US Army Corps
of Engineers
Los Angeles District

STANDING INSTRUCTIONS TO THE PROJECT OPERATOR FOR WATER CONTROL

LYTLE CREEK INTAKE STRUCTURE
LYTLE - CAJON CREEKS
SAN BERNARDINO COUNTY, CALIFORNIA

APRIL 1990

LYTLE CREEK INTAKE STRUCTURE
LYTLE-CAJON CREEKS, SAN BERNARDINO COUNTY, CALIFORNIA

PERTINENT DATA

Completion date		
Intake & West Branch Channel		1949
East Branch Channel		1976
Stream system		Lytle-Cajon Creeks
Drainage area	sq-mi	164
Intake Structure		
Elevation		
West Branch Channel invert	ft, NGVD	1130.0
East Branch Channel invert	ft, NGVD	1143.0
Top of Intake Structure	ft, NGVD	1160.0
Type		Earthfill
Height above original streambed		
Invert of west branch	ft	30.0
At Tainter Gate	ft	40.0
Top length	Approx.. ft	2550
Top width	ft	18.0
Freeboard on channels	min.. ft	2
Spillway		
Type		Concrete Levee
Crest length	ft	577
Crest elevation	ft	1160.0
Outlets		
Controlled		
Gate - Type		Tainter
Number and size		1 @ 60'W x 25'J
Entrance invert elevation	ft, NGVD	1130.0
West branch channel length	ft	15,340
Regulated channel capacity	c.f.s..	30,000
Unregulated up to	c.f.s..	29,400
Uncontrolled		
Number and size		1 @ 400'W x 17.5'H
Invert elevation	ft, NGVD	1143.0
East branch channel length	ft	17,610
Design capacity	c.f.s..	58,000
Standard Project Flood		
Peak flow at Foothill Boulevard	c.f.s..	88,000
Peak flow at West Branch Channel	c.f.s..	30,000
Peak flow at East Branch Channel	c.f.s..	58,000
Historic maximum		
Peak flow	c.f.s..	17,500
Date		Mar. 4, 1978
Peak flow	c.f.s..	16,800
Date		Jan. 25,1969
Peak flow	c.f.s..	14,800
Date		Dec. 29, 1966
Peak flow	c.f.s...	8,070
Date		Feb. 16, 1980

DEPARTMENT OF THE ARMY
SOUTH PACIFIC DIVISION, CORPS OF ENGINEERS
630 Sansome Street, Room 720
San Francisco, California 94111-2206

REPLY TO
ATTENTION OF:

CESPD-ED-W (1110-2-240b)

MAR 20 1991

MEMORANDUM FOR Commander, Los Angeles District
Commander, Sacramento District

SUBJECT: Planned Deviations from Approved Water Control Plans

1. All planned deviations from approved water control plans for reservoir projects within the South Pacific Division must be coordinated with the Coastal Engineering and Water Management Division at CESPD. Approval must be given prior to implementation of the deviation.

2. Emergency deviations do not require prior approval but coordination must still be made as soon as is practical.

ROGER E. KANKOSPE
Brigadier General, U.S. Army
Commanding

STANDING INSTRUCTIONS TO THE PROJECT OPERATOR FOR WATER CONTROL

LYTLE CREEK INTAKE STRUCTURE AND IMPROVEMENTS

Type II Project

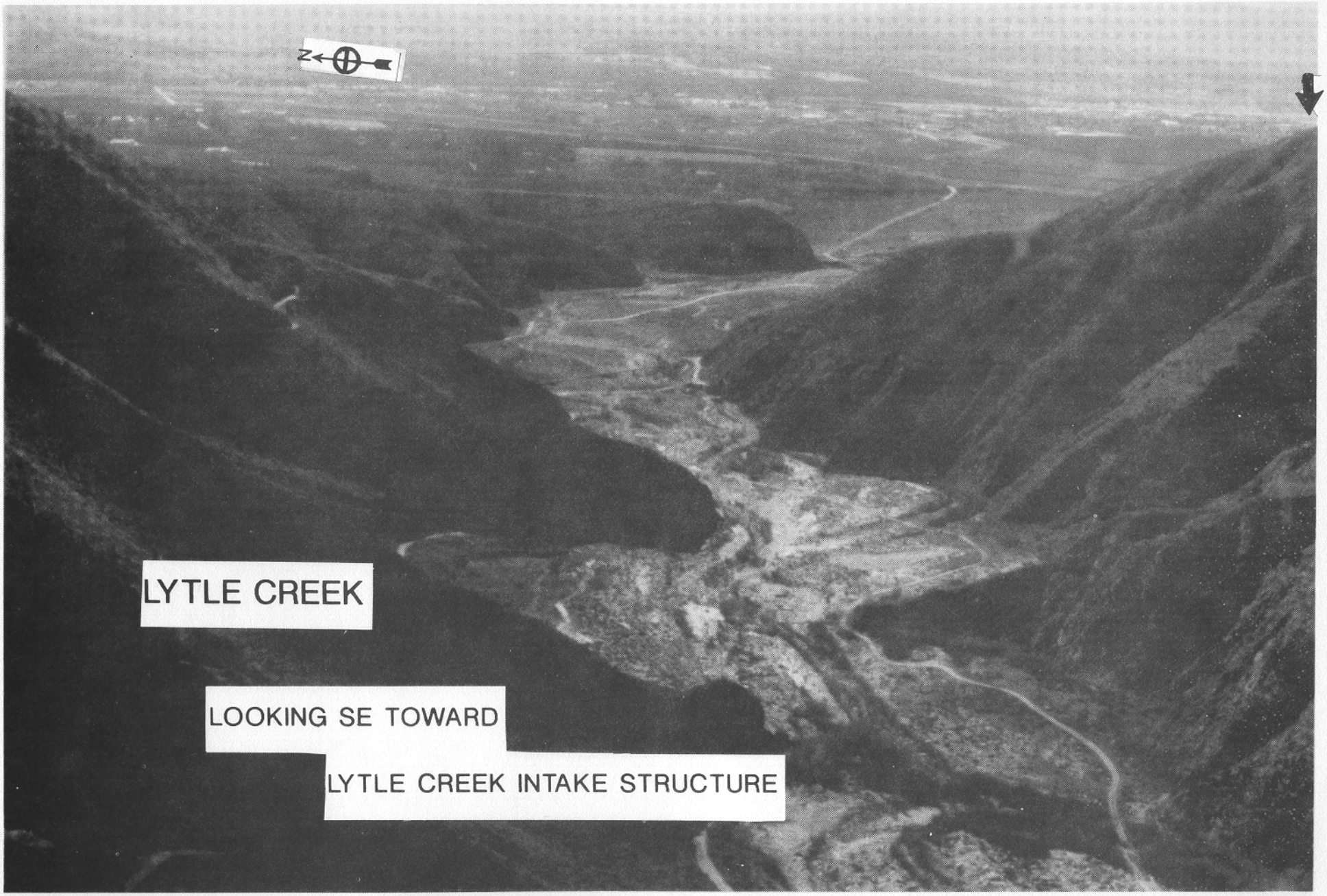
LYTLE-CAJON CREEKS

Santa Ana River Basin

Los Angeles District

U.S. Army Corps of Engineers

April 1990


LYTLE CREEK
LOOKING SE TOWARD
LYTLE CREEK INTAKE STRUCTURE

STANDING INSTRUCTIONS TO THE PROJECT OPERATOR
FOR WATER CONTROL
LYTLE CREEK INTAKE STRUCTURE

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Abbreviations Used

CD	Climatological Data
COE	Corps of Engineers
c.f.s	Cubic Feet Per Second
EM	Engineering Manual
ER	Engineering Regulation
FAX	Facsimile Transmission
ft	Feet
fps	Feet Per Second
HPD	Hourly Precipitation Data
LAD	Los Angeles District
LATS	Los Angeles Telemetry System
MSL	Mean Sea Level
NGVD	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration
PMF	Probable Maximum Flood
ROC	LAD Reservoir Operations Center
SBCFCD	San Bernardino County Flood Control District
SPF	Standard Project Flood
sq-mi	Square Miles
TELEM	Interactive Program on Water Control Data System in LATS
USACOE	United States Army Corps of Engineers
USGS	United States Geological Survey

STANDING INSTRUCTIONS TO THE PROJECT OPERATOR FOR WATER CONTROL LYTLE CREEK INTAKE STRUCTURE

I. BACKGROUND AND REPONSIBILITIES

A. GENERAL INFORMATION.

1. PURPOSE OF DOCUMENT

This document is prepared in accordance with instructions contained in Engineering Manual (EM) 1110-2-3600, Management of Water Control Systems, Nov. 1987, paragraph 9-2, (Standing Instructions to Project Operator for Water Control), and Engineering Regulation (ER) 1110-2-240, Water Control Management, Oct. 1982, and pertains to duties and responsibilities of project operators associated with the operation of Lytle Creek Intake Structure.

Definitions used are those in the U.S. Army Corps of Engineers 1950 Operations and maintenance manual for Lytle and Cajon Creeks and are updated to relate to definitions cited in EM 1110-2-3600. "As used hereinafter, the term "Superintendent" shall be defined to mean the person appointed by local interests to be directly in charge of an organization which will be fully responsible for the continuous inspections, operation, and maintenance of the project works; the term "District Engineer" shall be defined to mean the District Engineer of the Los Angeles District, Corps of Engineers, U.S. Army, or his authorized representative. The term "flood" shall mean any river stage which reaches elevation of 1134.0 ft. on the staff gauge at the intake of the outlet works. The term "right bank" or "left bank" shall be defined to mean the right or left bank or side, respectively, of a stream or channel facing downstream"; San Bernardino County Flood Control District is the designated representative of local interests for the Lytle-Cajon Creek Flood Control Improvements. For purposes of Standing Instructions to the Project Operator for Water Control, the "Superintendent" shall be the "Project Operator", and the Los Angeles District, Corps of Engineers, U.S. Army, Reservoir Regulation Section shall be the "Water Control Manager".

Operational instructions to project operators are outlined with specific emphasis on flood emergencies when communication between the dam tender and the San Bernardino County Flood Control District Operation Center have been disrupted. This document is designed to be used as an operational guide for the project operator in implementing the Lytle Creek Intake Structure Regulation Schedule (Exhibit A). Associated plates are referenced and are located in the back of this document.

The project operator is advised to have available at the Intake Structure this water control document, and the current version of other manuals that complement theses Standing Instructions including: Operations and Maintenance Manual for Lytle and Cajon Creeks (Plate 1, Ref.10); San Bernardino County Flood Control District Storm Operations Guide Manual, Oct. 1989.

Any deviation from Standing Instructions will require approval of the Reservoir Operations Center (ROC).

2. PURPOSE OF PROJECT

The purpose of the project is to protect San Bernardino, Colton, Rialto, and Fontana from a Standard project Flood (SPF) of 88,000 cubic feet per second (c.f.s.) at Foothill Boulevard. The contributing natural alluvial channels carry 35,000 c.f.s. on Lytle Creek, 26,000 c.f.s. on Cajon Creek and 17,000 c.f.s. from Devil Creek Diversion upstream of Foothill Boulevard. From the Foothill Boulevard intake, the concrete channel along the West Branch of Lytle Creek carries a design flood discharge of 30,000 c.f.s. controlled by a tainter gate which diverts flood waters above 30,000 c.f.s. into the 58,000 c.f.s. capacity concrete-lined East Branch of Lytle Creek Channel. (Figure 2) The project is an integral part of the comprehensive flood-control plan for the Santa Ana River drainage area, and prevents all but minor damage from a flood of SPF magnitude to the highly improved areas of San Bernardino and Colton near the channel, to the yards and shops of several railroads, and to the transcontinental railroads, highways, and utilities which cross the area. (See Plate 9)

3. CHAIN OF COMMAND IN FLOOD EMERGENCIES

Applicable regulations governing responsibilities of representatives of local interests and the Federal Government are found in Part 208.1, Title 33, of the Code of Federal Regulations - Navigation and Navigable Waters, Chapter II, Corps of Engineers, Department of the Army - Flood Control Regulations, Maintenance and Operation of Flood Control Works, approved by the Secretary of the Army, 9 August 1944, and published in Federal Register, 17 August 1944. Applicable sections indicating chain of command in flood emergencies contained in Par 208.10 are quoted as follows in conjunction with provisions as provided in the 1950 United States Army Corps of Engineers (USACOE) Operations and Maintenance manual for Lytle Creek Improvements:

> " The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the 'Superintendent', who shall be responsible for the development and maintenance of, and directly in charge of an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the Untied States."
>
> " The Superintendent will, during periods of flood flow, coordinate the functions and activities of all agencies, both public and private, that are connected with the protective works. Arrangements shall be made with the Local law enforcement agencies, street departments, and railroad and utility companies for developing a coordinated flood-fighting program, and an outline of this program filed with the District Engineers."

" Appropriate measure shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods."

" The District Engineer will assist the Superintendent as may be practicable, in his duties of ascertaining storm developments having flood-producing potentialities, assembling flood-fighting forces and materials, and initiating and carrying out flood-fighting operations."

" The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works."

4. LOCATION

Located in San Bernardino County, Lytle Creek and its principal tributary, Cajon Creek, together drain an area of 164 square miles to the Santa Ana River. Headwaters originate from the east slopes of the San Gabriel Mountains and the southwest slopes of the San Bernardino Mountains in the upper Santa Ana River Basin, varying in elevation from more than 10,000 feet at Mount San Antonio (Mount Baldy) to about 2,000 feet at the mouths of Lytle and Cajon Canyons. Upon emerging from the mountains, Lytle and Cajon Creeks flow over a large common alluvial cone and converge 3 miles northwest of the city of San Bernardino, California. From the confluence, Lytle Creek continues southeastward to the western part of the city, where it divides into two channels, the west branch following a southerly course through the city of Colton to Warm Creek and then to the Santa Ana River, and the east branch flowing southeasterly through the cit of San Bernardino to Warm Creek, a tributary of Santa Ana River. Lytle Creek Intake Structure is at the intersection of Foothill Boulevard (5th Street) and Rancho Avenue in San Bernardino at Latitude 34°07', Longitude 117°20'. The length of Lytle Creek is about 30 miles and its average slope is about 290 feet per mile. The project location is shown on Plate 2.

Lytle Creek Water Control Structures consist of: Lytle Creek (West Branch) and Cajon Creek Improvements (1944), a series of grouted-quarry-stone collecting levees (Upper and Lower Devore, Muscoy, and Island) and groins, (four Muscoy and five Riverside Avenue groins), a gated intake structure, and 15,340 feet of concrete rectangular channel from Foothill Boulevard to Warm Creek; Devil, East Twin and Warm, and Lytle Creek Improvements (1950) consisted of the following: Lytle Creek levee consists of 6,130 linear feet of grouted stone levee. Al later contract for the restoration work along the Creek's levee consisted of construction of 1,000 feet of gabions. Devil Creek Diversion which diverts flows from Devil, Badger, and Cable Creeks into Lytle Creek upstream from Highland Avenue, consists of 6,800 feet of grouted stone levee and 10,890 feet of concrete lined channel, of which 5,200 feet is rectangular and 5,690 feet is trapezoidal; Lytle Creek (East Branch) and Warm Creek Improvements (1976) (See Plate 9) added 17,610 feet of rectangular reinforced concrete channel on the East Branch of Lytle Creek from the intake structure to the confluence with Warm Creek. The existing bypass weir at the

Foothill Boulevard Intake Structure was modified to provide an inlet for the East Branch Channel. The Lytle-Cajon water control structures are shown on Plate 3A & 3B in Figures 1 through 26.

4. HISTORY

a. Construction Legislation

(1) Lytle Creek (West Branch) and Cajon Creek Improvements. (The project was constructed under Public Law 534, Seventy-eight Congress, 22 December 1944.)
" This act, in addition to previous authorizations, authorized to be appropriated the sum of $10,000,000 for prosecution of the projects approved in the Act of 22 June 1936, as modified by the Act of 28 June 1939 for the Santa Ana River Basin, including the projects on Lytle and Cajon Creeks for local flood protection at San Bernardino and Colton, California, in accordance with recommendations contained in the report of the Chief of Engineers dated 11 February 1944." (Plate 1, Ref.10)

(2) Devil, East Twin, Warm and Lytle Creek Channel Improvements. (Public Law 516, Eight-first Congress, 17 May 1950.)
" The purpose of the project is to continue the improvement of the Santa Ana River Basin by providing another important unit under the general comprehensive plan for flood control. Construction of the Devil Creek diversion would protect the city of San Bernardino and adjacent suburban areas against floods on Badger, Devil and Cable Creeks." (Plate 1, Ref.13)

(3) Lytle Creek (East Branch) and Warm Creek Improvements. (Public Law 298, 89th Congress, Flood Control Act of 27 October 1965.)
" The purpose of the project is to continue the improvement of the Santa Ana River Basin by providing another important unit under the approved general comprehensive plan for flood control in San Bernardino County, California. The project will provide protection against floods to developed areas consisting of valuable residential, commercial and industrial property, important power facilities, arterial and interstate highways and all transcontinental railroad lines serving this area." (Plate 1; Ref. 17)

b. Description of Water Control Structures at Intake Structure

Lytle Creek West Branch Channel was constructed in 1946 from Foothill Boulevard along the west branch of Lytle Creek to Warm Creek. The Lytle Creek concrete channel extends from the upstream end of the outlet structure to the downstream end of the intake transition channel, a distance of 14,741 feet. The channel is reinforced concrete and is rectangular in section, with a width of 40 feet, wall heights varying between 20 feet and 25 feet, and a design capacity of 30,000 c.f.s. (Plate 1, Ref.10; Plate 4)

The intake-transition-drop structure at the upstream end of the 40-foot-wide concrete channel is 475 feet long and was constructed din 1946. The invert is at elevation 1130 MSL. This structure consists of a converging

drop inlet 120 feet long varying in width from 213 feet at the upstream end of the structure to 60 feet at the gate (Figures 4-8). The gate, a 60-foot wide by 25-foot high tainter gate of 35-foot radius, was installed in 1949 (Plate 5). Walls in the upstream section range in height from 30 feet at the upstream and, to 40 feet at the gate. Below the gate, a vertical walled transition 355 feet in length connects the 60-foot gate section to the 40-foot wide downstream channel. Walls in this section are 25 feet high except for locally increased height necessary to retain the levee fill adjacent to the gate structure. The transition section has an adverse slope between the 60-foot gate section and the 40-foot channel which increases gradually. (Plate 4)

The original bypass structure consists of a wing levee 1,000 feet long to the west of the gate section and a broad-crested overflow section 1,000 feet long to the east. The overflow section, which served to bypass excess stream flow to the natural east branch of Lytle Creek was completed in 1946. (Plate 1, Ref.4; Plate 4)

The 3.36 mile long East Branch of Lytle Creek channel improvements were completed in 1976. Other options such as flood control dams on both Lytle and Cajon Creeks were studied, but were not implemented due to the possibility of altering existing water right distributions. The improved channel of the East Branch of Lytle Creek was designed to control 58,000 c.f.s., which combined with 30,000 c.f.s. diverted into the West Branch Channel, would control a total SPF of 88,000 c.f.s at the Intake Structure. (Plate 1, Ref. 16; Plate 6).

The East Branch channel Inlet, as constructed, was modified so that the original bypass spillway was lowered to elevation 1142.5 feet MSL for a distance of 410 feet at the section in line with the 577 foot spillway levee wall addition. Side walls of the inlet were raised to elevation 1160.0 feet MSL, and 577 feet of concrete spillway levee wall was added to the top remaining bypass levee to raise it to elevation 1160.0 feet MSL. The design discharge of 58,000 c.f.s. is maintained on the East Branch Channel with the difference being that the intake walls on the East Branch Channel were angled outward so that the entrance is 417 feet wide and the crest is 400 feet wide.

