RIVERSIDE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

RIVERSIDE, CALIFORNIA

REPORT ON

MASTER PLAN FOR FLOOD CONTROL

FOR

EAST WIDE CANYON, LONG CANYON AND TRIBUTARIES

ZONE SIX

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SUMMARY

The area east of Desert Hot Springs is subject to severe flooding from a large mountainous watershed north of Dillon Road. There are no existing well-defined watercourses to carry the flows from the mountains through the alluvial fan at the base of the mountains. The unpredictable nature of flood flows at the lower elevations present a serious hazard and detriment to present and future development.

A Master Plan is herein presented as an ultimate solution to the flood control problem. The plan provides for earthfill flood control detention dams and reservoirs near the mouths of Long Canyon and West Wide Canyon. A training levee would be provided to insure that flows from East Wide Canyon would be directed to the reservoir and not split into an easterly path. About nine miles of improved channels would also be provided and would extend from the dam outlets to the Willow Hole area. The detention dams, reservoirs and improved channels would be designed to give protection from the once in 100 year storm event.

The recommended plan, when constructed, will offer nearly complete flood protection to the area and will permit development of the land to the highest and best use. The plan should serve as a guide for future planning and development in this area.

INTRODUCTION

General Statement - The area immediately east of Desert Hot Springs is subject to serious flooding by flows emanating from Long Canyon, East Wide Canyon, and several smaller canyons north of Dillon Road. Upon leaving the mountainous canyons the storm waters are not confined in well-defined washes, but instead spread over a broad area in many small poorly-defined washes. The location of these washes can change from storm to storm and their unpredictable nature makes land development in the area difficult and hazardous.

To eliminate this problem the District proposes to control the storm runoff with flood detention dams on Long and West Wide Canyons and concrete lined channels from the dam outlets to the Willow Hole area.

Purpose - The purpose of this report is to evaluate the requirements for flood control in the area east of Desert Hot Springs and to develop a Master Plan which will provide an ultimate solution to the flood problems in the area.

Scope - The scope of this study includes the following:

1. Determination of the peak flows and their points of concentration.
2. Determination of the flood volumes.
3. Determination of the basic flood problems in this area.
4. Investigation of alternate methods of flood control.
5. Preparation of preliminary design plans and cost estimates.

Description of Watershed - The entire watershed covers an area of 74 square miles and is divided into subareas as shown on plate 1. There are two large canyons, Long Canyon and East Wide Canyon, and several smaller ones located in the Little San Bernardino Mountains north of Dillon Road. The outflow from the canyons has formed an alluvial fan beginning at the base of the mountains and extending southerly across Dillon Road.

The mountains are rugged and elevations range from about 1300 feet to 5400 feet. They are barren and rocky at the lower elevations with some sparse growth present at the upper elevations. Subarea A is a 33.2 square mile drainage area above the Wide Canyon dam site and subarea B is a 27.3 square mile drainage area above the Long Canyon dam site.

Most of subarea C is on the alluvial fan which drains primarily into the Willow Hole region of Seven Palms Valley. Gradients are steep and the land slopes to the south and west. There are no well-defined watercourses to carry the outflow from the canyons across the fan. Instead, there are many small washes and the runoff takes various courses from one storm to the next.

There are some residential dwellings, trailer parks and subdivided, but undeveloped, tracts in the area. There is no significant agricultural development in the area.

Description of the Problem - Storm runoff coming from the canyons in the Little San Bernardino Mountains onto the alluvial slopes is not confined in well-defined watercourses. There are numerous existing washes in the alluvium which are evidence of the many and varied paths that storm flows have taken in the past.

Large, infrequent storms would produce high peak flows from Long Canyon and the Wide Canyons, and these flows are much too large to be handled in the existing small washes. Such large, uncontrolled and unpredictable storm flows are an extreme flood hazard to any existing or future development and actually serve to retard or restrict development in the area, and could also cause loss of life. Smaller, more frequent thunderstorms that often occur in these desert areas would cause minor damage to property and public highways and otherwise cause a nuisance.

HYDROLOGY

General - The mean seasonal precipitation varies from about 5 inches per year in the vicinity of Willow Hole to about 12 inches per year in the higher mountainous parts of the watershed. Most of the precipitation occurs during the winter months. Thunderstorms of short duration and high intensity producing very high instantaneous peak flows, but with relatively low runoff volumes, can occur during either the winter or summer months. Thunderstorms producing high peak flow - low volume runoff storms are the most serious flood threat to this area.

Rainfall - Runoff Records - The District has maintained a precipitation station in Desert Hot Springs since December 1948, with an automatic recording rain gage since October 1957. There are no runoff records available for either Long or Wide Canyon prior to 1963. The Colorado River Aqueduct crosses both canyons a short distance upstream from the proposed dam sites, and field personnel who maintain the aqueduct have reported some large flows in the past from both Long Canyon and East Wide Canyon.

