down Dufferin Avenue nearly 5000 feet to St. Lawrence Street, and then empty into the St. Lawrence Wash. Together with Line B-1, Line B will drain an area of over 320 acres above Dufferin Avenue from Bradley Street to Washington Street. Line B-1 will begin on Summit Street, turn northerly in Grace Street, and flow 2000 feet to its outlet at Line B.

#### Line C

With a total drainage area of over 70 acres, Line C will start above Washington Street in Bradley Street. After running westerly in Bradley Street for about 1200 feet, the line will angle across an open field above Grace Street to the intersection of Gladstone Street and Grace Street. Shortly thereafter, Line C will dip down a natural ravine and empty into the St. Lawrence Wash.

#### Line D

Line D will begin in the steep foothills on Heather Lane, turn northerly onto Jefferson Street, and run approximately 2600 feet before emptying into the St. Lawrence Wash. Although having a drainage area of over 190 acres, the size of the pipe used in Line D can be kept relatively small due to the very steep grade of Jefferson Street.

At this point an explanation should be given concerning the St. Lawrence Wash as an outlet for Line B, Line C, and Line D. The wash will carry the flows through the area to Lincoln Avenue. Here, between St. Lawrence Street and Adams Street, a lateral of the Railroad Lateral will collect and convey the combined flow to the Monroe Retention Basin.

#### Line E

With a total drainage area of over 1100 acres, Line E is the largest facility proposed in this Master Drainage Plan. Beginning above the Gage Canal and emptying into the Monroe Retention Basin, the line will remain in Gratton Street for all of its 8500 foot length. Line E-2 and Line E-3 will together drain a contributing foothill area of 350 acres. Their juncture above the Gage Canal is the beginning of Line E. Runoff from the area west of Gratton Street between the Gage Canal and Dufferin Avenue will be collected and conveyed in Line E-4. Beginning southwest of Irving Street, Line E-4 will run some 3500 feet in Dufferin Avenue and outlet into

Line E. The runoff from the area on the other side of Gratton Street between the canal and Dufferin Avenue will be collected and conveyed in Line E-5. It will run between Adams Street and Gratton Street in Dufferin Avenue. Line E-1 and Line E-6 will be in Cleveland Avenue; Line E-1 east of Gratton Street, and Line E-6 west of Gratton Street. Together they will drain the area between Dufferin Avenue and Cleveland Avenue and convey the runoff to Line E.

#### Line F

As stated previously, portions of Line F now exist in Monroe Street. When completed under this Master Drainage Plan, Line F will begin 700 feet above Victoria Avenue and outlet into the Monroe Retention Basin. Together with Line F-1, Line F will drain an area of slightly more than 200 acres. Beginning in Irving Street at Victoria Avenue, Line F-1 will turn onto Lincoln Avenue and confluence with Line F at Monroe Street and Lincoln Avenue.

#### Alternate Studies

Several alternates were developed and studied during the generation of the Revised Monroe Master Drainage Plan. This procedure was necessary to best determine the ultimate facilities and their locations as proposed in this report.

One alternate considered in this study was the use of open channel in lieu of underground storm drain on Line A-2 from a point 400 feet upstream of Lincoln Avenue to the A.T.&S.F. Railroad tracks. The alignment was the same as that chosen for the storm drain and would have required the construction of a reinforced concrete box under the railroad tracks and a slab bridge crossing under Victoria Avenue. Although the total cost of this alternate was slightly less, it was decided that the underground storm drain would be more compatible with the future one-third acre single-family zoning in this area.

A second alternate considered dealt with the realignment of Line F-1 in an attempt to utilize the existing 42 inch diameter RCP and 30 inch diameter steel line in Lincoln Avenue. Starting at Victoria Avenue in Irving Street and turning easterly at mid-block, the Line F-1 alternate was to meet and follow Tropicana Drive to Lincoln Avenue and outlet into the existing 42 inch diameter RCP. Because of the hydraulic limitations of the 42 inch diameter RCP and its affect upon the capacity of the entire line and the inability of the 30 inch steel line to convey the remaining flows, this alternate was eliminated. After all attempts to make use of these existing facilities failed, the complete removal and replacement of the 30 inch diameter steel line with a larger and longer facility became the best approach possible. The 42 inch diameter RCP will remain, however, to accept the runoff from Tropicana Drive.

The third alternate studied concerned the modification and realignment of the upper reaches in Line E. The major intent of this alternate was to reduce the overall cost of Line E by running an open channel from Cleveland Avenue to the Gage Canal instead of the more expensive underground storm drain. The path of this channel



section was to be parallel to Gratton Street and 500 to 600 feet to the west. The six laterals to Line E were kept on the same alignments and locations as proposed, but appropriately shortened or lengthened to meet this alternate. Considering the uncertainties involved in the purchasing and preservation of right of way through this mid-block alignment, the lesser total cost of this alternate was not significant enough to justify its selection.

#### CONCLUSIONS

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

1. The Monroe Area has experienced flooding problems in the past, and the damages incurred are expected to increase as much of the area converts from predominantly citri-cultural to a more residential type usage.
2. A drainage system is required to safely convey storm runoff through the area with the least interruption to public services. The Revised Master Drainage Plan presented in this report, a coalescence of the best alternates explored, is such a system.
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 \$7,620,000. (August 1979)

#### RECOMMENDATIONS

It is recommended that:

1. The Revised Master Drainage Plan, as set forth herein, be adopted by the Riverside City Council and the Riverside County Flood Control and Water Conservation District's Board of Supervisors as a revision to the "B System" area of the original "Master Drainage Plan for the City of Riverside, (Monroe Area)" and as part of the overall master plan for the City and 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.

COST SUMMARY

MONROE MASTER DRAINAGE PLAN

FACILITY	CONSTRUCTION COST	ENGINEERING & CONTINGENCIES	RIGHT OF WAY	TOTAL COST
Line A	\$ 92,000	\$ 28,000		\$ 120,000
Line A-2	802,000	241,000	\$28,000	1,071,000
Line A-3	113,000	34,000		147,000
Line B	597,000	179,000		776,000
Line B-1	287,000	86,000		373,000
Line C	171,000	51,000		222,000
Line D	346,000	104,000		450,000
Line E	1,348,000	405,000		1,753,000
Line E-1	132,000	40,000		172,000
Line E-2	265,000	80,000		345,000
Line E-3	268,000	81,000		349,000
Line E-4	475,000	143,000		618,000
Line E-5	201,000	61,000		262,000
Line E-6	69,000	20,000		89,000
Line F	269,000	81,000		350,000
Line F-1	293,000	88,000		381,000
<u>RETENTION BASIN</u>				
Dufferin Basin	74,000	22,000	46,000	142,000
TOTAL	\$5,802,000	\$1,744,000	\$74,000	\$7,620,000