For the East Branch improvements, the channel alignment and cross sections were selected on the basis of economic studies. The width of the control section at the bypass spillway was based on the common head that would be required to discharge 30,000 c.f.s. through the existing West Branch inlet and 58,000 c.f.s. through the East Branch inlet. Spillway flow was based on control at the spillway crest. The existing bypass spillway was to be modified by lowering the middle 300 feet from elevation 1,151.5 to elevation 1,141.5 and raising the end sections to the height of the existing embankment (elevation 1160). (Figures 17 & 18). The channel width was to be reduced from 300 feet at the inlet to 100 feet over a length of 1,000 feet. The 100-foot width is maintained for a distance of 2,270 feet, before transitioning to an 80-foot width. Design flow depth of ranges from 14 to 19 feet; a minimum of 2 feet is provided for freeboard. The channel is superelevated in curved reaches. The velocity of the design flow in the concrete channel ranges from 37 to 51 feet per second. The downstream terminus at the Warm Creek channel consists of a stone-lined transitions with revetted levees. The transition dissipates the energy and changes the flow to the subcritical regime within the transition.

The backwater from the natural section downstream would be sufficient to maintain the hydraulic jump in the transition (Plate 1, Ref. 16)

The levees and groins on Lytle and Cajon Creeks primarily were designed to have adequate strength and stability against high-velocity, debris-laden flows and against undercutting or overtopping rather than for the usual freeboard allowance above a computed water surface. The dimensions of channel cross sections on the debris cone change during every flood, and not accurate estimate of flow capacity can be made. Either scour or aggradations may occur along the levees and both may occur in succession at any point during a single flood. The location and severity of such action during future floods cannot be determined in advance by hydraulic computations, and consequently every point must be considered subject to that action. As designed, the levees and groins are believed adequate to contain and withstand a flood with a peak discharge of 26,000 c.f.s. in Cajon Creek at its mouth, 35,000 c.f.s. in Lytle Creek at the canyon mouth, and 60,000 c.f.s. in Lytle Creek above Foothill Boulevard. (Plate 1, Ref. 2 1945)

The Lytle Creek Levee, built in 1956 as an addition to the Lytle-Cajon Flood Control Improvements, is a revetted earth-filled levee, about 6,100 feet long and 10 feet high. It controls a flood of 60,000 c.f.s. with minimum freeboard allowance of 5 feet and would not be overtopped by a maximum flood of 96,000 c.f.s. The cross-section of the embankment is similar to the cross-sections used for the Muscoy Groin No. 4 on the opposite side of the channel; the River side Avenue Groins, upstream from the Levee; and the Island Levee, downstream. The top of Lytle Creek Levee is 18 feet wide and about 10 feet above average ground line. Both sides of the levee have slopes of 1 vertical on 2 horizontal. The channelward side of the levee is covered with a grouted-stone blanket, which extends from the top of the levee to a point 8 feet below the lowest existing channel of the adjoining stream bed to protect the slope from scour. A V-shaped, loose-stone apron, 8 feet deep, is placed at the toe of the revetted slope to retard undercutting. Streambed material is backfilled on top of the apron to the average ground line, and graded to a slope of 1 on 40 away from the levee to direct low flows away from the levee face. The channelward side of the levee extends from 10 feet above the top of the graded backfill to depths ranging from 9 to 12 feet below the top of that backfill. (Plate 1; Ref. 15)

The design of the Lytle Creek Levee System upstream of Foothill Boulevard to control the SPF was reviewed during the 1964 Corps of Engineers study and it was concluded that the existing levees would satisfactorily convey the SPF at Foothill Boulevard. (Plate 1, Ref.16)

6. HYDROLOGY

Hydrologic data and statistics for historical rainfall and runoff for the Lytle-Cajon Creek watershed are presented in Exhibit B. Plate 7 shows a hydrologic map of the watershed with instrument locations. The hydrographs on Plate 8 show floods that could occur if the January 1943 storm, the largest regional storm of record, were to center over the drainage area at a time when ground conditions were conducive to a high rate of runoff. The resultant flood

is about twice as large as any known flood of record. The SPF peak inflow for future conditions at the Lytle Creek Intake Structure is computed to be 88,000 c.f.s. at Foothill Boulevard (Plate 9). Exhibit B presents documentation of determination of the SPF and discusses the possibility of larger floods at Lytle Creek Intake Structure.

7. GEOLOGY AND GROUDNWATER

a. GEOLOGY

The project area is located in the eastern part of the broad alluvial plain of the upper Santa Ana River Valley, about 7 to 8 miles south of the San Gabriel-San Bernardino Mountains, which are a portion of the eastwest trending Transverse Ranges. Underlying the valley is an oblong structural basin, composed of valley alluvium overlying the basement complex. The alluvium is derived mainly from the granite and metamorphic rocks that form the basement complex of the San Gabriel and San Bernardino Mountains to the north. These deposits are of late Quaternary age and include Holocene and Pleistocene alluvium. The total thickness of the later Quaternary alluvium in the vicinity of San Bernardino exceeds 1,000 feet.

The San Andreas and San Jacinto faults are the major active fault zones in the project area. The San Andreas Fault zone crosses through the Transverse Ranges diagonally in a northwest-southeast direction about 6 1/2 miles north of the project. The San Jacinto fault zone branches off from the San Andreas fault on the north side of the Transverse Ranges and crosses through the mountains, near parallel to the San Andreas fault zone, entering the valley along Lytle Creek. The Cucamonga fault zone parallels the south face of the San Gabriel Mountains, extending from Lytle Creek westward to Monrovia. Plate 10 shows the location of major faults relative to Lytle Creek Intake Structure and plots seismic epicenters by magnitude of the event.

b. GROUNDWATER

The downstream part of the East Branch of Lytle Creek is inside the southwest part of the Bunker Hill groundwater basin in contrast to the West Branch of Lytle Creek, which was built west of the San Jacinto fault, known also as the "Bunker Hill dike" because of its effect as a groundwater barrier. The Bunker Hill groundwater has been studied in detail by various agencies because of its economic importance to San Bernardino County. Water is absorbed by alluvium at the upstream end of the basin and is partly confined as it travels to the downstream end, where it discharges as subsurface and surface flow through the Colton Narrows of the Santa Ana River. The resultant total outflow from the basin can sometimes result in a value less than inflow during wet periods and greatly exceeding inflow during dry periods. There is natural adjustment of groundwater storage in the confined area as the water table responds to differences between inflow and outflow. The downstream part of the East Branch of Lytle Creek is within the area of perennial outflow from the Bunker Hill groundwater basin, and the water table is expected to be

continuously above the channel-invert elevation downstream from station 60+00. The rest of the channel is in an area where the water table would fluctuate from below the invert elevation to substantially above that elevation.

8. PROBLEMS ENCOUTERED

a. EROSION

After the floods of January and February 1969, the COE inspected damages to levees and groins of the Lytle Creek Improvements. For the second time (the first repairs to the project occurred in 1967 subsequent to the floods of 1965 and 1966) it had been necessary to repair damage to groins, which had previously been repaired at federal expense. The cause, as presented in a letter of explanation to the San Bernardino County Supervisor, was in large measure attributed directly to the creation of large pits in the channel downstream of the groins. Ill-considered gravel extraction was considered to have started the cycle of bedload movement due to "head-cutting" into the pits and running long distances upstream to undermine important structures such as highways and flood-control works. The Corps suggested that San Bernardino County review the need to form a comprehensive policy on gravel extraction in the County which would protect public works against being undermined by head-cutting erosion.

b. SEDIMENTATION

Post-construction sedimentation problems have become evident in the lower reaches of the Warm Creek channel and Santa Ana River confluence which are partially contributed to by the Lytle-Cajon Creek watershed. Steep mountains that rise abruptly from the valley floor and have a minimum of vegetative cover are subject to major brush fires that can increase erosion potential significantly. The sediment deposition problem is aggravated at channel grade changes designed to transition with the concrete-lined channel. These conditions, combined with energy dissipators installed at the downstream end of the concrete-lined channel, resulted in an increased deposition, thereby decreasing the channel capacity.

Sediment deposits were anticipated by the LAD's initial studies, but the magnitude of these problems was not predictable from data existing at the time of the study. Following construction in 1977, the major storms of 1978 deposited approximately 1,280,000 cubic yards of sediment in the Santa Ana River improvement area and the lower improved reaches of Warm Creek. The maximum discharge during these storms recorded at E Street by the Untied States Geological Survey (USGS), was approximately 13,700 c.f.s., which was approximately equivalent to a 10-year exceedance interval. The USGS gauge Lytle Creek at Colton registered a maximum discharge of 17,500 c.f.s. on March 4, 1978. Deposits in the lower Warm Creek reach were approximately 200,000 cubic yards.

The sediment was removed at a cost of $2.7 million in 1979, but the floods of 13-21 February 1980 carried large sediment loads and deposited

approximately the same amount of sediment in the same area. The maximum discharge during the period was 14,500 c.f.s. recorded at E Street by the USGS. The USGS Lytle Creek gauge at Colton registered a maximum discharge of 8,070 c.f.s. on February 16, 1980. The volume of flood in the 8-day period was 81,000 acre-feet. The 14,500 c.f.s. discharge was approximately equal to a 10-year exceedance interval.

9. CONSIDEATIONS IN THE PHYSICAL OPERATION OF WATER CONTROL STRUCTURE

a. OFFICIAL STAFF GAUGE

The official staff gauge used for determining stages listed on the rating curves and for determining the 1134.0 elevation defined officially as a "flood" is located on the left abutment of the intake of the West Branch Channel as facing downstream. It can also be referenced as the staff gauge directly north of the control house on the left intake abutment, or as the staff gauge on the east abutment of the intake to the West Branch Channel. This official staff gauge must always remain visible as an accurate indicator of water level at the Lytle Creek Intake Structure. (Figure 11)

b. RATING CURVES

Original rating curves were developed from a physical model of the Intake Structure, the original bypass structure and the west Lytle Creek Channel as studied in 1946 (Plate 1, Ref.4). The current discharge rating curve (Plate 11) accounts for the Lytle-Creek East Branch Improvements of 1976. Observations from the physical modeling indicated that for all discharges, a certain amount of movement of the bed in front of the intake structure was involved, and therefore, the discharge rating curve for the tainter gate indicates only the general trend of the relationship between pool elevation and discharge. The free-flow rating curves generated are only indicative of the relationship that existed for one condition of the channel configuration on the ground surface directly upstream from the gate intake and should not be considered as representative of all conditions, because the ground pattern, and hence the control varied with flow conditions.

For example, it was found that at high discharges, a large volume of detritus was deposited in front of the intake. This deposit affected considerably the discharge through the intake by changing the character of the control. At low flows the tendency for the water to channelize in its approach to the intake and its absence of pooling resulted in scouring of the existing bed, or of the detritus deposit in the event higher flows had preceded. Therefore, staff gauge water surface elevation-inflow discharge relationships are accurate, but the outflow rating curve relationship is not completely reliable.

The rating curves on Plate 11 indicates flow amounts n both East and West Lytle Creek Channels as read on the staff gauge on the left intake abutment of the west branch inlet.

c. UPPER DEVORE LEVEE

The Upper Devore Levee (Plate 3B, Figure 21) is a key structure for the entire project. Unexpected depositions of sediment could result in floodflows overriding the levee. Therefore, the Upper Devore Levee and Santa Fe Railway Bridge shall be continuously patrolled and emergency personnel should be prepared to raise the levee on short notice. It shall be the duty of the Superintendent to maintain a periodic patrol of the project works during all periods of flood flow in excess of a reading of 1134.0 on the staff gauge at the Intake Structure. (Plate 1, Ref.10, Figure 11)

d. TRASH BUILDUP

The intake outlet works must be monitored at all times for trash buildup of any significant amount and appropriate measures taken to remove blockages should they occur.

10. LYTLE-CAJON FLOODWAY IMPROVEMENTS

The Lytle-Cajon floodway improvements are a local protection project. All improvements have been turned over to the San Bernardino County Flood Control District, San Bernardino, California, who by resolution dated 1 May 1945, gave assurances that it would comply with all requirements of local cooperation under Part 208.10, Title 33, of the Code of Federal Regulations - Navigation and Navigable Waters, and Chapter II, Corps of Engineers, Department of the Army - Flood Control Regulations, Maintenance and Operation of Flood control Works, approved by the Secretary of the Army, 9 August 1944, and published in the Federal Register, 17 August 1944. San Bernardino County Flood Control District was granted the responsibility of representing local interests for further improvement transactions because it has already demonstrated its ability to comply with Government requirements. Under federal regulations cited, operation and maintenance is done by San Bernardino County Flood Control District.

B. ROLE OF THE PROJECT OPEATOR

1. NORMAL CONDITIONS

a. The Project Operator is responsible for water control actions during normal hydrometeorological conditions (non-flood, non-drought) without daily instruction. However, the water control manager should be contacted any time conditions are such that consultation or additional instruction regarding water control procedures are needed.

b. The Superintendent is responsible to make periodic inspections of all water control structures to insure that all levees and groins are in proper condition. Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days. For the sake of uniformity and to the extent practicable, the dates of inspection shall be as follows: 1

January, 1 April, 1 July, and 1 October, and immediately following each flood flow in excess of a reading of 1134.0 on the staff gauge at the Intake Structure.

c. Responsibilities of the Superintendent in line with the provisions of the Flood Control Regulations include under general duties:

(1) Training of Key Personnel. Key personnel shall be trained in order that regular maintenance work may be performed efficiently and to insure that unexpected problems related to flood control may be handled in an expeditious and orderly manner. The Superintendent should have available the names addresses, and telephone numbers of all of his key personnel and a reasonable number of substitutes. Theses key people should, in turn, have similar data on all of the personnel that will be necessary for assistance in the discharge of their duties. The organization of key personnel should include the following:

(a) Assistant to act in the place of the Superintendent in case of his absence or indisposition.

(b) Sector foremen in sufficient number to lead maintenance patrol work of the entire levee and groin systems during flood fights. High qualities of leadership and responsibility are necessary for these positions.

(2) To keep a reserve supply of materials needed during a flood emergency on hand at all times.

2. EMERGENCY CONDITIONS (FLOOD OR DROUGHT)

a. Superintendent Responsibility During Flood Conditions

(1) The Superintendent is responsible to see that all gate operations performed at Lytle Creek Intake Structure are performed in accordance with the Regulation Schedule of Exhibit A.

(2) Pertinent requirements of the Code of Federal Flood Control Regulations. Flood Control Regulations, paragraph 208.10 (b) (2) are quoted in part as follows:

" During flood periods the levee shall be patrolled continuously to locate unusual wetness of the landward slope and to be certain that:

(a) There are no indications of slides or sloughs developing;

(b) Wave wash or souring action is not occurring;

(c) No low reaches of levee exist which may be overtopped;

(d) No other conditions exist which might endanger the structure;

(e) Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section."

(3) It shall be the duty of the Superintendent to maintain a periodic patrol of the project works during all periods of flood flow in excess of a reading of 1134.0 on the staff gauge at the intake structure, and to maintain a store of supplies and equipment available for emergency flood-fighting operations and emergency repairs.

(4) The Upper Devore Levee is a key structure for the entire project and unexpected depositions of sediment that might be caused by changes in direction of current or debris accumulations at the Santa Fe Railway bridge, could result in flood flows overriding the levee. The Superintendent shall, therefore, cause a continuous patrol to be made on the Upper Devore Levee and the Santa Fe railway bridge and be prepared to raise the levee on short notice, either by sandbags or other suitable means.

(5) The Superintendent shall dispatch a message by radio in the control house, or by telephone or telegraph, to the LAD ROC whenever the water surface in the channel reaches the reading of 1134.0 on the staff gauge on the east abutment of the intake to the West Branch Channel. The Superintendent shall provide additional staff gauge readings to the LAD Reservoir Operation Center as may requested during the storm and flood event.

(6) The Superintendent shall also ensure readings are taken of the staff gauge at intervals of one two hours during the time when the water surface is above the flood flow stage 1134.0 feet, noting the time of the observation, the staff gauge reading and the tainter gate setting. These readings shall be entered in the log of flood observations, one copy of which shall be forwarded to the District Engineer immediately following the recession of the flood, and one copy transmitted as an enclosure to the semi-annual report.

b. Drought Conditions

Drought management at Lytle Creek Intake Structure is not an issue because Lytle Creek outflows are normally captured upstream by local water companies. The Lytle Creek intake Structure is never used to impound water except for flood control. Originally, a bypass diversion for water claimed by prior water rights was included in construction at the Lytle Creek intake Structure, but has become obsolete by construction of the Lytle Creek East Branch Channel.

II. DATA COLLECTION AND REPORTING

A. NORMAL CONDITIONS

The Superintendent shall transmit to the LAD Reservoir Regulation Section once each month the original charts from the rain gauge installed at the intake works, to reach the District Office by the 7th day of the following month. In case of a major storm, the chart for that storm should be transmitted to the District Engineer immediately on removal from the gauge. The Superintendent shall maintain a file of the charts from the water level recorders and gate position recorder, such file to be available for inspection by the LAD ROC.

The Los Angeles District Corps of Engineers maintains a telemetered rain gauge record at the Lytle Creek Intake Structure for which punch tapes are collected by COE personnel at 2 month intervals. Telemetered rainfall information is available using the COE Los Angels Telemetry System (LATS), which gives instantaneous readings of precipitation as sensed in amounts of 0.04 inch of rain. Call letters for Lytle Creek Intake Structure within the TELEM data system are LYDB.

The stream gauge most accurately measuring inflows at Lytle Creek Intake Structure is the USGS gauge No. 11065000, Lytle Creek at Colton.

B. FLOOD CONDITIONS

The Superintendent shall dispatch a message by radio in the control house, or by telephone or facsimile (FAX), to the LAD ROC, at telephone number 213/452-3527 or FAX 213/452-3545, whenever the water surface in the channel reaches the staff gauge reading of 1134.0.

The Superintendent shall also ensure readings are taken of the staff gauge at intervals of one or two hours during the time when the water surface is above the flood flow stage 1134.0, nothing the time of the observation, the staff reading and the gate setting. These readings shall be entered in the log of flood observations, one copy of which shall be forwarded to the LAD immediately following the recession of the flood, and one copy transmitted as an enclosure to the semi-annual report.

C. REGIONAL HYDROMETEOROLOGICAL CONDITIONS

The Water Control Manager will inform the Project Manager by radio in the control house, or by telephone or by FAX of regional hydrometeorological conditions that may impact the intake structure.

III. WATER CONTROL ACTION AND REPORTING

A. NORMAL CONDITIONS

Under normal conditions there is no water control action to be taken at Lytle Creek Intake Structure due to the intermittent nature of Lytle-Cajon Creeks and the open standby setting of the tainter gate. Runoff occurs only at times of high intensity rainfall events. The tainter gate and backup generator are tested on a monthly basis.

B. FLOOD CONDITIONS

It shall be the duty of the Superintendent to maintain a periodic patrol of the Project Works during all periods of flood flow in excess of a reading of 1134.0 on the staff gauge at the intake structure, and to maintain a store of supplies and equipment available for emergency flood-fighting operations and emergency repairs.

A dam tender must be at the Intake Structure to record flood stage readings and to monitor floodwaters for debris buildup. The dam tender must keep the Superintendent advised of any conditions that need correcting at the Intake Structure. The dam tender is to follow the operation schedule presented below and in Exhibit A. The tainter gate operation retards flood inflows to a maximum of 30,000 c.f.s. along the West Branch Lytle Creek Channel. The spillway to the East Branch Channel will begin to spill when the discharge at the West Branch Channel is 22,800 c.f.s. The tainter gate is initially set at an opening of 20.4 feet and is reduced as the water surface rises to keep West Branch channel flow below 30,000 c.f.s. Rating curves for outflow through the West Branch tainter gate and over the East Branch spillway are shown on Plate 11.

