

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

**REPORT ON  
MASTER DRAINAGE PLAN  
FOR THE  
BEAUMONT AREA  
ZONE FIVE**

JULY 1983

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## PURPOSE

The purpose of this report is to investigate and analyze the drainage problems of the Beaumont area and to develop an economical drainage plan that considers flood protection for both existing and future development envisioned in the study area.

The Beaumont area consists primarily of the City of Beaumont and portions of the County of Riverside; the largest portion being the community of Cherry Valley. The master plan boundary is roughly the community of Oak Glen to the north, Highland Springs Avenue to the east, Beaumont City Limits to the south and Interstate 10 and Wildwood Canyon to the southwest and northwest respectively.

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 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 of said facilities. 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.

## SCOPE

The drainage area encompassed by this plan is approximately 34 square miles in size (see Drainage Map 2/2 at the back of the report). The northern half of the watershed consists of rather steep mountainous terrain, while the southerly half is composed of moderately sloping valley terrain falling generally to the southwest. 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 Beaumont area. This plan consists primarily of a network of underground storm drains and several open channels. Also included are three retention basins and a debris basin. Runoff conveyed by the proposed drainage facilities ultimately discharges into one of several major, natural watercourses, among which are Noble Creek (ultimately San Timoteo Canyon), Potrero Creek, and Smith Creek (see Drainage Map 2/2 for locations).

At present, during periods of runoff, flood waters, silt and debris impact significant portions of the community of Cherry Valley. The City of Beaumont also experiences occasional flooding, yet the bulk of this flooding may be deemed nuisance drainage problems. In both cases, the area is susceptible to property damage and to having streets rendered impassable. As development expands throughout the area, so will the drainage problems, thus requiring 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 a high level of flood protection.

## 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 assumed 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 curb. At this point, the plan proposes the initiation of an underground drain which will intercept and convey the entire 10 year storm runoff to an outlet downstream. (Where curbs do not presently exist, future 8 inch curbs were assumed.) Flows exceeding the 10 year frequency storm will generally be carried within street rights of way; the combination of both the street and the underground storm drain providing a high level of protection. In a few instances, circumstances have dictated that an underground drain be sized to convey the full 100 year flow rate.

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. 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

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 used for larger areas and in all instances where storm volume was needed. The design discharges used in sizing all future appurtenant facilities within 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.

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

The General Plan - City of Beaumont  
May 25, 1982

Land use Element  
San Gorgonio Pass General Plan 1990 - Riverside County  
Planning Dept.  
June 13, 1979

### EXISTING FACILITIES

Presently, there are several major flood control facilities situated within the study area. These facilities are the Cherry Avenue - 8th Street Channel, Highland Springs Channel, Little San Gorgonio Creek Channel and Spreading Grounds, Marshall Creek Channel, Mountain View Channel, Noble Creek Channel, and Orchard Avenue Channel. In addition, a small storm drain in Maple Avenue as well as a variety of drainage structures constructed by the California Department of Transportation (Caltrans), convey flows under Interstate Highway 10.

#### Cherry Avenue - 8th Street Channel

This concrete lined trapezoidal channel was constructed under the direction of the District in 1957. Under existing conditions approximately 1.4 square miles of drainage area is tributary to the channel. The channel is improved from 8th Street to its current outlet at 6th Street.

#### Highland Springs Avenue Channel

Highland Springs Avenue Channel was constructed in two stages in 1970 and 1974 by the Riverside County Road Department and by the District respectively. The existing channel is a concrete lined trapezoidal section extending northerly from Interstate 10 to the eastern prolongation of 16th Street. At present the District envisions the channel being extended upstream by developers to connect to the channel constructed by Tract 4636 at Cherry Valley Boulevard.

### Little San Gorgonio Creek Channel

This facility exists as a rectangular section "wire and rail" channel. Vertical earthen walls are supported by a wire mesh secured to lengths of steel rails placed vertically and anchored by steel cables. This type of channel utilizes an earthen or "soft" bottom. The Little San Gorgonio Creek Channel extends from Orchard Street south to its confluence with Noble Creek Channel below Cherry Valley Boulevard.