The U. S. Geological Survey placed an automatic recording stream gage in Long Canyon in Section 27, T2S, R5E, just downstream from the aqueduct, in the spring of 1963. On 7 August 1963 intense thunderstorm activity occurred over the higher elevations of the Little San Bernardino Mountains and generated considerable runoff from East Wide and Long Canyons. The stream gage was washed out at Long Canyon during this flood. The Geological Survey made some slope area studies and is attempting to determine an approximate peak discharge for the flood. At this writing however, they had not yet completed their analysis. It is known that the flood was of a low volume since the peak came up very fast and receded rapidly.

District personnel have made field investigations of flooding conditions after the August 1963 storm, and in the past after small rain storms, on both Long and Wide Canyons. Flows from Long Canyon remain fairly well confined until they reach a point about one-half mile north of Dillon Road where they split into several paths. The flows that follow southwesterly paths usually pass through B-Bar H Ranch south of Dillon Road and continue to flow toward Morongo Wash. The flows following a more southerly direction usually flow into Willow Hole. Water tends to pond over a large area at the intersection of Mountain View Road and 20th Avenue.

Flows from East Wide Canyon have been observed to split at a point about 1900 feet north of the aqueduct crossing, with the westerly portion of the flow passing through a small saddle and emerging at the mouth of West Wide Canyon. The easterly portion of the split flows south from the mouth of East Wide Canyon and then southwesterly towards Willow Hole. There are indications that in the past some flows have gone southeasterly into Fun Valley. On the occurrence of large flows this condition could possibly recur.

Design Storm Frequency and Duration - It was determined that the dams and channels should give protection from the once in 100 year storm event. It was found that a 6-hour storm created more critical flow conditions at the dam sites than storms of longer duration. Therefore, the 6-hour 100 year storm was used in design of the dams and 100 year peak flows were used in channel design.

Rainfall Loss Rates - An average constant loss rate of 0.35 inch per hour for the design storms and 0.25 inch per hour for the spillway design storms was considered applicable to this area.

Design Discharges - General - Synthetic unit hydrographs were developed and used in the design of the dams. Adequate rainfall and runoff records for the drainage basins are not available. Therefore, standard unit hydrograph analyses could not be made and synthetic unit hydrographs had to be developed and used to derive the design hydrographs. The hydrographs were computed by the method outlined in the District's report on "The Application of Synthetic Unit Hydrographs to Drainage Basins in the Riverside County Flood Control and Water Conservation District," and using rainfall data from U. S. Weather Bureau Technical Paper Number 28.

The design hydrographs represent the time distribution of runoff from rainfall during a 6-hour storm with a frequency of once in 100 years. The spillway design hydrographs were computed from a 6-hour storm event of sufficiently high magnitude that the probability of such a storm actually occurring is very remote.

Peak discharges from the 100 year storm used in designing the channels were computed by the Rational Method. Rainfall intensities were taken from a rainfall intensity-duration curve for the once in 100 year storm plotted for the Desert Hot Springs area from data contained in U. S. Weather Bureau Technical Papers Number 24 and 28. Concentration time for the various areas was determined from a nomograph found on page 47 of U. S. Bureau of Reclamation book, "Design of Small Dams." A runoff coefficient of C = 0.50 was used.

Design Discharges-Wide Canyon Dam - The Wide Canyon dam and levee would control all of the drainage from subarea A. The hydrograph of the design flood with a volume of 1,560 acre-feet and a peak of 6,200 cubic feet per second is shown on plate 2. The hydrograph of the spillway design flood with a volume of 4,690 acre-feet and a peak of 15,500 cubic feet per second is shown on plate 3.

Design Discharges-Long Canyon Dam - The Long Canyon dam would control all of the drainage from subarea B. The hydrograph of the design flood with a volume of 1,370 acre-feet and a peak of 5,300 cubic feet per second is shown on plate 4. The hydrograph of the spillway design flood with a volume of 4,110 acre-feet and a peak of 13,000 cubic feet per second is shown on plate 5.

Design Discharges-Channels - Subarea C was divided further into five smaller drainage areas tributary to the channel system at varying points. The design discharges were determined by routing the maximum dam outflow discharges with the tributary drainages from subarea C. The discharges used in channel design are shown on the preliminary plan and profile sheets, plates 9, 10, 11, 12 and 13.

PLANS OF IMPROVEMENTS CONSIDERED

General - The type of storm most often encountered in this area is one of high intensity and short duration, producing high instantaneous peak flows, but relatively low flood volumes. This type of storm lends itself ideally to control by a detention dam which will greatly reduce the high peak flows by providing a relatively small amount of storage.

The dam sites proposed in this Master Plan were field inspected, but no detailed geologic or foundation investigations have been conducted.