Water Surface Elevations Feet	Gate Opening Feet	West Branch Discharge c.f.s.	East Branch Discharge c.f.s.	Combined Discharge c.f.s.
1130.0	20.4	0.0	0.0	0.0
1134.0	20.4	3,000.0	0.0	3,000.0
1135.0	20.4	5,400.0	0.0	5,400.0
1140.0	20.4	19,000.0	0.0	19,000.0
1143.0	20.4	22,800.0	0.0	23,000.0
1144.0	20.4	24,000.0	1,200.0	25,000.0
1145.0	20.4	24,400.0	3,500.0	28,000.0
1150.0	20.4	29,000.0	23,000.0	52,000.0
1150.5*	20.0	30,000.0	25,000.0	55,000.0
1151.0	19.4	30,000.0	28,000.0	58,000.0
1152.0	18.8	30,000.0	33,000.0	63,000.0
1153.0	18.5	30,000.0	39,000.0	69,000.0
1154.0	18.2	30,000.0	45,000.0	75,000.0
1155.0	18.0	30,000.0	51,000.0	81,000.0
1156.0	17.8	30,000.0	58,000.0	88,000.0
1156.1**	16.4	27,000.0	58,000.0	85,000.0
1160.0	16.4	30,000.0	87.000.0	117,000.0

* Dam tender commences gate operation
** Dam tender makes final gate change

The design for the project is the standard flood with a peak inflow of 88,000 c.f.s. The West Branch Channel passes 30,000 c.f.s. through the tainter gate and the remaining 58,000 c.f.s. is passed over the spillway to the East Branch Channel at a design pool elevation of 1156.05 ft.

If a rainfall-runoff event that exceeded the design inflow were to occur, the tainter gate would be lowered as the pool elevation rises, to limit the flow in the West Branch Channel to 30,000 c.f.s. Flow in the East Branch Channel is uncontrolled over the spillway. Flows in excess of the project design are passed downs the East Branch Channel. After the channel freeboard is surpassed, overflows would occur along portions of the East Branch Channel.

Top of the dam elevation is 1160.0 ft but the Lytle Creek Intake Structure and downstream channels are designed to pass 88,000 c.f.s. at a pool elevation of 1156.05 ft. The operation schedule provides gate settings up to the top of dam. For runoff events that produce a water surface elevation above 1156.05 ft., the dam tender will make a final setting that limits flow down the West Branch Channel to 30,000 c.f.s. (at the top of dam elevation) before the Superintendent considers evacuation of the project. At a water surface elevation matching the top of the dam, the Intake Structure can pass 116,600 c.f.s, which is 33 percent larger than the design flood. The actual inflow that makes it downs to the Intake Structure depends upon the system of upstream levees and their capability of preventing breakout flows before reaching the project.

C. INQUIRIES

The LAD Reservoir Regulation Section should be notified of all significant inquiries received by the Project Operator or Superintendent from citizens, constituents or interest groups regarding water control procedures or actions.

D. WATER CONTROL PROBLEMS

The water control manager must be contacted immediately by the most rapid means available in the event that an operational malfunction, erosion, or other incident occurs that could impact project integrity in general or water control capability in particular.

E. COMMUNICATION NETWORK IN FLOOD SITUATIONS

San Bernardino County Flood Control District	714/387-2800
San Bernardino County Communication Center 24 hr.	714/387-6076
LAD Corps of Engineers Reservoir Operation Center	213/452-3623
Control House at Lytle Creek Intake Structure	714/386-5141

F. COMMUNICATION OUTAGE

Coordination of flood control operation is under the direction of the San Bernardino County Flood Control District. During flood periods, close contact will be maintained between Operating personnel at Lytle Creek Intake Structure, the San Bernardino County Superintendent, and the Corps of Engineers Reservoir Regulation Section in Los Angeles. If communication is broken between the dam tender and the Superintendent, continue to monitor flood stage data and record, using flood lights at night if necessary, to monitor reading of staff gauge on left wall of Lytle Creek West Channel Intake.

Follow the operation schedule under Exhibit A. Operate the tainter gate (Gate and backup generator instructions, Exhibit C) if stage readings approach elevation 1150.0 feet as listed on the regulation schedule in Exhibit A.

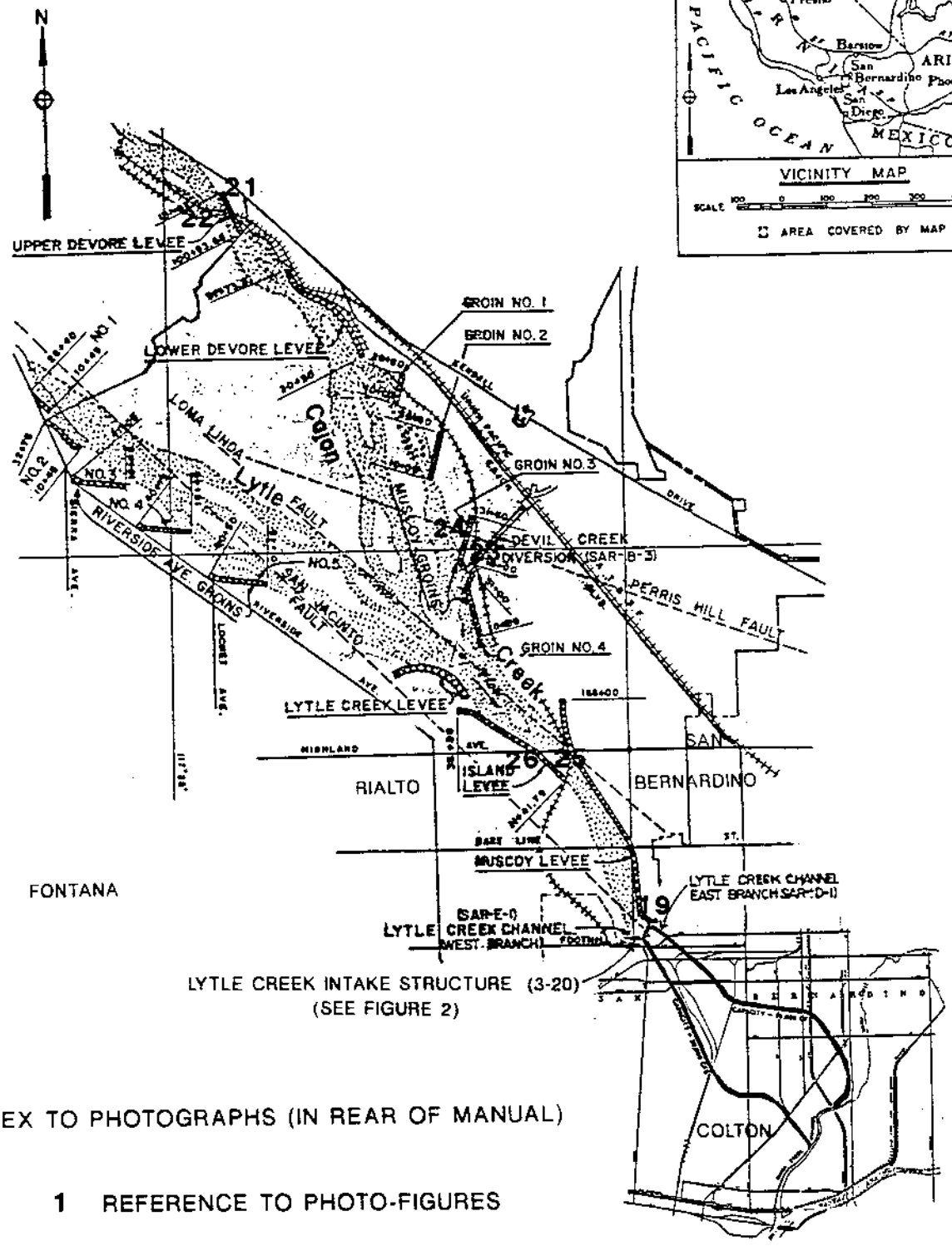
In the event of communication outage, the Los Angeles District Corps of Engineers Reservoir Regulation Section can be reached via radio call sign WUK4ROC. Also refer to the Superintendents' survey of phone located in the immediate area of Lytle Creek Intake Structure. Continued attempts should be made to re-establish communications.

Emergency notifications are normally made by the Superintendent, however if the dam tender loses communication with the San Bernardino County Flood Control District, and an emergency notification situation arises, such as an imminent dam failure or uncontrolled flow, the dam tender should make the necessary notifications as listed in the San Bernardino County Flood Control District Storm Operations Guide Manual.

Notifications should include: (a) description of the type and extent of existing or impending emergency; (b) advisement for evacuation from the flood plain; (c) information on the time of initial release of hazardous amounts of water; (d) the depth of water behind the Intake Structure; and (e) the dam tender's name and telephone number.

Upon completing the above notifications, an attempt will be made to try to re-establish communications with the Superintendent. All notifications and lack of notifications, should be documented. The dam tender should not leave the Intake Structure unless his safety is in jeopardy. For runoff events which produce a water surface elevation above 1156.05, the dam tender should make a final gate change before following evacuation instructions of the Superintendent.

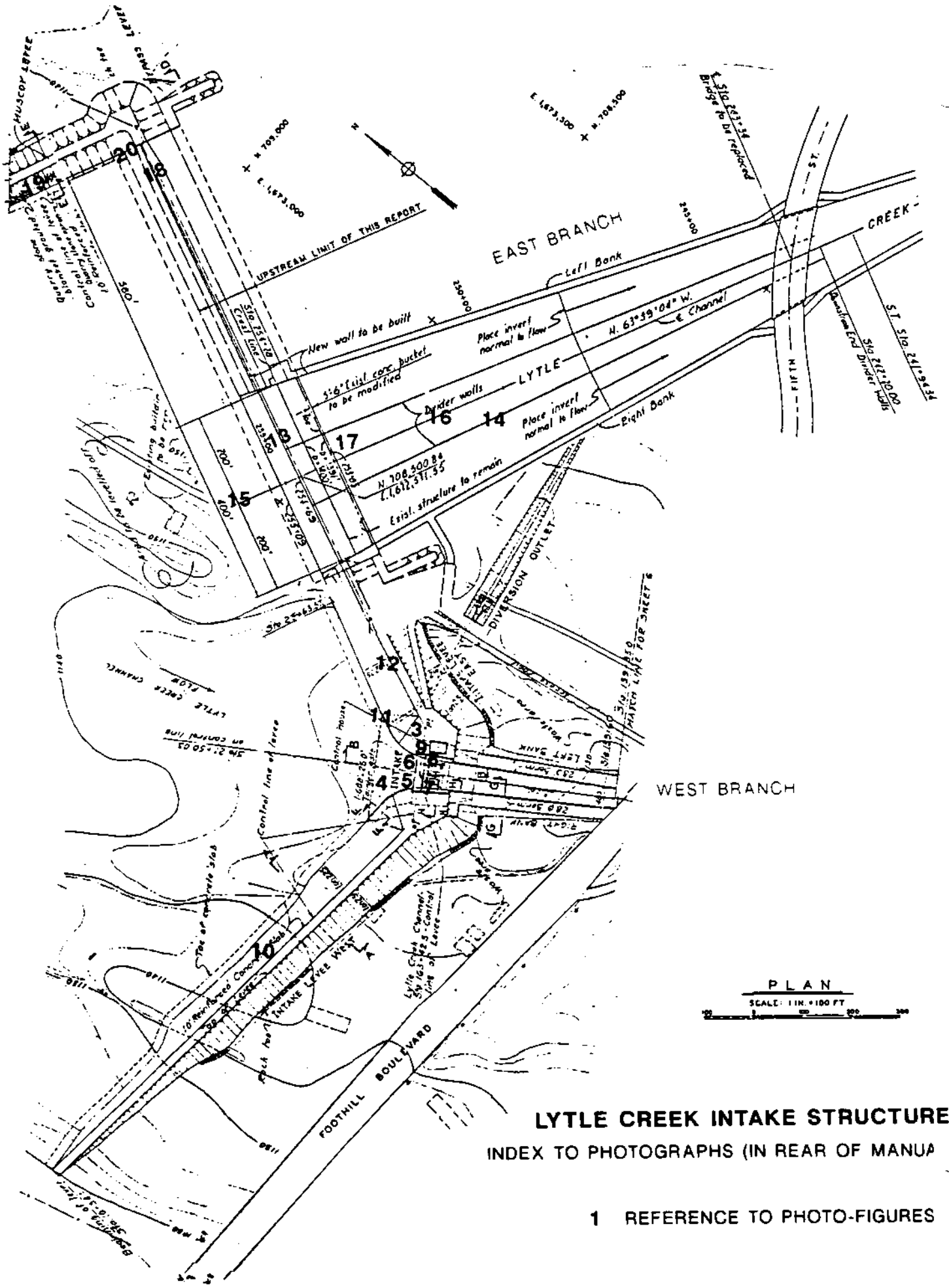
LYTLE-CAJON FLOOD CONTROL STRUCTURES



INDEX TO PHOTOGRAPHS (IN REAR OF MANUAL)

1 REFERENCE TO PHOTO-FIGURES

FIGURE 1



LYTLE CREEK INTAKE STRUCTURE

INDEX TO PHOTOGRAPHS (IN REAR OF MANUA

1 REFERENCE TO PHOTO-FIGURES

FIGURE 2

FIGURES

(PHOTOGRAPHS)

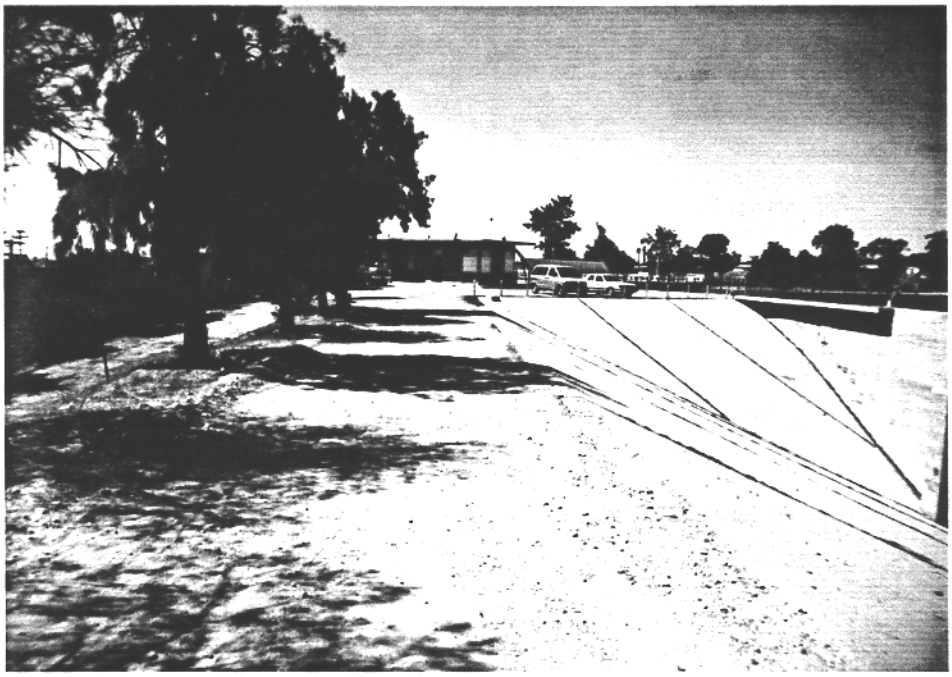


Figure 3. Lytle Creek Intake Structure Looking SW At Control House At West Branch Intake. East Wing Levee In Background.

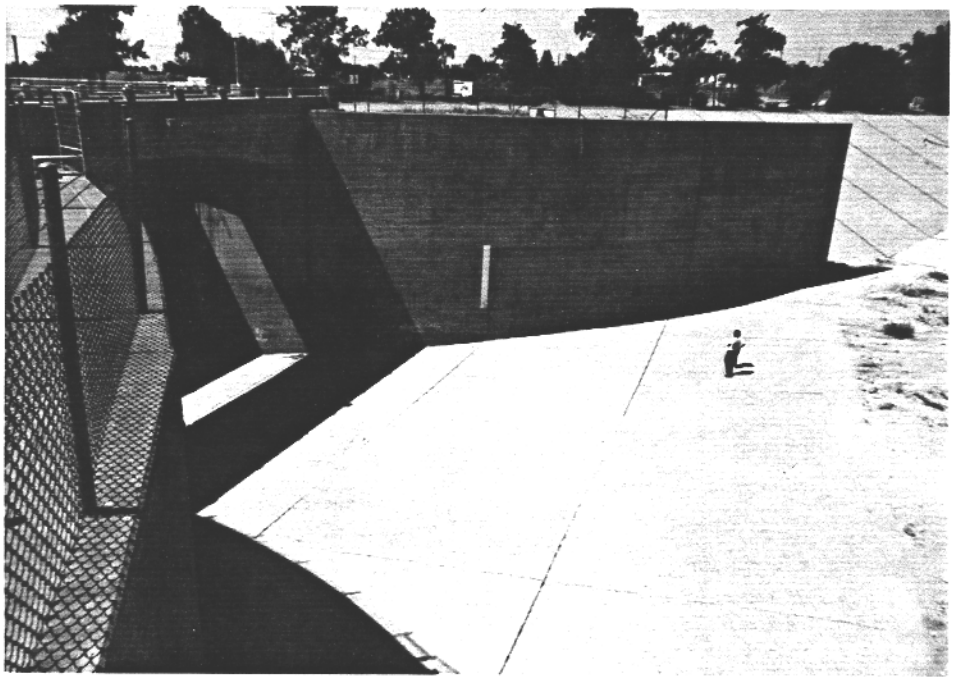


Figure 4. Lytle Creek Intake Structure. West Branch Intake With Tainter Gate Housing. Looking SW With West Wing Levee Beyond Intake.

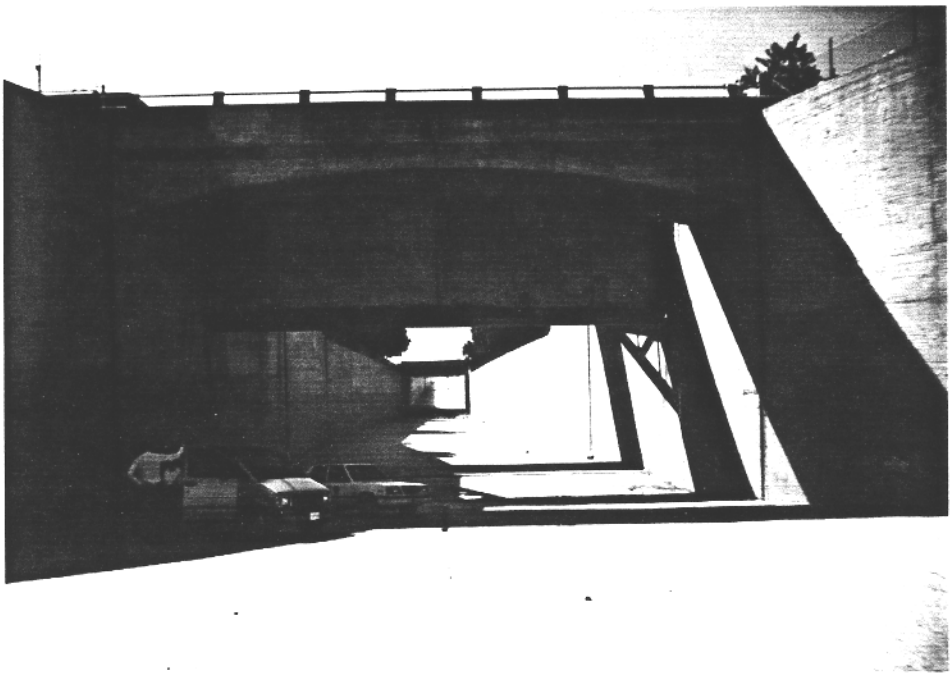


Figure 5. West Branch Lytle Creek Intake Channel With 60'x25' Tainter Gate. Looking South.

Figure 6. West Branch Lytle Creek Channel Looking SW At Tainter Gate During Gate Test. Unused Bypass To East Branch Of Lytle Creek In Foreground; No Longer Used After Construction Of The East Branch Lytle Creek Channel.