### Little San Gorgonio Creek Spreading Grounds

A system of nine earthen basins serve to recharge the subterranean water table for the Cherry Valley area. A portion of the large amount of silt and debris generated by erosion settles out within the system.

Since the main watercourse of the Little San Gorgonio Creek bypasses the basins, the effect of flow attenuation is negligible.

### Marshall Creek Channel

This "wire and rail" channel was constructed in 1938 under the direction of the Riverside County Road Department. From its outlet at Bellflower Avenue the channel extends approximately 2000 feet upstream into Marshall Canyon. The 100 year flow rate in this reach of channel is approximately 1200 cfs.

### Mountain View Channel

This concrete lined trapezoidal channel, constructed by the District in 1965, extends from its confluence with Noble Creek, upstream to a point midway between Cherry Valley Boulevard and Vineland Street. Approximately 1.5 square miles of drainage area is tributary to this facility.

### Noble Creek Channel

Noble Creek Channel exists as an ultimate design concrete lined trapezoidal channel conveying flows from Noble Creek and Little San Gorgonio Creek through the Cherry Valley area. This facility, constructed in 1967, is designed for a 100 year peak flow rate of 10,700 cfs. An interim channel section currently functions as the upstream terminus of the system from Cherry Valley Boulevard north to Vineland Avenue.

### Orchard Street Channel

Constructed in 1958 under the direction of the District to intercept flows from Cherry Valley Creek, this channel currently outlets at Nancy Avenue. A 100 year flow rate of 530 cfs is associated with this existing concrete lined channel of trapezoidal cross section.

### Interstate 10 Drainage Improvements

More than 30 drainage facilities and their appurtenances have been constructed by Caltrans to convey flows across Interstate 10 within the study area. After implementation of the Master Plan, these State maintained facilities will in aggregate afford the adjacent upstream area protection from a storm of 10 year frequency or greater.

### FLOOD PLAIN MAPPING

The limits of the 100 year flood plains throughout the study area are shown as cross-hatched, shaded areas on the Master Plan Map (see Map 1/2). This flood plain mapping is that which is presently available through the Federal Insurance Administration.

### RECOMMENDED IMPROVEMENTS

The recommended improvements discussed briefly below are shown on the enclosed map found at the back of this report, as well as on the preliminary plan and profile plates. 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 I, Cost Summary page 13). This map not only shows proposed alignments, but also pertinent preliminary size information as well as design flow rates.

During the preparation of plan and profile drawings of proposed facilities, information was gathered on all 30" high pressure gas lines throughout the study area. Further research at the design phase may show additional utilities which will necessitate minor alignment or size changes, or utility relocations.

### OPEN CHANNELS

The open channel facilities in this plan are proposed to be concrete lined. In general these channels will be of trapezoidal cross section with concrete paving on the side slopes and bottom. The walls slope outward from the channel bottom at a ratio of 1.5 feet horizontally for every foot vertically. The trapezoidal channels included in this plan range in size from 2 to 24 feet in bottom width and from 4 to 9.5 feet in total depth. Several short reaches of concrete lined channel of rectangular cross section are also proposed within the plan.

### UNDERGROUND STORM DRAINS

The underground conveyance systems proposed in this plan consist primarily of reinforced concrete pipe (RCP). In cases where special circumstances dictate, a storm drain may be constructed as a reinforced concrete box (RCB). This alternative usually proves to be more expensive than RCP and is avoided whenever possible.

All underground storm drains in this plan are proposed within existing or assumed future street rights of way, or in storm drain easements.

For outletting purposes, some storm drains will require small earthen daylight channels to return flows to their natural flow state. In such cases rock riprap will be provided at the storm drain outlet to reduce flow velocities commensurate to those of the natural watercourse or flood plain.

### RETENTION AND DEBRIS BASINS

The inclusion of three regional retention basins and a debris basin in the Master Drainage Plan for the Beaumont area has significantly reduced the overall cost of the plan and in several instances enhances the possibility of stage construction.

The use of a retention basin allows runoff to be temporarily stored, usually less than 36 hours, and released at a significantly lesser rate than it arrived. This reduced flow rate allows for the construction of smaller and less costly downstream facilities. Each basin is sized to safely pass 100 year storm flows without threatening the integrity of the facility.