Recommended Plan - The plan herein recommended as the best means for the ultimate control of flood runoff in the area east of Desert Hot Springs would consist of (a) dams on Wide Canyon and Long Canyon, and (b) improved outlet channels from the dams to Willow Hole.

A 1,070 acre-foot flood detention reservoir would be created by a 640,000 cubic yard earthfill dam near the mouth of West Wide and East Wide Canyons. The embankment would have a maximum height of 68 feet above streambed and a crest length of 2,100 feet. The upstream slope of the embankment would be 1 vertical on 3 horizontal and the downstream slope 1 vertical on 2 horizontal. The outlet works would consist of a concrete tower inlet structure and a 48-inch diameter outlet conduit. The conduit would be ungated and the inlet structure would be constructed to maintain an outlet free and clear of trash and debris at all times. The conduit would discharge a maximum of 450 cubic feet per second when the reservoir is full to spillway crest. The spillway would be located to the left of the left abutment of the dam and would

be completely independent of the dam structure. It would be 150 feet wide with 2 to 1 side slopes, would be unlined, and would have a concrete wall across the crest to give a point of control at elevation 1544.0. The spillway would have an adverse slope upstream of the crest and supercritical slope downstream of the crest. On the basis of field investigations, the soil structure of the unlined spillway appeared adequate to handle the design flows without any serious erosion. Also, the fact that the spillway is independent of the dam structure makes it unnecessary to line the spillway with concrete.

A training levee would be provided to insure that flows from East Wide Canyon enter the reservoir and do not split off to the east as has occurred in the past. The levee would tie into high ground about 1700 feet northeast of the Colorado River Aqueduct and run in a southwesterly direction for a distance of about 2800 feet. The levee would have a maximum height of about 10 feet. The face of the levee would have to be reveted with concrete or native stone if available. The dam and appurtenant structures are shown on plates 6 and 7.

A 900 acre-foot flood detention reservoir would also be created by a 403,000 cubic yard earthfill dam near the mouth of Long Canyon. The embankment would have a maximum height of 60 feet above streambed and a crest length of 2,000 feet. The upstream slope of the embankment would be 1 vertical on 3 horizontal and the downstream slope 1 vertical on 2 horizontal. The outlet works would consist of a concrete tower inlet structure and a 48-inch diameter outlet conduit. The conduit would be ungated and the inlet structure would be constructed to maintain an outlet free and clear of trash and debris at all times.

The conduit would discharge a maximum of 425 cubic feet per second when the reservoir is full to spillway crest. The spillway is located to the left of the left abutment of the dam and would also be completely independent of the dam structure. It would be 150 feet wide with 2 to 1 side slopes, would be unlined, and would have a concrete wall across the crest to give a point of control at elevation 1306.0. The spillway would have an adverse slope upstream of the crest and a supercritical slope downstream of the crest. As in the case of the Wide Canyon Dam, the spillway would be unlined because the soil structure appeared to be adequate to handle flows without excessive erosion and because the spillway is independent of the dam structure.

A training levee would be provided to direct water flowing over the spillway back into the natural wash. It would also be necessary to do a small amount of excavation and cleaning out to provide a clear channel for water from the spillway to the natural wash and to place revetment along the toe of the dam to protect it from any erosion from spillway flows.

About 9 miles of open channels which would include (a) an improved channel from the Long Canyon dam outlet to the Willow Hole area, and (b) an improved channel from the Wide Canyon dam outlet to the confluence with the Long Canyon Channel would be provided.

The Long Canyon Channel would be about 21,900 feet long, beginning at the dam outlet and extending in a southerly direction toward Willow Hole. The first 17,100 feet of channel, from the dam outlet to the confluence with Wide Canyon Channel, would be trapezoidal in section

with a 5-foot bottom-width, a 3.5-foot-depth and 1½ to 1 side slopes. From the confluence to the outlet at Willow Hole the channel would have a 15-foot bottom width, a 7-foot depth and 1½ to 1 side slopes. The channel would be excavated below natural ground surface and would be lined with 4-inch thick unreinforced concrete. Velocities would range from about 17 to 29 feet per second. Right-of-way-width would be about 50 feet from the dam to the confluence and about 70 feet from the confluence to Willow Hole (see plates 9 and 10). Side drainage into this channel is local type flow and can be handled at street intersections and small inlets. At the channel outlet in Willow Hole a stone apron and cutoff wall would be provided to reduce the velocity of flow and protect the end of the channel.

The Wide Canyon Channel would be about 26,200 feet long, beginning at the dam outlet and extending in a southwesterly direction to the confluence with Long Canyon Channel. The channel would be trapezoidal in section with bottom widths varying from 5 to 10 feet, depths varying from 3 to 7 feet and 1½ to 1 side slopes. The channel would be excavated below natural ground surface and would be lined with 4-inch thick unreinforced concrete. Velocities would range from about 22 to 31 feet per second. Right of way width would vary from about 50 to 65 feet (see plates 11, 12 and 13). Four major inlets would be provided at points of large flow-concentration as shown on the preliminary plan and profile sheets.