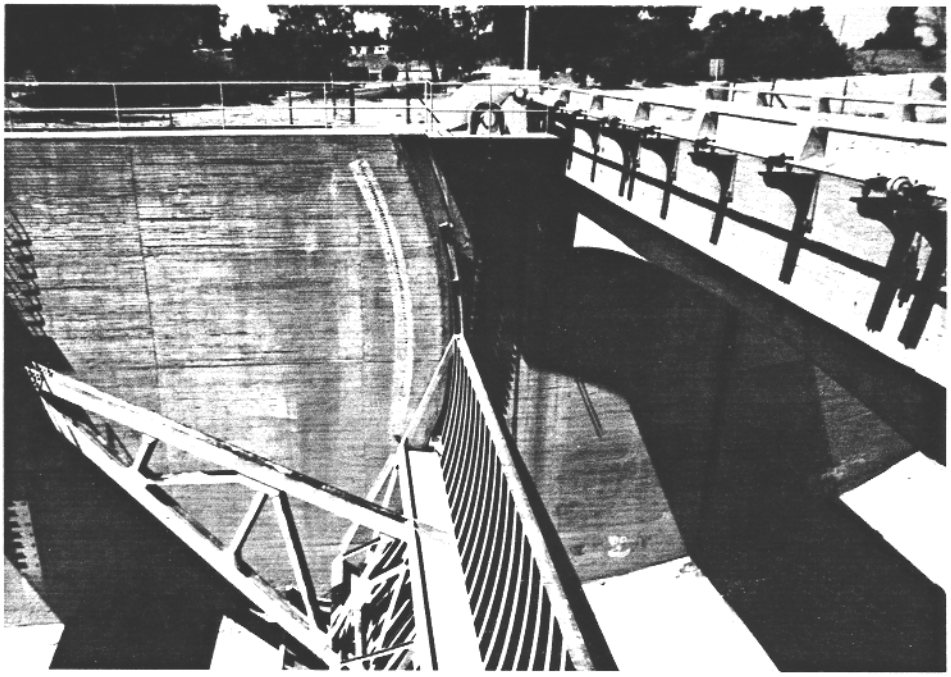


Figure 7. 60′ x 25′ Tainter Gate In Lytle Creek West Branch Channel Looking West During Gate Test. Lytle Creek Intake Structure.

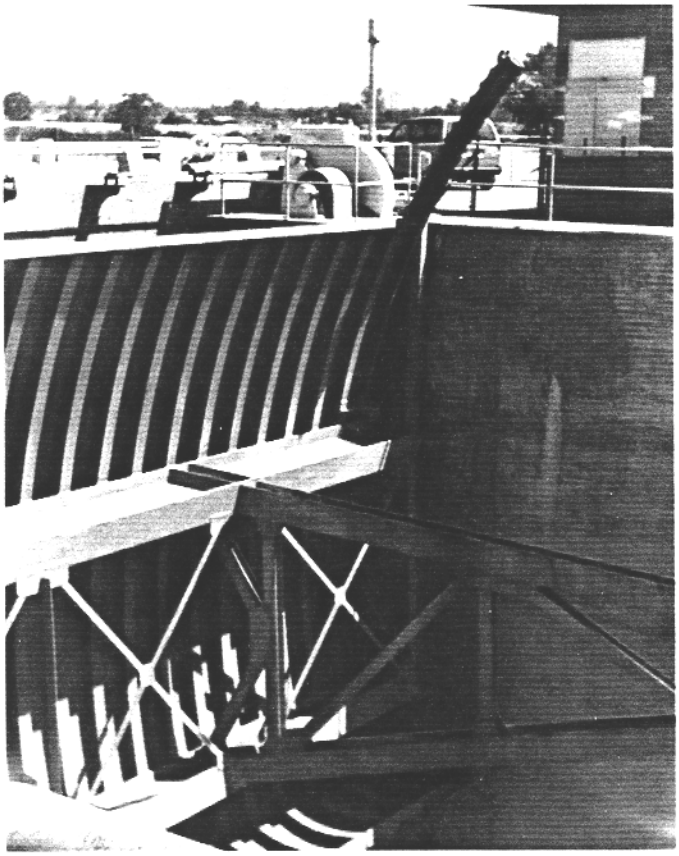


Figure 8. Lytle Creek Intake Structure And Control House. Looking NE Showing 60′ x 25′ Tainter Gate During Gate Test.

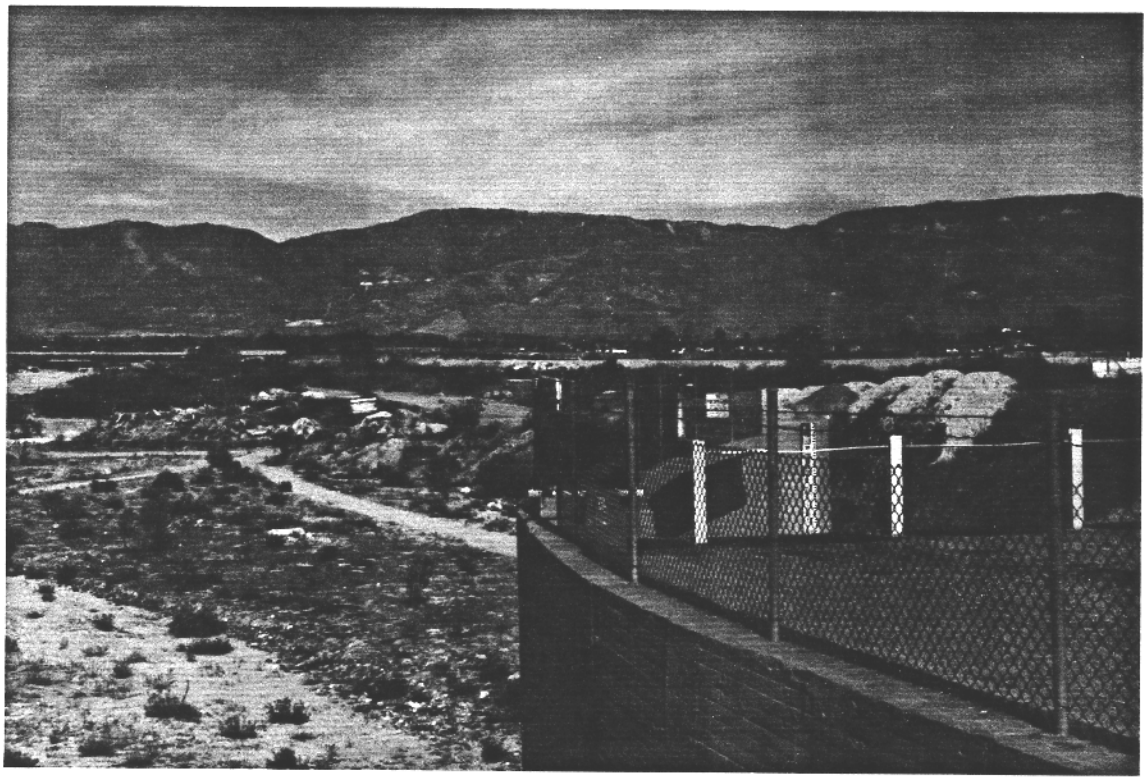


Figure 9. Lytle Creek Inlet Structure At West Branch Intake Looking NE At Lytle Creek Channel With Muscoy Levee In Background.

Figure 10. Lytle Creek Intake Structure Looking SW From Intake To West Branch Channel At The West Wing Levee, 1,000 Ft. Long.

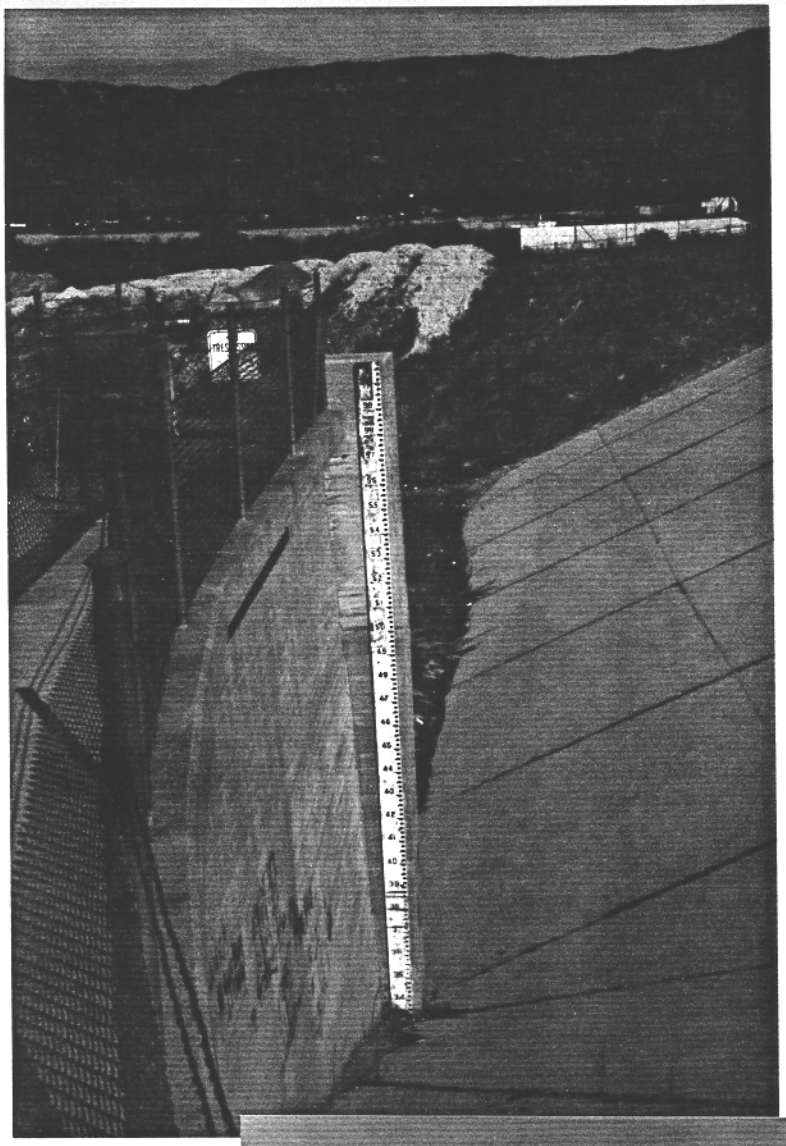
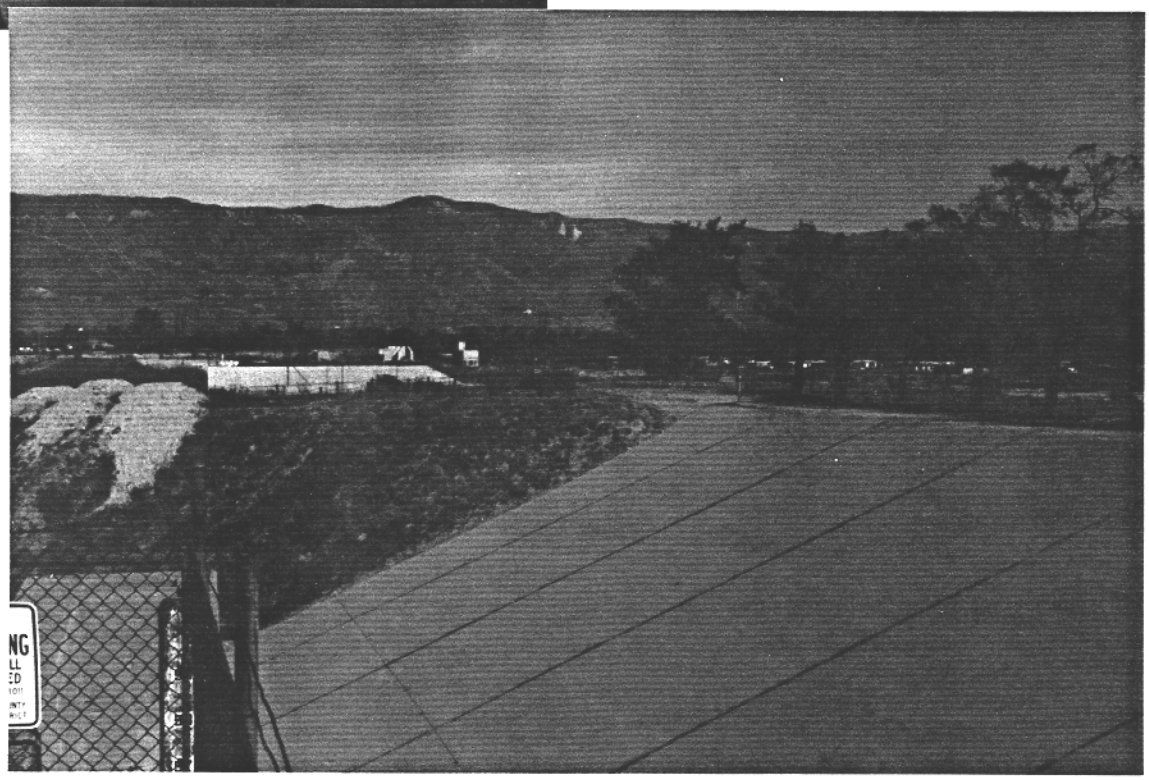


Figure 11. (Left)

Official Staff Gauge
At Lytle Creek Intake
Structure, Located On
East Wall Of West Branch
Inlet Just North Of
Control House Looking NE.

Figure 12. (Below)

Lytle Creek Intake
Structure Looking East
Along Wing Levee Toward
East Branch Channel Inlet.
Haul Road For Gravel Works
Crosses Over Inlet Structure
Before East Branch Inlet.



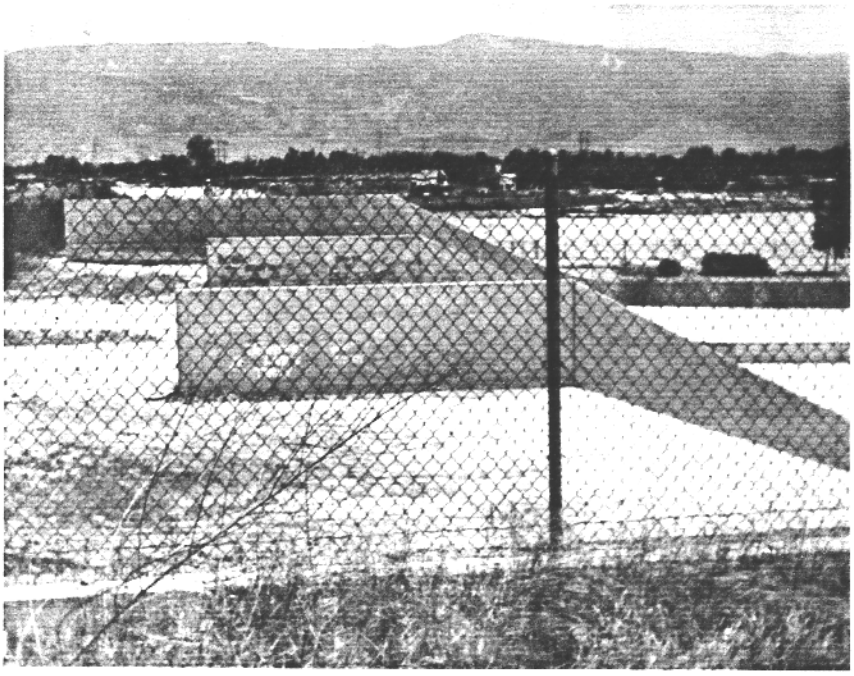


Figure 13. Invert To Lytle Creek East Branch Channel. Elev. 1143.0 looking East.

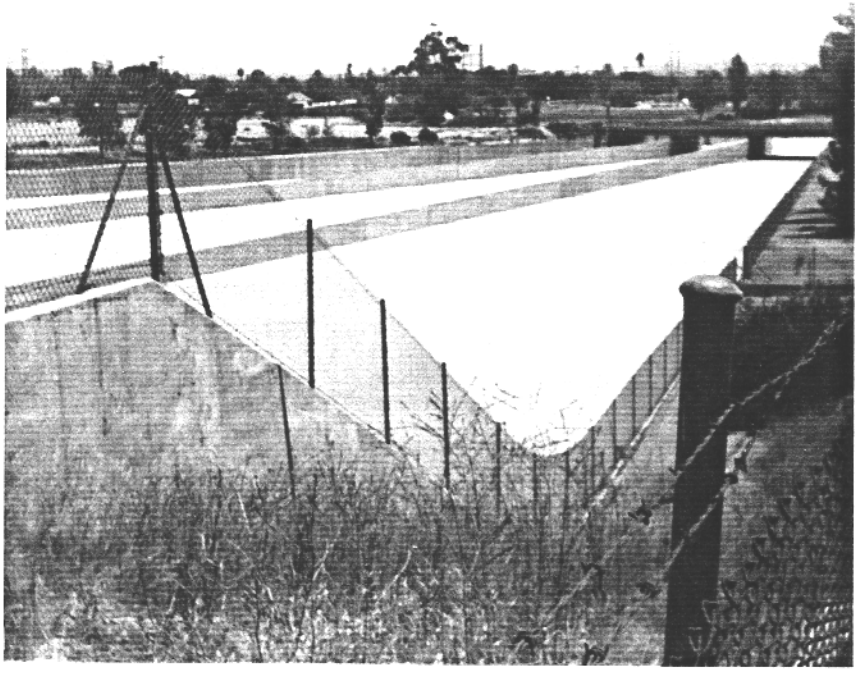


Figure 14. East Branch Lytle Creek Channel Looking SE. The 58,000 c.f.s. Capacity Channel Is 400 Feet Wide With Training Walls At 132 Foot Intervals.

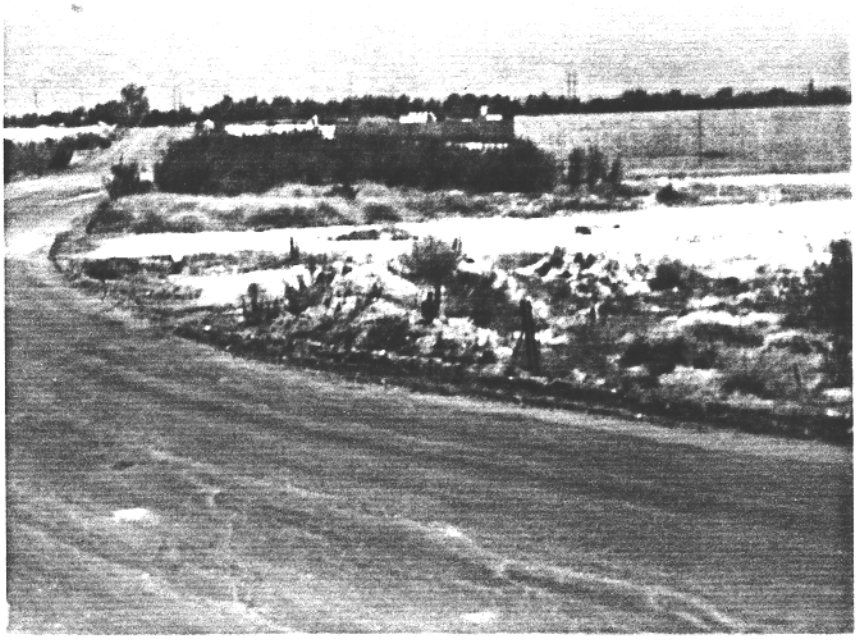


Figure 15. Invert of Lytle Creek East Branch Channel,Elev. 1143.0, With Haul Road Crossing Toward Muscoy Levee. Looking East. A Portion Of Lytle Creek Inlet Structure.

Figure 16. Looking SE Along Lytle Creek East Branch Channel. Flows Above 22,800 c.f.s. Will Begin To Flow Around The Left Wing Levee And A Portion Will Begin To Flow Down The East Branch Channel.