In the case of the Little San Gorgonio Creek Debris Basin, downstream facilities can be downsized to carry "clear water" flows rather than flows heavily laden with silt and debris. Debris production throughout this subwatershed has long been an area of major concern.

A certain degree of flexibility exists with respect to the shape of all the basins as long as the required storage volume and outletting criteria are provided for. To ensure the maximum recreational use of the Stewart Park Retention Basin, a low flow bypass system may be incorporated into the final design.

#### STEWART PARK RETENTION BASIN

This basin is located within Stewart Park on the corner of 10th Street and Maple Avenue in the City of Beaumont. The preliminary design of this basin calls for a maximum 3.3 feet of embankment to be constructed along the park's southeastern perimeter. No excavation will take place within the park site and costs have been included for landscaping the embankment in order to maintain the character and primary function of the site in serving as a neighborhood park.

Providing nearly 11 acre feet of flood storage, the basin will reduce a 10 year peak inflow rate of 230 cubic feet per second (cfs), to an outflow rate of 13 cfs.

#### WINESAP RETENTION BASIN

The 100 year peak inflow delivered to this basin via Lines 10 and 11 is 1300 cfs. Without the attenuation effect of this basin the capacity of the existing Cherry Avenue - 8th Street Channel and its crossing beneath Interstate 10 would be exceeded. The 9.3 acre, 10 foot deep basin has a peak outflow rate of only 250 cfs, enabling existing as well as proposed concomitant downstream facilities' construction costs to be reduced significantly.

### MOUNTAIN VIEW RETENTION BASIN

Mountain View Retention Basin is situated along Rancho Bonita Drive at the western projection of Tokay Street. Through this facility a 100 year peak inflow rate of 1330 cfs is reduced to 270 cfs. As in the case of the Winesap Retention Basin, this structure is needed to reduce the peak flow rate in order not to exceed the capacity of existing facilities downstream. The inclusion of this basin eliminates the need for a costly channel and road crossing reconstruction project. Situated on a 5 acre site, Mountain View Retention Basin generates over 55 acre feet of flood storage. By virtue of the basin's size and impounding capacity, it will fall under the jurisdiction of the California Department of Water Resources, Division of Safety of Dams.

### LITTLE SAN GORGONIO CREEK DEBRIS BASIN

Large quantities of silt and debris emanate from the Little San Gorgonio Creek watershed and debouch at the mouth of this canyon. The additional volume associated with this debris must be accounted for when sizing downstream conveyance systems.

Los Angeles County Flood Control District and U. S. Army Corps of Engineers' methods for determining potential debris production were used in establishing a debris basin storage requirement of 206 acre feet.

The top of the basin embankment is 31 feet above the outlet flow line and has a 100 foot wide, over the crest spillway set 11 feet below the top of the embankment. The proposed basin will store 206 acre feet of debris while passing a 100 year, 6 hour storm peak flow rate of 8850 cfs over its spillway. This basin, as with the Mountain View Basin, falls within the jurisdictional purview of the California Department of Water Resources, Division of Safety of Dams.

### ALTERNATIVE STUDIES

In developing this Master Drainage Plan a number of alternatives were developed and studied for both their hydraulic and economic feasibility.

Early in the hydrologic study of the Beaumont area it was determined that existing facilities were constructed for design flow rates envisioned for the area 40 years ago. Since then, development patterns have changed, and more accurate methods for calculating storm water runoff have evolved. In order to preserve these existing facilities, yet maintain the high level of flood protection desired, the use of regional retention basins was of prime consideration. Without exception, the basins proposed in the Master Drainage Plan for the Beaumont area are the most cost effective approach to the drainage problems within their specific area of influence.

For instance, the total cost of Winesap Retention Basin and the proposed downstream reaches of the Cherry Avenue - 8th Street Channel is \$2,079,000. If this basin were eliminated the existing reach of channel between 8th Street and 6th Street as well as the underground structure built to convey flows beneath Interstate 10 would each have to be reconstructed. All additional reaches of channel downstream of the basin would be upsized to convey the larger flow rates. The increase in cost of such an upsized system would approach \$200,000. Similarly, the inclusion of the Mountain View Retention Basin allows the utilization of the existing Mountain View Channel. Cost savings are evident in the avoidance of costly channel reconstruction and in the downsizing of the reach of proposed channel.