Bridge Crossings - The Riverside County Road Department owns and maintains an 80-foot right of way along Dillon Road and Long Canyon Road and maintains 20th Avenue, but owns no right of way. Two major clear span bridge crossings would be provided for Dillon Road and one for Long Canyon Road at the channel crossings. Smaller clear span bridge crossings would be provided for Bennett Road, 20th Avenue, and on 18th Avenue for two crossings.

Alternative Plan of Improvement - The feasibility of carrying all runoff in large channels and thus eliminating the need for detention dams was investigated. Because of the high instantaneous peaks that can occur from desert type thunderstorms, it was found to be more economical to construct the dams and smaller channels than to construct channels large enough to carry the once in 100 year peak flows.

Numerous other dam sites and channel alignments were studied and cost comparisons made. It is believed that the recommended plan will give the best and most economical ultimate solution to the flood problems of this area.

Recommended Sequence of Development - The dams, of course, would be constructed first and when constructed would offer a high degree of protection to the area. However, the runoff occurring below the dams plus outlet from the dams would still have the tendency to follow unpredictable paths and would require additional control. By constructing unlined earth channels with capacity for about a once in 10-year flow, a definite control of the flows could be maintained. Development could then be allowed to take place on a large scale and when the level of development warranted, the channels could then be lined with concrete to achieve their ultimate design capacity.

Estimated Cost of Project -- The estimated cost of construction for the recommended improvement is summarized in Table 1. All costs are based on present (August 1963) prices.

TABLE 1

Item	Unit	Quantity	Unit Price	Cost Subtotal	Cost Total
Wide Canyon Detention Dam					
Embankment, Spillway, and Outlet Works	L.S.			$385,000	
Training Levee	L.S.			40,000	
Engineering				25,000	
Sub-total					$450,000
Right of Way					54,500
TOTAL					$504,500
Long Canyon Detention Dam					
Embankment, Spillway, and Outlet Works	L.S.			$242,000	
Engineering				20,000	
Sub-total					$262,000
Right of Way					19,000
TOTAL					$281,000
Wide Canyon Channel					
Excavation	Cu.Yd.	74,400	$ 0.50	$ 37,200	
Concrete	Cu.Yd.	7,840	35.00	274,400	
Inlet Structures	L.S.	4	2,000.00	8,000	
Contingencies				25,000	
Engineering				30,000	
Sub-total					$374,600
Right of Way					80,000
Bridge Crossings @ Bennett Road, Dillon Road and 18th Avenue					23,300
TOTAL					$477,900

TABLE 1

Item	Unit	Quantity	Unit Price	Cost Subtotal	Cost Total
Long Canyon Channel					
Excavation	Cu.Yd.	55,000	$ 0.50	$ 27,500	
Concrete	Cu.Yd.	6,100	35.00	213,500	
Outlet Structure				10,000	
Contingencies				20,000	
Engineering				25,000	
Sub-total					$296,000
Right of Way					41,000
Bridge Crossings @ Long Canyon Road, Dillon Road, 18th Avenue and 20th Avenue					27,600
TOTAL					$364,600
GRAND TOTAL - ENTIRE PROJECT					$1,628,000

CONCLUSIONS

Based upon the investigations made for this report, the following conclusions can be made:

1. A large area east of Desert Hot Springs is subject to severe flooding from Long Canyon, East Wide Canyon and several smaller tributary drainages because the existing watercourses are not capable of carrying large flows from the mountains through the alluvial fan. Flows tend to split off in several directions, spreading over large areas and causing damage to existing development and public roads.
2. The existence of this condition not only creates a serious hazard, but also acts as a detriment to development of the area. Future urban or suburban development of this area will be determined by the extent of adequate flood control measures that are provided.
3. The construction of earthfill detention dams on Long Canyon and Wide Canyon and about 9 miles of improved channels would provide complete protection to the area, and would be the most feasible ultimate solution to the flood problem.
4. The dams, along with unlined pilot channels, would offer a high degree of protection to the area. Development could then be permitted to take place and when the level of development warranted, the channels could be lined to ultimate capacity.
5. The total cost of the recommended improvements, including rights of way, would be about $1,628,000, based on present (August 1963) price levels.

RECOMMENDATIONS

It is recommended that:

1. The District have foundation investigations made at the earliest practicable date to determine the structural adequacy of the dam sites.
2. The right of way be acquired at the earliest practicable date in order to preserve the available dam sites and channel alignments for future construction and before land costs become excessive.
3. All future development in this area be made to conform to this Master Plan if possible.