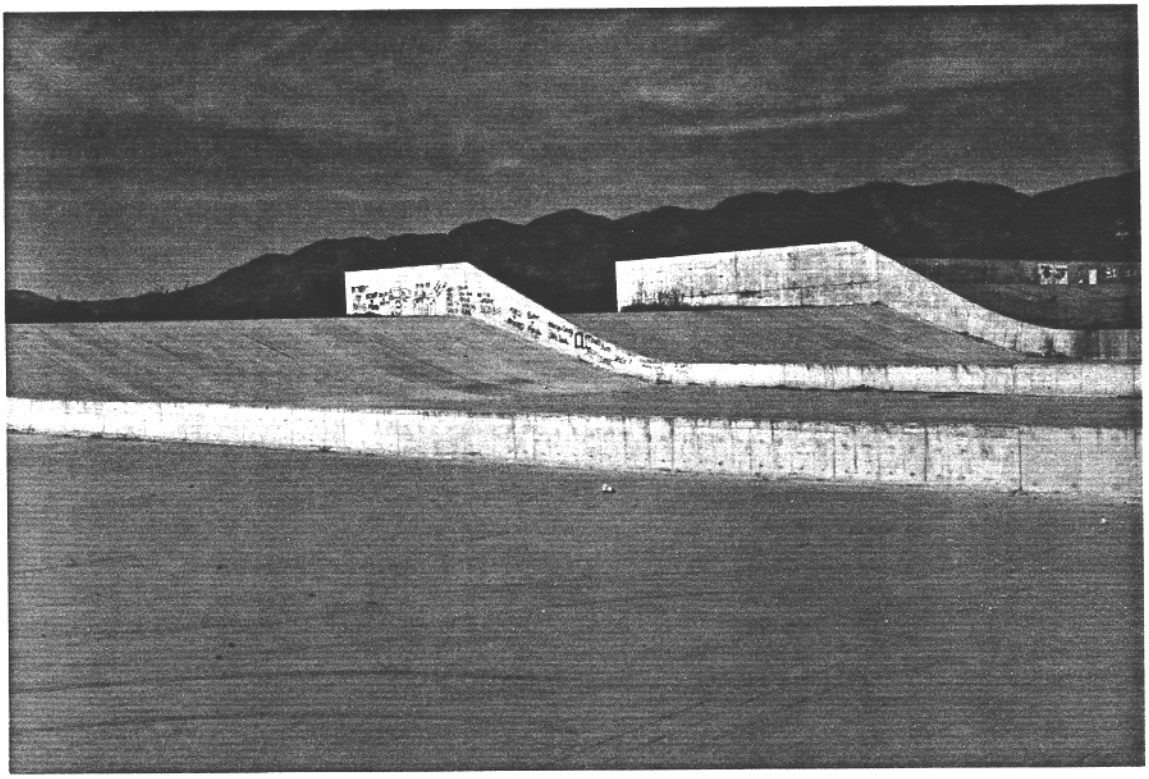


Figure 17. Lytle Creek East Branch Inlet Looking NE. On Right Is The Spillway Levee At Elev. 1160 Ft. Added Onto The Original Bypass Spillway When The East Branch Channel Was Modified. Top Of Levee Wall Is At Elevation 1160 Feet.

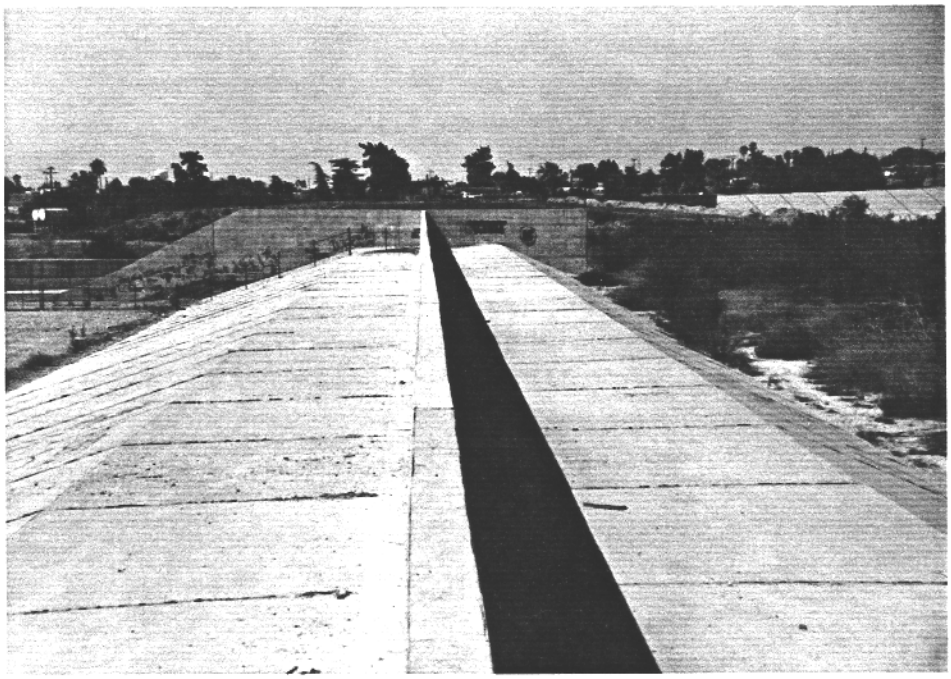


Figure 18. Looking SW Along Spillway Levee Wall Modification To Original Bypass Spillway Toward Inlet To Lytle Creek East Branch Channel And Control House At Lytle Creek West Branch Channel.

Figure 19. Looking NW Along Grouted Quarry Stone Of Muscoy Levee Near The Junction Of East Side Of Lytle Creek Intake Structure With Muscoy Levee.

Figure 20. East Junction Of Lytle Creek Intake Structure With Muscoy Levee At Edge Of Original Bypass Spillway. Looking NW, Showing Original Stage Recorder For Spillway. Gauge Is No Longer Used.

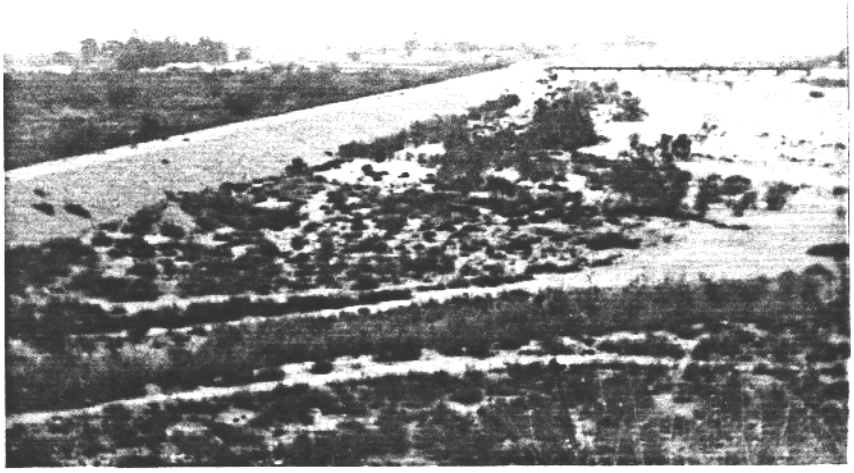


Figure 21. Upper Devore Levee On Cajon Creek Looking South. Showing One Of Two Transcontinental Railroad Bridges At Location.

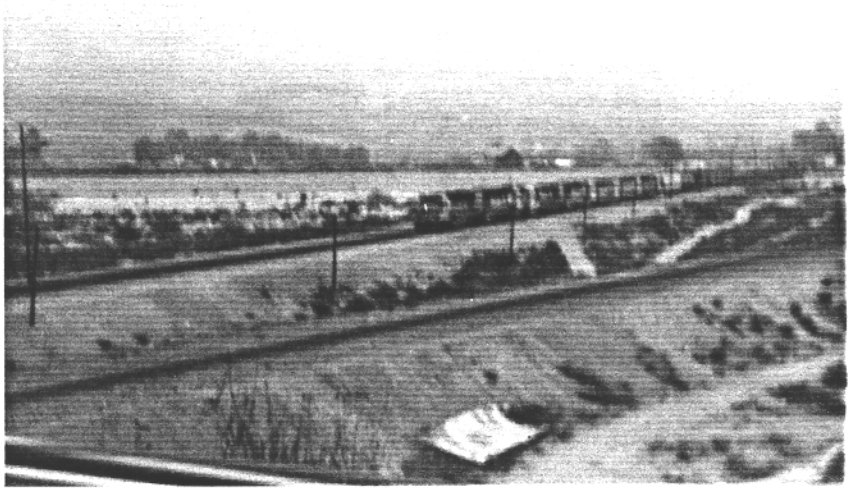


Figure 22. Upper Devore Levee Looking SE Showing Two Transcontinental Railroad Tracks Crossing Cajon Creek.

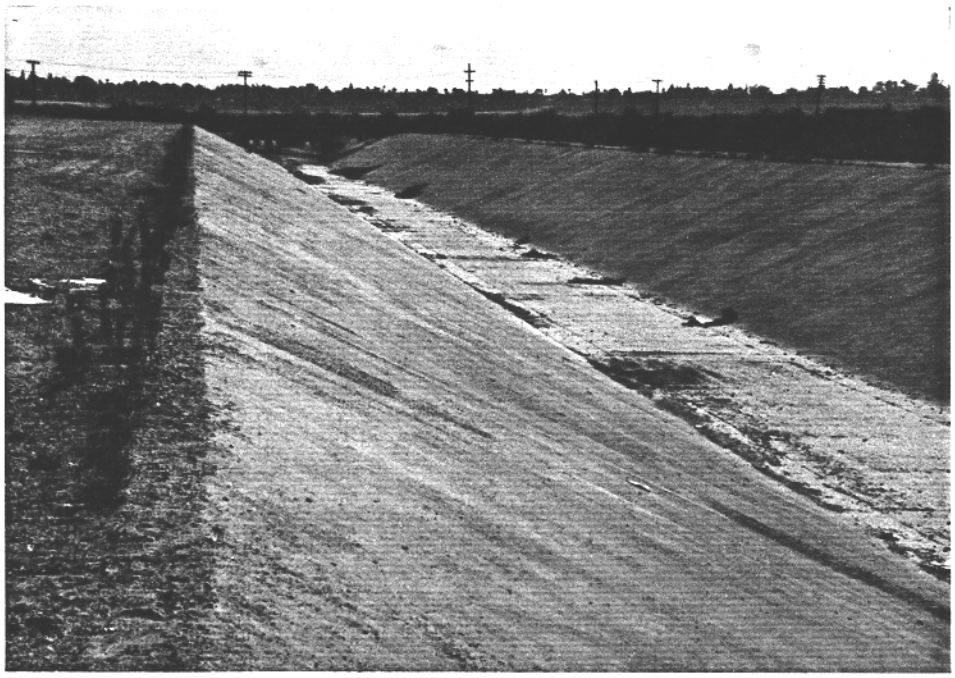


Figure 23. Devil Creek Diversion Structure Looking Downstream (SW) From 3RD Avenue Extension.

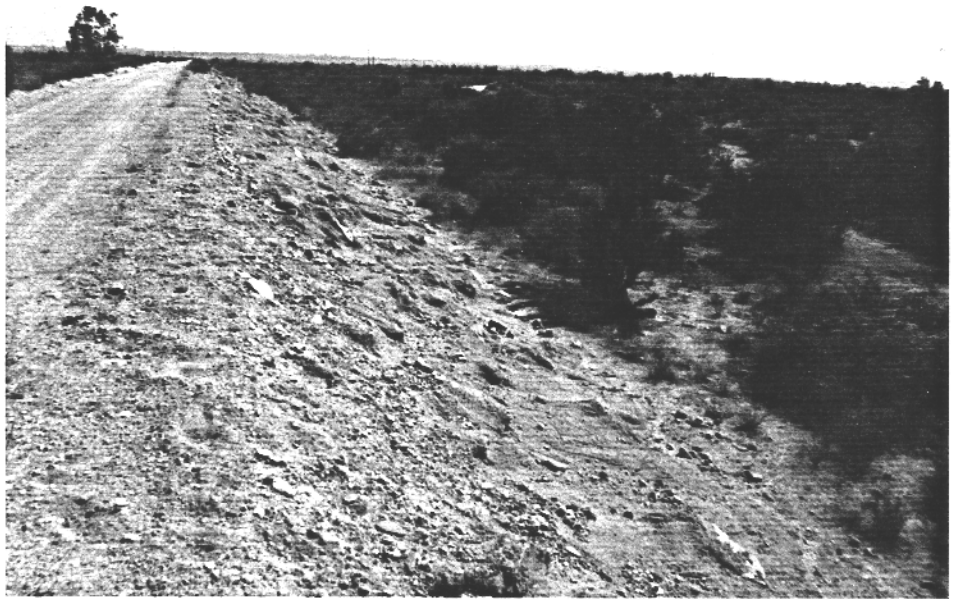


Figure 24. Levee Road On Muscoy Groin No.3 Looking South (Downstream) At Grouted Quarry Stone With Cajon Creek Channel On Right.

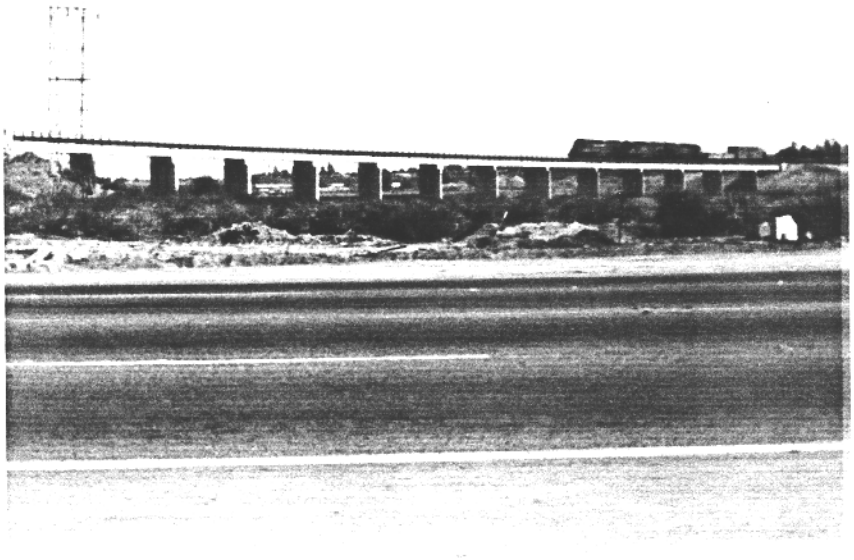


Figure 25. Railroad Crossing Lytle-Cajon Drainage At Highland Avenue Looking South With Island Levee At Right Embankment.

Figure 26. Grouted Quarry Stone Of Island Levee At Highland Avenue Looking South On Lytle-Cajon Drainage, San Bernardino County, California.

PLATES

REFERENCE TO LOS ANGELES DISTRICT CORPS OF ENGINEERS DOCUMENTS
PERTAINING TO LYTLE-CAJON CREEK IMPROVEMENTS
SAN BERNARDINO COUNTY, CALIFORNIA

	REPORT	DATE
1.	Interim Report On Survey Of Lytle Creek, San Bernardino County, California, For Flood Control	Dec. 10, 1943
2.	Definite Project Report On Lytle And Cajon Creeks Channel Improvement, Santa Ana River Basin California	May 1945
3.	Engineering Construction Record Lytle And Cajon Creeks Improvement Bypass, Levees And Groins	1945-1946
4.	Hydraulic Model Study Intake And Bypass Structures Lytle And Cajon Creeks Channel Improvement, Santa Ana River Basin, California	July 1946
5.	Analysis Of Design Lytle And Cajon Creeks Improvement	May 1946
6.	Report On Survey Of Santa Ana River And Tributaries, California, For Flood Control	Nov. 1946
7.	Santa Ana River Basin, California Lytle And Cajon Creeks Improvement Lytle Creek Channel Intake Plans For Gate Structure And Control House	Feb. 1947
8.	Specifications For Tainter Gate And Hoist At At Lytle Creek Channel Intake, San Bernardino County, California	Apr. 1947
9.	Santa Ana River Basin, California Lytle And Cajon Creeks Improvements Specifications For Gate Structure And Control House For Lytle Creek Channel Intake San Bernardino County, California	Dec. 5, 1947
10.	Operation And Maintenance Manual For Lytle And Cajon Creeks Santa Ana River Basin San Bernardino County, California Flood Control Project	Mar. 1950
11.	Design Memorandum No.1 General Design For Lytle Creek Levee, Devil, East Twin, Warm, And Lytle Creeks, California	Nov. 1955
12.	Specifications For Lytle Creek Levee Near San Bernardino, California	Jan. 1956
13.	Design Memorandum No.2 General Design For Devil Creek Diversion Devil, East Twin, Warm, and Lytle Creeks, California	Feb. 1956
14.	General Design For Devil Creek Diversion, Devil, East Twin, Warm and Lytle Creeks, California	Feb. 1956
15.	Operation & Maintenance Manual For Lytle Creek Levee Appendix To Operations & Maintenance Manual For Lytle And Cajon Creeks, Santa Ana River Basin	Jul. 1958
16.	Santa Ana River And Tributaries, California Review Report For Flood Control Lytle And Warm Creeks San Bernardino County, California	Oct. 30, 1964
17.	Design Memorandum No.1 General Design For Lytle And Warm Creeks San Bernardino County, California	May 1969
18.	Specifications For Restoration Of Lytle-Cajon Creek Levees, San Bernardino County, California	Oct. 1969
19.	San Bernardino County Appendix F Report On Floods Of January And February 1969	Dec. 1969
20.	Design Memorandum No.1 General Design For Lytle And Warm Creeks San Bernardino County, California	Sept. 1971
21.	Specifications For Flood Debris Removal And Rehabilitation of Channels At Lytle And Warm Creeks And Santa Ana River, San Bernardino County, California	June 1978
22.	Supplement To Design Memorandum No.1 For Lytle And Warm Creeks San Bernardino County, California	May 1983
23.	Supplement To Design Memorandum No.1 For Lytle And Warm Creeks San Bernardino County, California	Apr. 1984

SOURCE: COMPILED FOR STANDING INSTRUCTIONS 1989

SANTA ANA RIVER BASIN, CALIFORNIA
LYTLE AND CAJON CREEKS IMPROVEMENTS

DOCUMENT REFERENCE

U. S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

PROJECT LOCATION

VICINITY MAP

LEGEND

BOUNDARY OF SANTA ANA RIVER DRAINAGE AREA.

NOTE:
BASE MAP PREPARED FROM U.S.G.S. QUADRANGLE SHEETS, U.S. ARMY TACTICAL MAPS AND MISCELLANEOUS DATA.