Stewart Park Basin serves to reduce peak flow rates to the extent that facility requirements are reduced substantially. The basin's cost of \$7,000 for the construction of a small earthen berm compares quite favorably to a cost of over \$140,000 for a storm drain extending from Line 1 to Line 2 of the Master Plan.

The construction of a debris basin on Noble Creek just north of Orchard Avenue was proposed in lieu of bulking flow rates to account for debris transportation. This alternative proved not to be cost effective. As a result, design flow rates for Noble Creek will reflect bulked flow.

The downstream terminus of Noble Creek Channel is proposed to be Brookside Avenue. Initially, the intent was to continue the ultimate section downstream across 14th Street. This alternative was revised, however, with the reasoning that development can take place in the area without an ultimate design facility if floodproofing guidelines are met. This is viewed as the most practical solution for future development within this specific area.

Outletting of Line 2 and the Cherry Avenue - 8th Street Channel is proposed downstream of 1st Street, rather than outletting immediately downstream of Interstate 10. This was done to eliminate flooding problems for valuable acreage between 1st Street and the freeway. This area is envisioned as future light industrial property.

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

In short, the Master Drainage Plan for the Beaumont area 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 Beaumont area has experienced serious flooding problems in the past. As the area continues to urbanize, 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 herein presents the system that 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 \$23,715,000.

## RECOMMENDATIONS

It is recommended that:

1. The Master Drainage Plan, as set forth herein, be adopted by the Beaumont City Council, as part of the overall master plan for its City, and 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 development in the study area and that such development 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 BEAUMONT AREA  
COST SUMMARY

FACILITY	CONSTRUCTION COST	30% ENGINEERING & ADMINISTRATION	RIGHT OF WAY	MASTER PLAN COST
1	\$ 149,000	\$ 48,000	-	\$ 197,000
2	1,045,000	314,000	108,000	1,467,000
2A	145,000	44,000	-	189,000
2B	114,000	34,000	-	148,000
3	255,000	77,000	7,000	339,000
4	382,000	115,000	-	497,000
5	227,000	68,000	-	295,000
6	109,000	33,000	-	142,000
7	111,000	33,000	-	144,000
8	647,000	194,000	2,000	843,000
8A	89,000	27,000	-	116,000
8B	32,000	10,000	-	42,000
8C	139,000	42,000	-	181,000
9	706,000	212,000	4,000	922,000
10	678,000	203,000	-	881,000
10A	142,000	43,000	-	185,000
11	810,000	243,000	32,000	1,085,000
11A	117,000	35,000	-	152,000
11B	94,000	28,000	-	122,000
12	346,000	104,000	-	450,000
13	168,000	50,000	-	218,000
14	287,000	86,000	-	373,000
14A	112,000	34,000	-	146,000
15	124,000	37,000	-	161,000
16	772,000	232,000	-	1,004,000
17	16,000	5,000	-	21,000

TABLE I CONT'D

MASTER DRAINAGE PLAN FOR THE BEAUMONT AREA

COST SUMMARY

FACILITY	CONSTRUCTION COST	30% ENGINEERING & ADMINISTRATION	RIGHT OF WAY	MASTER PLAN COST
Little San Gorgonio Ck. Debris Basin	2,002,000	601,000	184,000	2,787,000
Mountain View Ret. Basin	344,000	103,000	200,000	647,000
Stewart Park Ret. Basin	5,000	2,000	-	7,000
Winesap Ret. Basin	443,000	133,000	185,000	761,000
Cherry Ave. 8th St. Ch.	873,000	262,000	183,000	1,318,000
Little San Gorgonio Ck. Channel	713,000	214,000	-	927,000
Marshall Ck. Channel & Storm Drain	3,000,000	900,000	478,000	4,378,000
Mountain View Channel	403,000	121,000	164,000	688,000
Noble Creek Channel	1,439,000	432,000	9,000	1,880,000
Orchard St. Drain	17,000	5,000	-	22,000
<b>TOTAL</b>	<b>\$17,055,000</b>	<b>\$ 5,124,000</b>	<b>\$ 1,556,000</b>	<b>\$23,735,000</b>