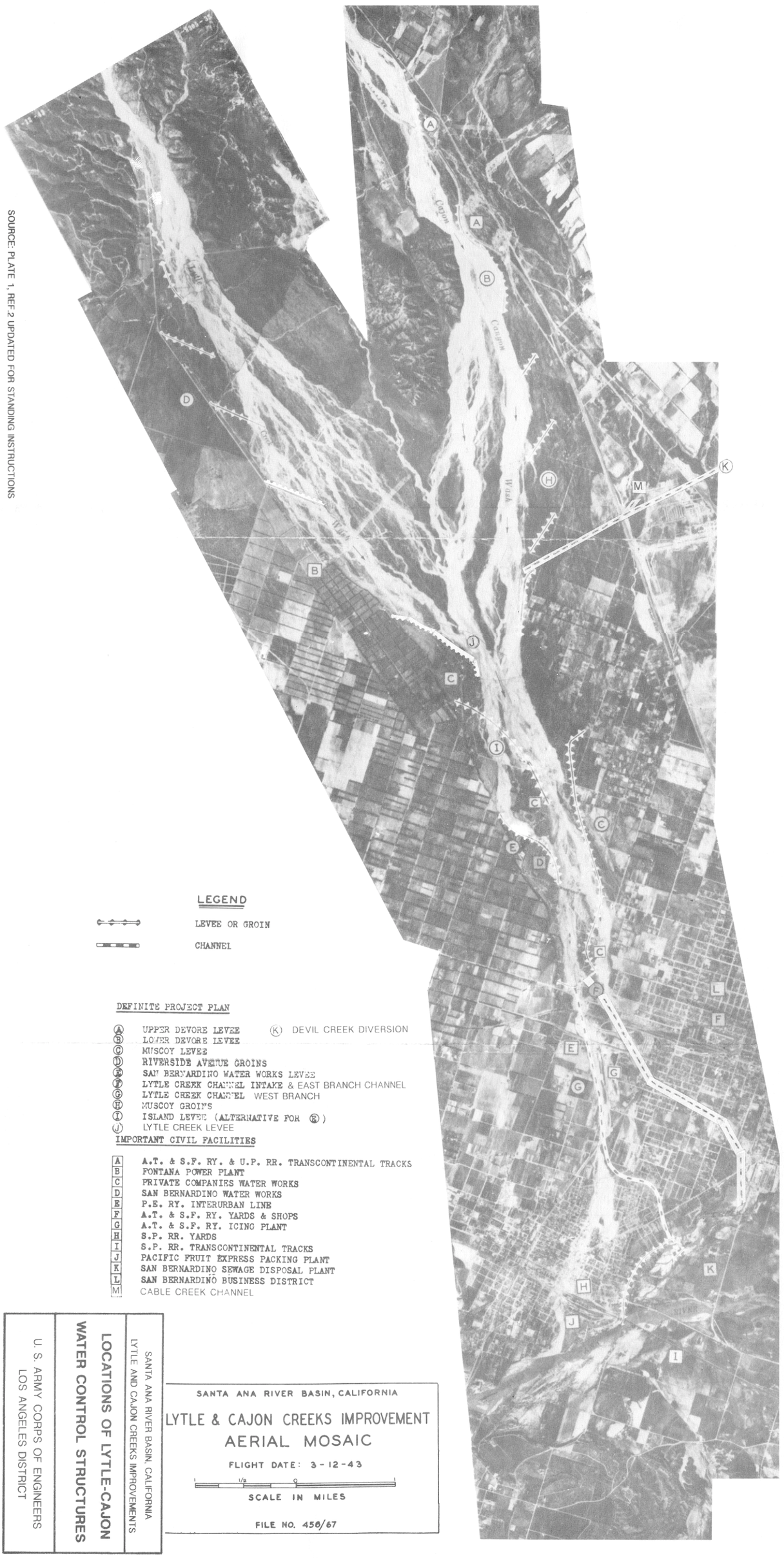
SANTA ANA RIVER BASIN, CALIFORNIA
LYTLE AND CAJON CREEKS IMPROVEMENTS

PROJECT LOCATION

U. S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

SOURCE: PLATE1, REF.4

PLATE 2



SOURCE: PLATE 1, REF.2 UPDATED FOR STANDING INSTRUCTIONS

LEGEND

LEVEE OR GROIN

CHANNEL

DEFINITE PROJECT PLAN

- (A) UPPER DEVORE LEVEE
- (B) LOWER DEVORE LEVEE
- (C) MUSCOY LEVEE
- (D) RIVERSIDE AVENUE GROINS
- (E) SAN BERNARDINO WATER WORKS LEVEE
- (F) LYTLE CREEK CHANNEL INTAKE & EAST BRANCH CHANNEL
- (G) LYTLE CREEK CHANNEL WEST BRANCH
- (H) MUSCOY GROINS
- (I) ISLAND LEVEE (ALTERNATIVE FOR (E))
- (J) LYTLE CREEK LEVEE
- (K) DEVIL CREEK DIVERSION

IMPORTANT CIVIL FACILITIES

- A. A.T. & S.F. RY. & U.P. RR. TRANSCONTINENTAL TRACKS
- B. FONTANA POWER PLANT
- C. PRIVATE COMPANIES WATER WORKS
- D. SAN BERNARDINO WATER WORKS
- E. P.E. RY. INTERURBAN LINE
- F. A.T. & S.F. RY. YARDS & SHOPS
- G. A.T. & S.F. RY. ICING PLANT
- H. S.P. RR. YARDS
- I. S.P. RR. TRANSCONTINENTAL TRACKS
- J. PACIFIC FRUIT EXPRESS PACKING PLANT
- K. SAN BERNARDINO SEWAGE DISPOSAL PLANT
- L. SAN BERNARDINO BUSINESS DISTRICT
- M. CABLE CREEK CHANNEL

SANTA ANA RIVER BASIN, CALIFORNIA

LYTLE & CAJON CREEKS IMPROVEMENT
AERIAL MOSAIC

FLIGHT DATE: 3-12-43

1/2 0 1

SCALE IN MILES

FILE NO. 456/67

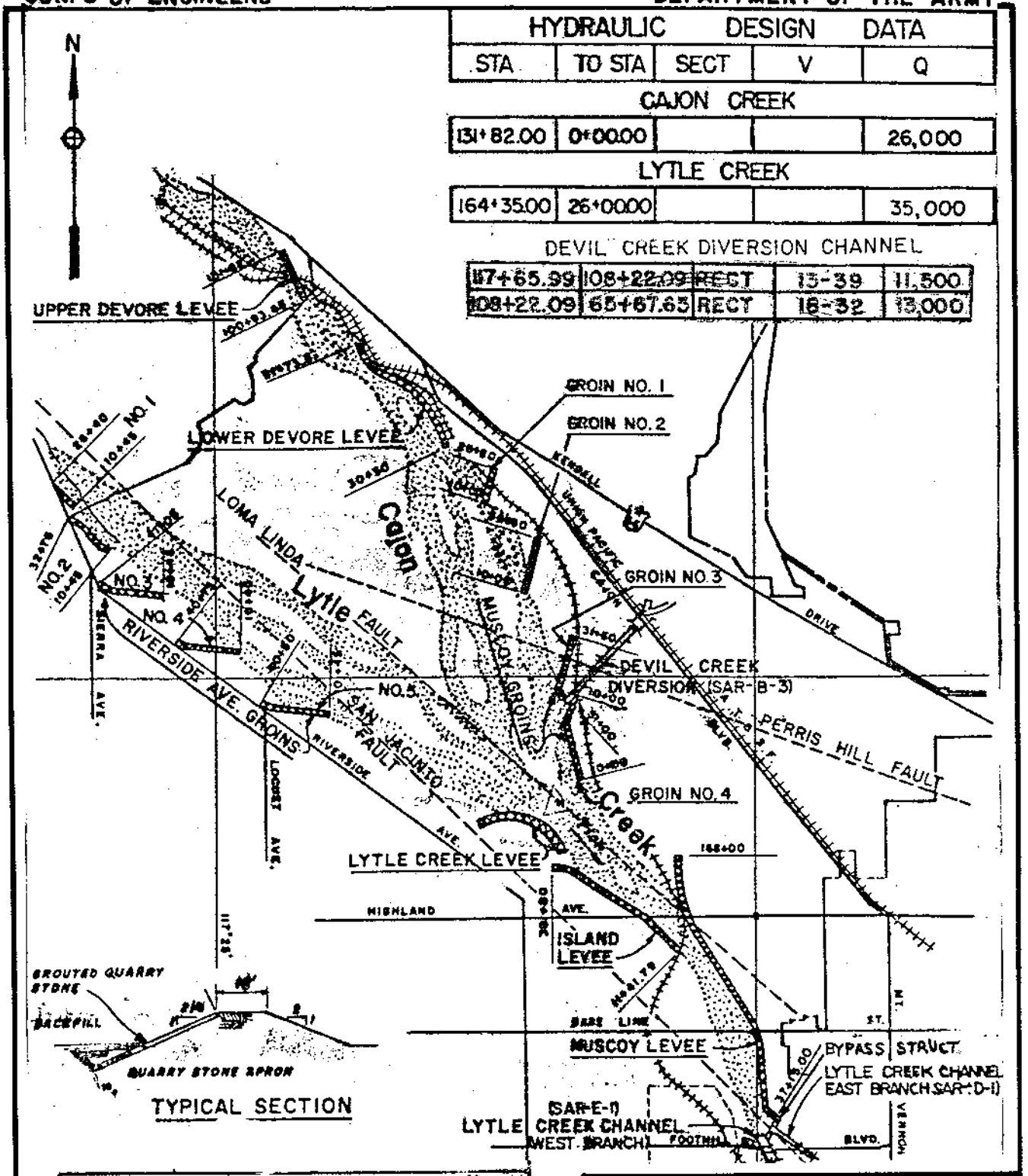
SANTA ANA RIVER BASIN, CALIFORNIA
LYTLE AND CAJON CREEKS IMPROVEMENTS

LOCATIONS OF LYTLE-CAJON WATER CONTROL STRUCTURES

U. S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 3A

STANDING INSTRUCTIONS



OPERATION AND MAINTENANCE MANUAL
LYTLE AND CAJON CREEKS IMPROVEMENT
SAN BERNARDINO COUNTY, CALIF.

LEVEES AND BYPASS

SCALE IN FEET
0 1000 2000 3000 4000

OFFICE OF THE DISTRICT ENGINEER
LOS ANGELES CALIFORNIA
SAR-C-1

SOURCE: LAD OPERATION & MAINTENANCE 1985

SANTA ANA RIVER BASIN, CALIFORNIA
LYTLE AND CAJON CREEKS IMPROVEMENTS

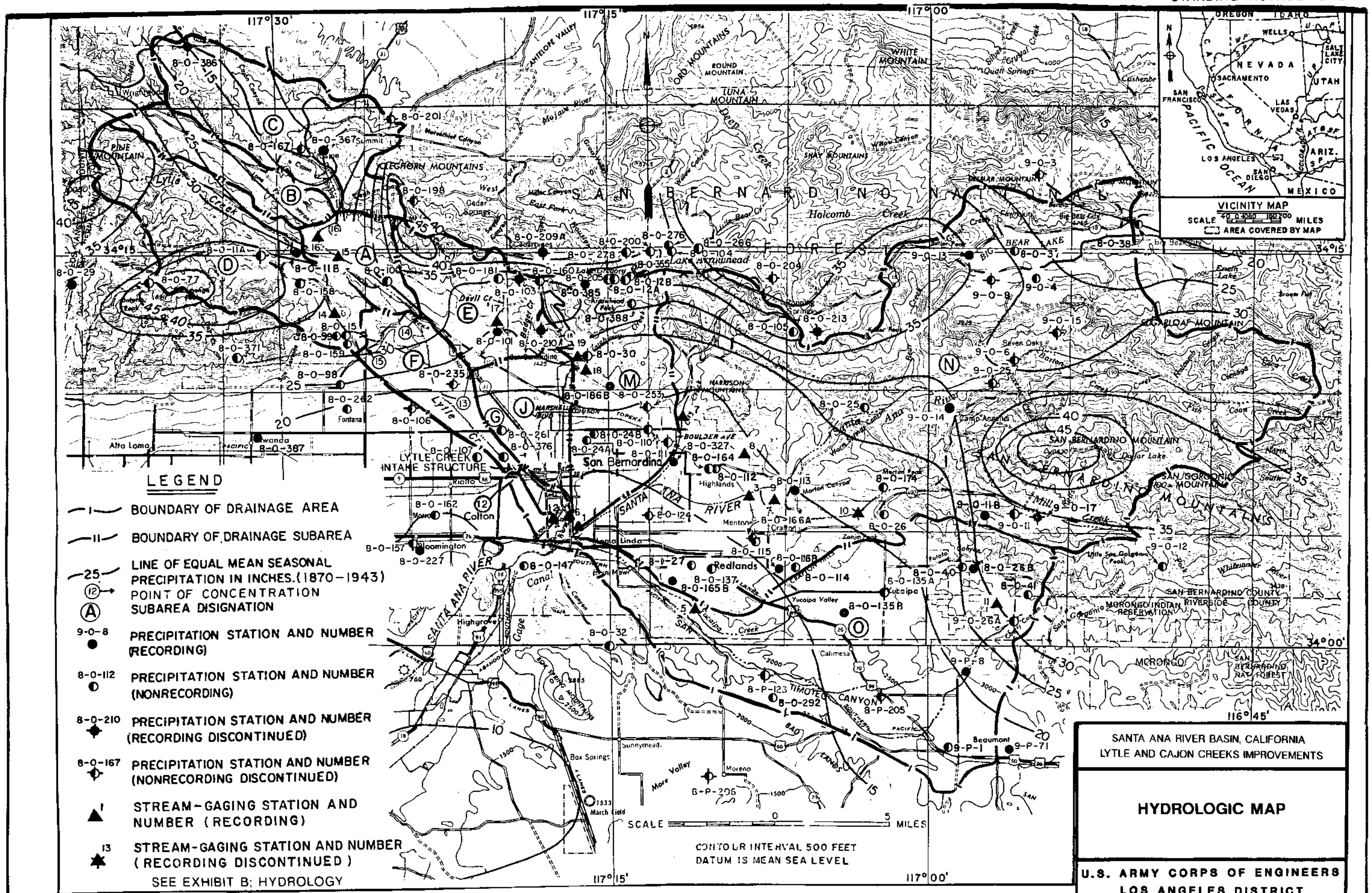
DIAGRAM OF LYTLE-CAJON
WATER CONTROL STRUCTURES
WITH FAULT ZONES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 3B

Plates 4-6 are not currently available.

For additional information, please contact the Los Angeles District Public Affairs Office at (213) 452-3908.

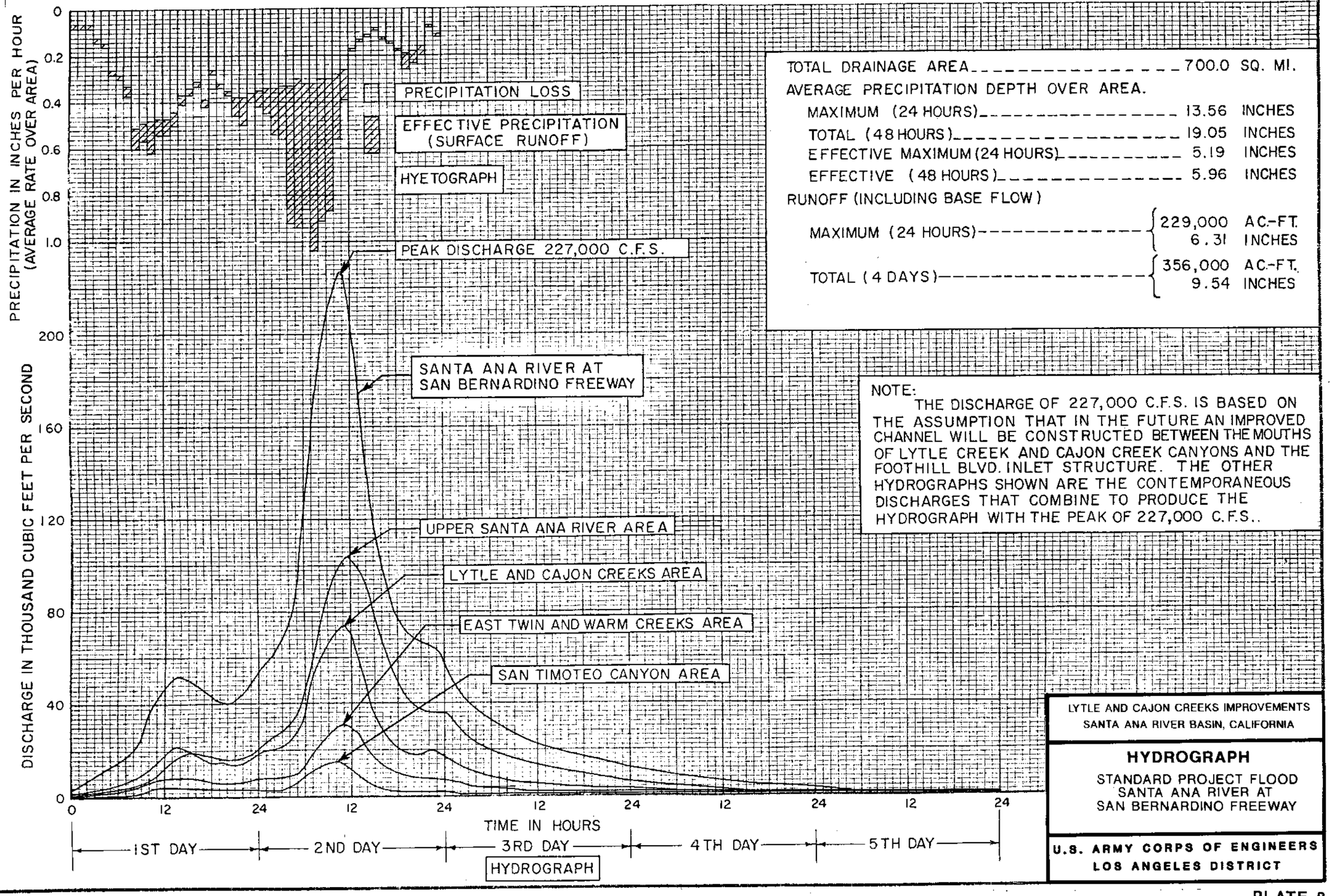


SOURCE: PLATE 1, REF. 16 MODIFIED FOR STANDING INSTRUCTIONS

U.S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS

STANDING INSTRUCTIONS



TOTAL DRAINAGE AREA	700.0	SQ. MI.
AVERAGE PRECIPITATION DEPTH OVER AREA.		
MAXIMUM (24 HOURS)	13.56	INCHES
TOTAL (48 HOURS)	19.05	INCHES
EFFECTIVE MAXIMUM (24 HOURS)	5.19	INCHES
EFFECTIVE (48 HOURS)	5.96	INCHES
RUNOFF (INCLUDING BASE FLOW)		
MAXIMUM (24 HOURS)	229,000	AC.-FT.
	6.31	INCHES
TOTAL (4 DAYS)	356,000	AC.-FT.
	9.54	INCHES

NOTE:
THE DISCHARGE OF 227,000 C.F.S. IS BASED ON THE ASSUMPTION THAT IN THE FUTURE AN IMPROVED CHANNEL WILL BE CONSTRUCTED BETWEEN THE MOUTHS OF LYTLE CREEK AND CAJON CREEK CANYONS AND THE FOOTHILL BLVD. INLET STRUCTURE. THE OTHER HYDROGRAPHS SHOWN ARE THE CONTEMPORANEOUS DISCHARGES THAT COMBINE TO PRODUCE THE HYDROGRAPH WITH THE PEAK OF 227,000 C.F.S..

LYTLE AND CAJON CREEKS IMPROVEMENTS
SANTA ANA RIVER BASIN, CALIFORNIA

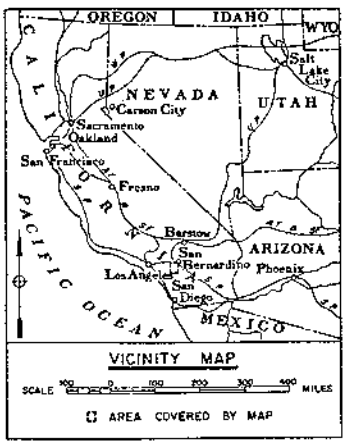
HYDROGRAPH

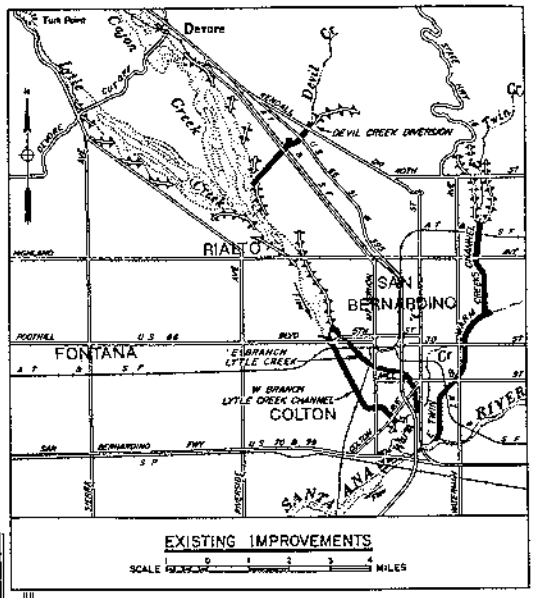
STANDARD PROJECT FLOOD
SANTA ANA RIVER AT
SAN BERNARDINO FREEWAY

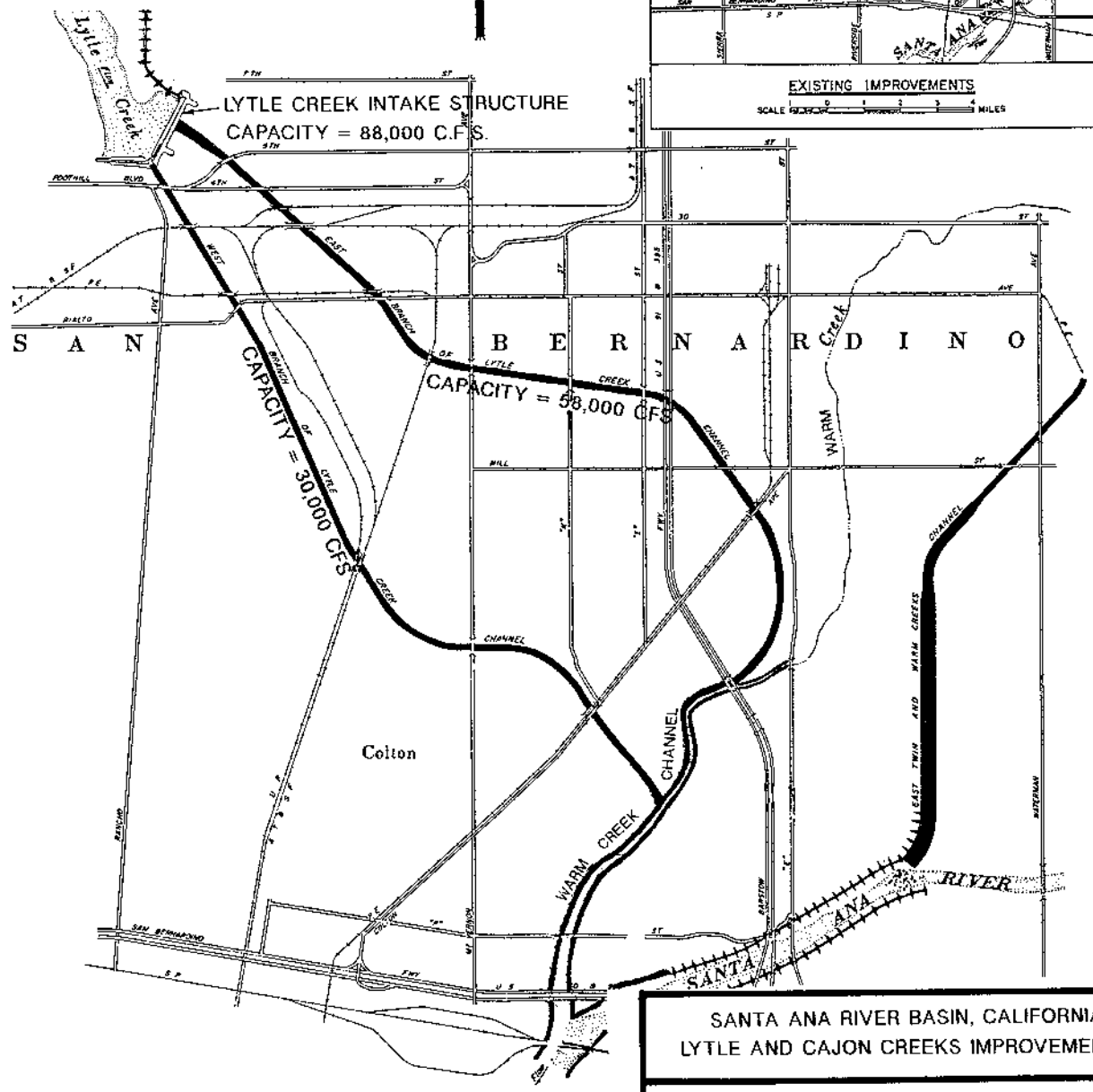
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

SOURCE: PLATE 1, REF. 16

PLATE 8







SOURCE: PLATE1, REF.16 UPDATED FOR STANDING INSTRUCTIONS

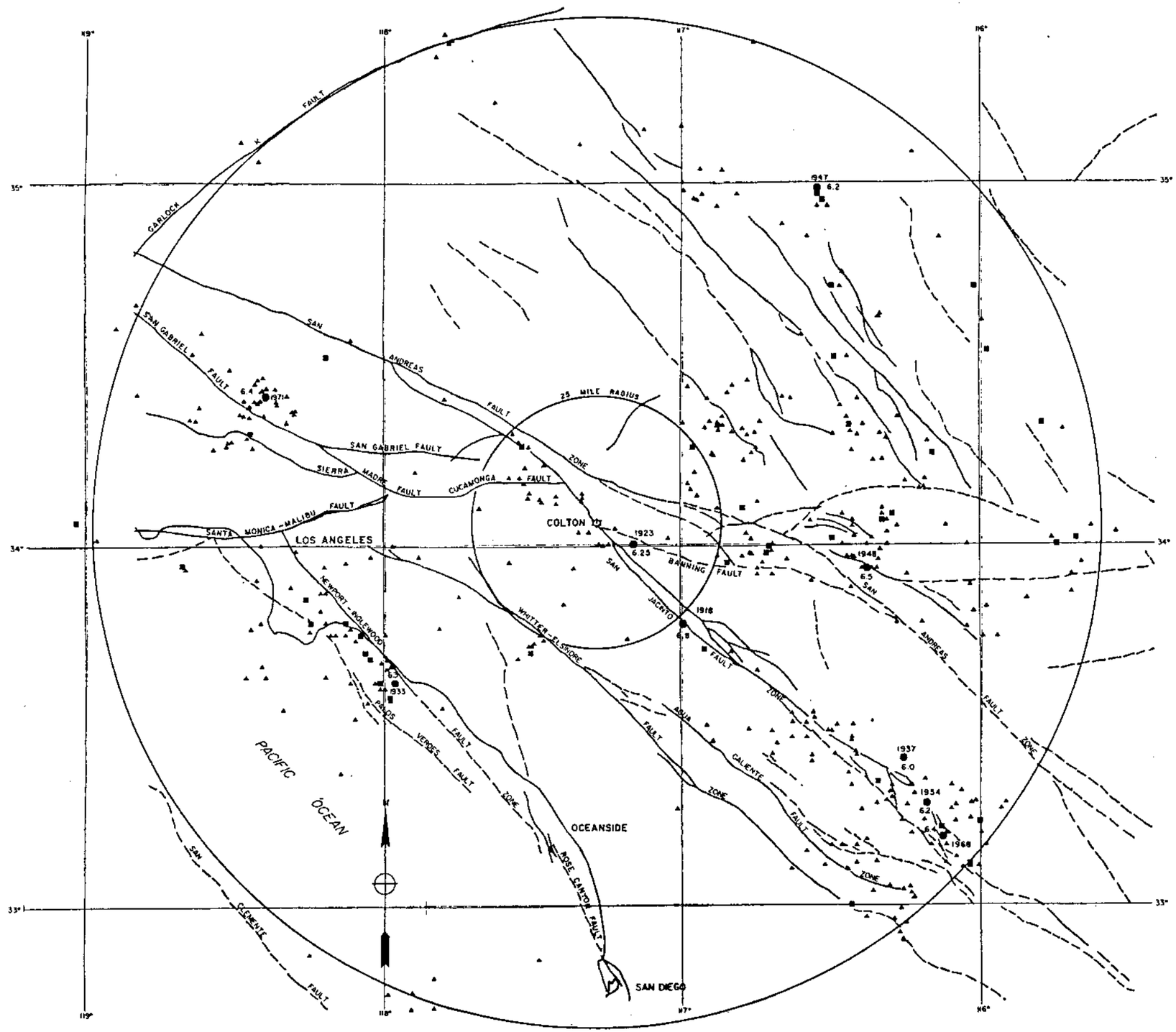
SANTA ANA RIVER BASIN, CALIFORNIA
LYTLE AND CAJON CREEKS IMPROVEMENTS

SPF ROUTED DISCHARGES
INTAKE STRUCTURE LYTLE CREEK
EAST & WEST BRANCH CHANNELS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 9

STANDING INSTRUCTIONS



LEGEND

- ▲ EARTHQUAKE WITH MAGNITUDE 4.0 THRU 4.99.
- ■ EARTHQUAKE WITH MAGNITUDE 5.0 THRU 5.99.
- ● EARTHQUAKE WITH MAGNITUDE 6.0 THRU 6.99.
- ☼ LOCATION OF PROJECT AREA.
- TRACE OF FAULT — DASHED WHERE INFERRED OR CONCEALED.

NOTES

1. RICHTER SCALE MAGNITUDES ARE A MEASURE OF THE ENERGY RELEASED AT THE FOCUS (CENTER OF THE EARTHQUAKE), AS DETERMINED BY THE AMPLITUDES PRODUCED ON A SEISMOGRAM.
2. THE EPICENTER IS THE POINT ON THE EARTH'S SURFACE DIRECTLY ABOVE THE FOCUS.
3. EARTHQUAKE EPICENTERS PLOTTED ARE FROM 1932 TO 1979, UNLESS EARLIER DATES ARE SHOWN.

SOURCE: PLATE 1, REF. 23

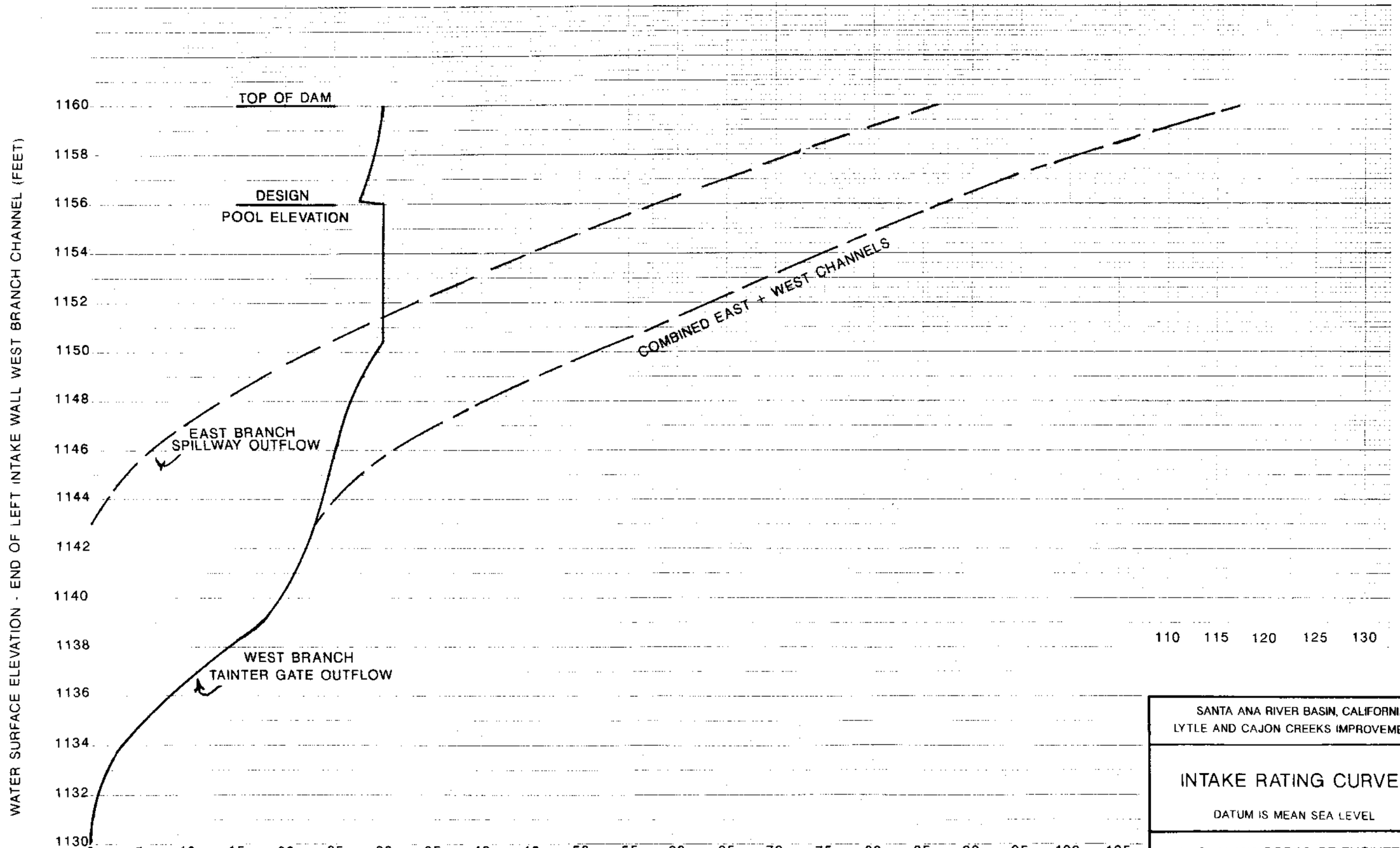
LYTLE AND CAJON CREEKS IMPROVEMENTS
SANTA ANA RIVER BASIN, CALIFORNIA

EARTHQUAKE EPICENTER AND FAULT LOCATION MAP
100 MILE RADIUS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

LYTLE CREEK INTAKE STRUCTURE

LYTLE AND CAJON CREEKS



SOURCE:WEST BRANCH CORPS HYDRAULIC MODEL STUDY 1946
SOURCE:EAST BRANCH PREPARED FOR STANDING INSTRUCTIONS 1990

SANTA ANA RIVER BASIN, CALIFORNIA
LYTLE AND CAJON CREEKS IMPROVEMENTS

INTAKE RATING CURVES

DATUM IS MEAN SEA LEVEL

U. S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 11

EXHIBIT A

LYTLE CREEK INTAKE STRUCTURE

REGULATION SCHEDULE

LYTLE CREEK INTAKE STRUCTURE REGULATION SCHEDULE
(FOR RISING AND FALLING STAGES)

STEP NO.	WATER SURFACE ELEVATION* FEET	GATE SETTING FEET	West Branch Q c.f.s.	East Branch Q c.f.s.	Combined Q West & East c.f.s.
1	1130.0 - 1150.5	20.4	0.0	0.0	0
	1134.0		3,000.0	0.0	3,000
	1135.0		5,400.0	0.0	5,400
	1140.0		19,000.0	0.0	19,000
	1143.0		22,800.0	0.0	23,000
	1144.0		24,000.0	1,200.0	25,000
	1145.0		24,400.0	3,500.0	28,000
	1150.0		29,000.0	23,000.0	52,000
2	1150.5 - 1151.0**	20.0	30,000.0	25,000.0	55,000
3	1151.0 - 1152.0	19.4	30,000.0	28,000.0	58,000
4	1152.0 - 1153.0	18.8	30,000.0	33,000.0	63,000
5	1153.0 - 1154.0	18.5	30,000.0	39,000.0	69,000
6	1154.0 - 1155.0	18.2	30,000.0	45,000.0	75,000
7	1155.0 - 1156.0	18.0	30,000.0	51,000.0	81,000
8	1156.0 - 1156.1	17.8	30,000.0	58,000.0	88,000
9	1156.1 - ABOVE***	16.4	27,000.0	58,000.0	85,000
	1160.0	16.4	30,000.0	87,000.0	117,000

*INTAKE STAGE FOR CHANNELS ARE READ ON THE STAFF GAUGE ON THE LEFT INTAKE ABUTMENT ON THE WEST BRANCH INLET

**DAM TENDER COMMENCES GATE OPERATION

***DAM TENDER MAKES FINAL GATE OPERATION DURING RISING STAGE

NOTE: 60' x 25' TAINTER GATE IS TO REMAIN OPEN AT 20.4 FT. IN ALL INSTANCES EXCEPT , AS INDICATED ON THE REGULATION SCHEDULE.

NOTE: UPPER DEVORE LEVEE

The Upper Devore Levee (Figure 21, Plate 3b) is a key structure for the entire project and unexpected depositions of sediment could result in floodflows overriding the levee. Therefore, the Superintendent shall continuously patrol the Upper Devore Levee and Santa Fe Railway Bridge and be prepared to raise the levee on short notice. It shall be the duty of the Superintendent to maintain a periodic patrol of the project works during all periods of flood flow in excess of a reading of 1134.0 on the staff gauge at the Intake Structure. (Plate 1, Ref. 10)

EXHIBIT A

DAM OPERATOR INSTRUCTIONS

1. Communication with the San Bernardino County Flood Control District Storm Intelligence Officer is available.

   a. Notify the SBCFCD Storm Intelligence Officer when a gate change will be required according to the schedule.

   b. Notify the SBCFCD Storm Intelligence Officer if unable to set the gate as instructed.

   c. Set gates in accordance with regulation schedule as directed by SBCFCD Storm Intelligence Officer.

2. In case of a communication outage.

a. If communication is broken between the dam tender and the SBCFCD Storm Intelligence Officer, initially continue to monitor flood stage data and record, using flood lights at night if necessary to monitor reading of staff gauge on left wall of Lytle Creek West Channel Intake. Dam tender should continue to make gate changes in accordance with the regulation schedule.

b. Coordination of flood control operation is under the direction of the San Bernardino County Flood Control District. During flood periods, close contact will be maintained between the San Bernardino County Storm Intelligence Officer, and the Los Angeles District Corps of Engineers Reservoir Operation Center (ROC).

c. Emergency notifications are normally made by the SBCFCD Storm Intelligence Officer, however if the dam tender loses communication with the San Bernardino County Flood Control District, and an emergency notification situation arises, such as an imminent dam failure, the dam tender should make the necessary notifications as listed in the San Bernardino County Flood Control District Storm Operations Guide Manual.

WATER CONTROL PROBLEMS

The SBCFCD Storm Intelligence Officer must be contacted immediately by the most rapid means available in the event that an operational malfunction, erosion, or other incident occurs that could impact project integrity in general or water control capability in particular. The SBCFCD Storm Intelligence Officer should notify LAD, ROC.

NOTES:

RATING CURVES

The rating curves indicate flow amounts on both East and West Lytle Creek Channels as read on the staff gauge on the left intake abutment of the west branch inlet. (Plate 11)

TRASH BUILDUP

The intake works must be monitored at all times for trash buildup of any significant amount and appropriate measures taken to remove blockages should they occur. The staff gauge on the left intake abutment must always remain visible as an accurate indicator of water level at the Intake Structure.

OFFICIAL STAFF GAUGE

The official staff gauge used for determining stages listed on the rating curves and for determining the 1134.0 elevation defined officially as a "flood" is located on the left abutment of the intake as facing downstream. It can also be referenced as the staff gauge directly north of the control house on the left intake abutment. Figure 11.

EXHIBIT B

HYDROLOGY

HYDROLOGIC DATA
LYTLE-CAJON CREEKS DRAINAGE AREA

TABLE OF CONTENTS

PRESENT STREAMGAGES
IN OR NEAR LYTLE-CAJON CREEKS

Stream Gages in Lytle Creek Basin	USGS Numb	Lat	Long	Drainage (Area-sq.mi)	Elevation (ft)	Period of Record	Map Ref. No. Plate 7
Devil Canyon Creek near San Bernardino	11063680	34°12' 30"	117°19' 50"	5.49	2080	11/11 to 9/12, 10/13 to 9/14, and 12/19 to pres	17
Cajon Creek below Lone Pine Creek near* Keenbrook	11063510	34°16' 04"	117°27' 58"	56.5	2600	10/71 to 9/77 and 10/83 to pres	
Lone Pine Creek near Keenbrook	11063500	34°15' 59"	117°27' 47"	15.1	2606	12/19 to 9/38 and 6/49 to pres	15
Lytle Creek near Fontana	11062000	34°12' 44"	117°27' 26"	46.6	2380	10/18 to pres	14
*Cajon Creek near Keenbrook (OPERATIVE AT TIME OF SPF STUDY)	11063000	34°16' 01"	117°27' 33"	40.6	2630	1919-1967	16

Stream Gages near Lytle Creek Basin

Lytle Creek at Colton	11065000	34°04' 44"	117°18' 17"	172	975	10/57 to 9/83 and 10/84 to pres	12
Warm Creek near San Bernardino	11060400	34°04' 22"	117°17' 58"	11.0	960	2/64 to 9/72 and 10/74 to pres	6
East Twin Creek near Arrowhead Springs	11058500	34°10' 45"	117°15' 53"	8.8	1590	12/19 to pres (aka Strawberry Crk near Arr Spgs before 1952)	
San Timoteo Creek near Loma Linda	11057500	34°03' 46"	117°16' 16"	125	1030	10/54 to 9/65, 2/68 to 9/73, and 4/79 to pres	4
Santa Ana River at E Street near San Bernardino	11059300	34°03' 54"	117°17' 58"	28	940	3/39 to 9/54 and 10/66 to pres	1

LYTLE CREEK (WEST CHANNEL) AT COLTON, CALIFORNIA
ELEVATION 980 FEET
PERIOD OF RECORD 1929 TO 1945

MONTHLY DISCHARGE (ACRE-FEET)

WATER YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
1928-29				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1929-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1930-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1931-32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1932-33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1933-34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1934-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1935-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1936-37	0.0	0.0	4.2	0.6	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7
1937-38	0.0	0.0	0.0	0.0	3.8	6010.0	0.0	0.0	0.0	0.0	0.0	0.0	6013.8
1938-39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1939-40	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
1940-41	0.0	0.0	3.6	0.6	17.0	9.7	4.4	0.0	0.0	0.0	0.0	0.0	35.3
1941-42	0.2	0.0	1.4	0.0	0.0	1.0	0.2	0.0	0.0	0.0	0.0	0.0	2.8
1942-43	0.0	0.0	0.2	3140.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	3156.2
1943-44	0.0	0.0	0.0	0.0	568.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	568.0
1944-45	0.0	0.0	2.0	0.4	2.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	5.6

NOTES:
-AVERAGE DISCHARGE, 16 YEARS: 0.85 CFS (615 ACRE-FEET YEAR)
-MOST FLOWS ONLY LOCAL RUNOFF
-WATER DIVERTED UPSTREAM BY FONTANA PIPELINE AND FOR SPREADING ON GRAVEL CONE
-MOST FLOOD FLOWS OF LYTLE CREEK DIVERTED TO EAST CHANNEL
-CONSTRUCTION OF LYTLE CREEK FLOODWAY PERMANENTLY CUT OFF THIS CHANNEL AT END OF 1945

DRAINAGE AREA NOT ESTABLISHED APPROXIMATELY 72 SQ-MI

WAS WEST BRANCH OF LYTLE CREEK BEFORE INTAKE STRUCTURE AT TIME WHEN BOTH WEST AND EAST BRANCHES WERE NATURAL CHANNELS

LYTLE CREEK (EAST CHANNEL) AT SAN BERNARDINO
ELEVATION 1050 FEET
PERIOD OF RECORD 1929 TO 1957

MONTHLY DISCHARGE (ACRE-FEET)

WATER YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
1928-29	0	0	0	0	0	0	0	0	0	0	0	0	0
1929-30	0	0	0	0	0	0	0	0	0	0	0	0	0
1930-31	0	0	0	0	0	0	0	0	0	0	0	0	0
1931-32	0	0	0	0	1100	36	0	0	0	0	0	0	1136
1932-33	0	0	0	0	0	0	0	0	0	0	0	0	0
1933-34	0	0	3	317	0	0	0	0	0	0	0	0	320
1934-35	192	0	32	348	173	3	162	0	0	0	0	0	910
1935-36	0	0	0	0	346	2	22	0	0	0	0	0	370
1936-37	0	0	744	11	2060	533	0	0	0	0	0	0	3348
1937-38	0	0	0	19	1320	29390	1580	2290	206	0	0	0	34805
1938-39	0	0	0	0	5	83	37	6	11	12	12	562	728
1939-40	9	12	12	351	104	28	41	9	12	12	9	12	611
1940-41	18	12	588	58	1270	1960	223	12	110	18	12	9	4290
1941-42	9	30	79	18	17	23	24	12	14	17	19	18	280
1942-43	14	40	31	4840	472	2130	524	172	15	16	19	27	8300
1943-44	36	24	128	58	1300	689	492	262	57	74	37	30	3187
1944-45	61	984	37	37	503	507	1780	93	48	18	18	20	4106
1945-46	35	60	76	60	70	70	61	73	20	34	30	24	613
1946-47	31	48	50	55	54	60	41	37	31	33	27	32	499
1947-48	35	52	51	48	60	67	54	68	42	39	35	38	589
1948-49	38	44	46	48	38	35	38	45	35	30	32	29	458
1949-50	33	63	59	77	79	47	38	43	52	24	31	32	578
1950-51	34	33	19	34	21	29	34	35	23	19	33	24	338
1951-52	40	45	53	85	46	65	60	47	39	35	37	42	594
1952-53	52	51	42	36	33	30	56	66	46	24	31	31	498
1953-54	49	49	77	83	56	55	42	49	18	14	12	17	521
1954-55	29	42	29	51	35	26	41	31	14	19	14	12	343
1955-56	12	20	18	53	29	19	32	22	29	29	31	20	314
1956-57	22	17	31	142	14	18	20	63	28	23	27	16	421
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
SUM	749	1626	2205	6829	9205	35905	5402	3435	850	490	466	995	68157
MEAN	26	56	76	235	317	1238	186	118	29	17	16	34	2350
MAX	192	984	744	4840	2060	29390	1780	2290	206	74	37	562	34805
YEAR	1934	1944	1936	1943	1937	1938	1945	1938	1938	44	44,52	1939	1937-38

NOTES:
-Flows upstream diverted for irrigation and to debris cone for ground water recharge.
-Lytle Creek flood-control dam, 1.5 miles above this station, has diverted flow away from this channel and carried it directly to Warm Creek since 1945.
-A maximum of 300 cfs of low stage flow can be diverted to east channel at dam when desired. Water over spillway of dam would enter east channel.
DRAINAGE AREA NOT ESTABLISHED, WAS EAST BRANCH OF LYTLE CREEK BEFORE INTAKE STRUCTURE AS NATURAL EAST BRANCH OF LYTLE CREEK (APPROX 94 SQ-MI)

WATER YEAR ENDING SEP 30	LYTLE CREEK AT COLTON WEST CHANNEL ELEV 980 FEET					LYTLE CREEK AT SAN BERNARDINO EAST CHANNEL ELEV 1050			
	MEAN DAILY FLOW CFS	MAX MEAN DAILY FLOW CFS	PEAK FLOW CFS	DATE		MEAN DAILY FLOW CFS	MAX MEAN DAILY FLOW CFS	PEAK FLOW CFS	DATE(S)
1929	0	0	0		*	0	0	0	
1930	0	0	0		*	0.032	6		MAR15
1931	0	0	0		*	0	0	0	
1932	0	0	0		*	1.573	383	700	FEB09
1933	0	0	0		*	0.264	62	610	JAN19
1934	0	0	0		*	0.442	159	555	JAN01
1935	0.009	1.6	20	JAN05	*	1.256	80	500	OCT18
1936	0.017	5	M	FEB13	*	0.511	37	208	FEB12/FEB11
1937	0.018	4	16	FEB06	*	4.624	521	1060	FEB14
1938	8.295	2180	7900	MAR02	*	48.03	7640	21500	MAR02
1939	0	0	0		*	1.005	277	1760	SEP25
1940	0.011	0	M		*	0.845	160	1180	JAN08
1941	0.05	4.8	M	FEB20	*	5.921	970	368	DEC24/FEB20
1942	0.004	0.5	M	TWICE	*	0.386	20	20	DEC29
1943	4.362	1570	13000	JAN23	*	11.46	1440	7800	JAN23
1944	0.784	286	2000	FEB22	*	4.403	617	1300	FEB22
1945	0.008	0.6	4.4	FEB01	*	5.673	100	425	NOV12
1946						0.86	4.5	15	DEC22
1947						0.689	3	13	DEC26/NOV13
1948						0.813	3.4	12	FEB05/DEC01
1949						0.632	1.8	9.2	NOV08/MAY19
1950						0.798	9.2	36	NOV10
1951						0.467	1.9	15	MAY14/MAY13
1952						0.82	5.4	5.4	JAN16
1953						0.687	2.8	14	APR27/NOV14
1954						0.719	7.2	19	JAN19/FEB02
1955						0.473	4.4	21	NOV11
1956						0.429	9.8	20	JAN26
1957						0.581	11	20	JAN13

MONTHLY RUNOFF IN ACRE-FEET---LYTLE CREEK AT COLTON
STATION NUMBER 11065000 ELEVATION 975 FEET
DRAINAGE AREA 186 SQUARE MILES
PERIOD OF RECORD 1957 TO 1988 (WY 1984 MISSING)

WATER YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
1957-58	0.0	0.0	95.0	22.0	1040.0	386.0	1980.0	1.8	0.0	0.0	0.0	0.0	3524.8
1958-59	0.0	0.0	0.0	24.0	292.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	316.8
1959-60	0.0	1.4	7.3	11.0	9.9	1.8	3.4	0.0	0.0	0.0	0.0	0.0	34.8
1960-61	0.0	7.9	0.4	0.2	0.0	6.9	0.0	0.0	0.0	0.0	4.6	0.0	20.0
1961-62	0.0	4.8	17.0	31.0	1300.0	3.4	0.0	0.2	0.0	0.0	0.0	0.0	1356.4
1962-63	0.0	0.0	0.0	0.0	74.0	18.0	24.0	0.0	0.6	0.0	0.0	42.0	158.6
1963-64	1.0	31.0	0.2	85.0	0.4	228.0	104.0	0.0	0.0	0.0	0.0	0.0	449.6
1964-65	0.0	223.0	175.0	5.8	0.8	31.0	428.0	0.0	0.0	0.0	0.0	0.0	863.6
1965-66	0.0	4700.0	6380.0	382.0	455.0	506.0	569.0	34.0	0.0	0.0	0.0	0.0	13026.0
1966-67	1.0	88.0	4840.0	1130.0	0.0	159.0	294.0	0.0	21.0	0.0	178.0	41.0	6752.0
1967-68	0.0	376.0	41.0	9.5	0.2	458.0	8.5	0.0	0.0	0.2	0.0	0.0	893.4
1968-69	0.0	0.1	0.5	19550.0	12930.0	3360.0	3410.0	5390.0	1100.0	241.0	1050.0	352.0	47383.6
1969-70	65.0	250.0	0.0	27.0	155.0	454.0	1.7	4.0	0.0	0.8	0.4	0.0	957.9
1970-71	0.0	713.0	466.0	15.0	2.7	48.0	6.9	6.3	0.0	0.0	0.0	0.0	1257.9
1971-72	5.1	1.5	1130.0	0.0	0.0	12.0	0.0	0.0	0.2	0.0	0.3	0.0	1149.1
1972-73	0.4	131.0	32.0	145.0	2210.0	221.0	0.0	3300.0	0.0	0.0	0.0	0.2	6039.6
1973-74	0.0	28.0	0.1	795.0	16.0	87.0	33.0	0.0	0.0	0.0	0.0	0.0	959.1
1974-75	14.0	0.0	115.0	0.0	31.0	91.0	2.6	0.0	0.0	0.0	0.0	3.2 T	256.8
1975-76	1.2	0.7	0.7	0.8	463.0	81.0	2.7	0.6	0.7	0.0	0.0	501.0	1052.4
1976-77	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1
1977-78	0.0	0.0	635.0	3060.0	4810.0	20050.0	1750.0	1470.0	3650.0	2180.0	0.0	63.0	37668.0
1978-79	1.2	178.0	159.0	340.0	248.0	2110.0	0.0	24.0	0.0	0.0	0.0	0.0	3060.2
1979-80	22.0	0.0	0.0	3890.0	20870.0	1650.0	105.0	1.5	119.0	0.0	48.0	570.0	27275.5
1980-81	972.0	1060.0	709.0	513.0	147.0	353.0	50.0	25.0	23.0	22.0	24.0	22.0	3920.0
1981-82	3.7	17.0	5.0	103.0	53.0	537.0	298.0	0.0	0.0	3.2	0.0	22.0	1041.9
1982-83	31.0	1380.0	585.0	844.0	1460.0	9000.0	308.0	2.4	292.0	407.0	562.0	41.0	14912.4
1983-84													
1984-85	1.1	27.0	1170.0	74.0	109.0	54.0	0.0	0.0	0.0	0.0	0.0	18.0	1453.1
1985-86	44.0	1040.0	52.0	488.0	1860.0	1550.0	359.0	13.0	32.0	8.0	1.0	183.0	5630.0
1986-87	5.6	55.0	107.0	341.0	95.0	177.0	16.0	0.0	0.0	0.0	1.2	0.0	797.8
1987-88	309.0	475.0	319.0	654.0	54.0	132.0	276.0	5.2	0.0	0.0	0.0	0.0	2224.2
1988-89													
MEAN	49.2	359.8	568.0	1084.7	1622.9	1392.2	334.4	342.6	174.6	95.4	62.3	61.9	6148.1
MAX	972.0	4700.0	6380.0	19550.0	20870.0	20050.0	3410.0	5390.0	3650.0	2180.0	1050.0	570.0	47383.6
YEAR	1980	1965	1965	1969	1980	1978	1969	1969	1978	1978	1969	1980	1968-69
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1
													1976-77

LYTLE CREEK AT COLTON
STATION NUMBER 11065000 ELEVATION 975 FEET
DRAINAGE AREA--186 SQUARE MILES
PERIOD OF RECORD--1957 TO PRESENT (WY 1984 MISSING)

WATER YEAR ENDING SEP 30	MEAN DAILY FLOW CFS	MAX MEAN DAILY FLOW CFS	DATE	PEAK FLOW CFS	DATE
1958	4.86	488	APR04	4080	APR04
1959	0.44	118	FEB16	1120	FEB16
1960	0.05	2.5	DEC24	52	JAN12
1961	0.03	2.6	NOV07	64	AUG04
1962	1.88	371	FEB11	1520	FEB11
1963	0.22	28	FEB10	139	SEP18
1964	0.62	67	MAR22	594	MAR22
1965	1.19	87	NOV17	470	DEC28
1966	18	2740	DEC29	14800	DEC29
1967	9.32	1630	DEC06	4600	DEC06
1968	1.23	230	MAR08	730	MAR08
1969	65.4	5040	JAN25	16800	JAN25
1970	1.32	110	MAR01	726	NOV07
1971	1.74	340	NOV29	1600	NOV29
1972	1.59	319	DEC24	2830	DEC24
1973	8.34	1020	FEB11	4810	FEB11
1974	1.3	208	JAN07	814	JAN08
1975	0.35	52	DEC04	462	DEC04
1976	1.45	184	SEP11	1170	SEP11
1977	0.01	3.1	NOV12	77	NOV12
1978	52	3870	MAR04	17500	MAR04
1979	4.22	340	MAR27	1035	MAR27
1980	37.6	2530	FEB16	8070	FEB16
1981	5.41	135	JAN29	620	JAN29
1982	1.44	203	MAR17	722	MAR17
1983	20.5	2040	MAR02	4000	MAR01
1984	M				
1985	2	152	DEC27	348	DEC19
1986	7.77	508	FEB15	908	JAN30
1987	1.1	81	JAN05	572	JAN04
1988	3.06	271	JAN17	1010	JAN17

MAXIMUM DISCHARGE OF RECORD--17,500 CFS ON MARCH 4, 1978

LYTLE CREEK NEAR FONTANA, CA, MONTHLY DISCHARGE (ACRE-FEET)
Combined discharge of Lytle Creek and conduit
and pipeline diversions three miles upstream

Drainage Area: 46.6 square miles, Gage Elevation 2380 feet

WATER YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
1918-19	2460	1950	1810	1630	1280	1510	1680	1510	1150	978	959	928	17800
1919-20	1240	1100	1220	848	1650	4650	3530	2810	2240	2020	2610	2590	26500
1920-21	2200	1440	1610	1650	1560	2030	1920	2050	2060	1700	1460	1330	21000
1921-22	M											M	
1922-23	3150	2580	2540	2250	2000	1970	2030	1980	1590	1660	1570	1640	25000
1923-24	1680	1520	1510	1280	1260	1520	1450	1510	1220	1040	898	809	15700
1924-25	806	827	842	916	822	935	1080	1080	1010	873	756	690	10600
1925-26	682	744	769	824	1270	904	2340	2090	1420	1320	1180	1170	14700
1926-27	1570	1560	1540	1320	7890	4060	2850	2340	2420	3060	2870	2360	33800
1927-28	2020	1530	1650	1520	1550	1540	1480	1460	1280	1030	910	821	16800
1928-29	1010	946	867	916	1090	1380	1520	1520	1170	867	744	684	12700
1929-30	713	726	836	935	772	2060	1930	2130	1680	1460	1060	946	15200
1930-31	1010	1010	1050	1030	1620	1140	1420	1220	1110	978	867	821	13300
1931-32	824	768	1200	1350	6440	3670	2830	2420	2240	1990	2610	2460	28800
1932-33	2130	1770	1510	1640	1580	1650	1580	1440	1430	1110	885	827	17600
1933-34	925	934	1360	2360	1270	1170	1070	1050	8990	795	693	669	13200
1934-35	1200	666	1430	2480	3420	2650	3820	3030	2410	2060	2250	2360	27780
1935-36	1920	1660	1780	1370	2910	1800	1960	2050	1600	1380	1290	1170	20890
1936-37	1120	1040	2220	2100	7050	9160	5400	4620	5340	5240	4510	3550	51350
1937-38	2840	2170	2000	2120	6300	48280	10100	9720	7050	5180	4620	3510	103900
1938-39	3000	2380	3140	2510	2070	1960	1980	1970	1690	1490	1440	2550	26180
1939-40	2220	1870	1690	2680	2820	2860	2420	2230	2000	1750	1630	1590	25760
1940-41	1540	1250	1840	2420	7270	15310	11190	8950	7530	7350	5160	4370	74180
1941-42	3550	2840	2940	2670	1950	2090	2290	2140	1660	1630	1750	1460	26970
1942-43	1500	1470	1430	8160	6970	14930	7920	5610	4870	4940	4250	3210	65260
1943-44	2670	2220	2530	2500	3850	6300	6760	6160	4090	4390	4090	3270	48830
1944-45	2730	3230	2630	2130	3340	3360	3230	2620	2170	2100	2210	2470	32220
1945-46	2050	1880	3740	2560	1820	3310	3830	2830	2060	2050	2070	1950	30150
1946-47	2020	3950	5070	4460	2910	2230	2180	2500	2250	1950	1690	1520	32730
1947-48	1500	1420	1280	1180	1380	1480	1690	1730	1240	950	855	789	15490
1948-49	825	835	958	920	1010	1290	1210	1430	1040	885	780	714	11900
1949-50	789	680	1020	1000	1280	986	1020	1160	932	732	629	635	10860
1950-51	630	580	470	675	704	785	718	736	595	552	702	612	7760
1951-52	588	653	1220	5280	2640	4910	5020	3620	2570	1860	2480	3090	33930
1952-53	2520	2280	1930	2110	1500	1410	1210	1060	1030	968	873	821	17710
1953-54	859	885	918	1640	1770	2230	2820	1770	1250	1060	998	940	17140
1954-55	1190	1460	1370	1540	1410	1450	1330	1360	1080	948	847	819	14800
1955-56	895	982	1120	2460	1260	1280	1160	1180	950	783	720	664	13450
1956-57	736	750	770	1680	1440	1490	1180	1020	801	706	766	716	12060
1957-58	837	972	1900	1530	4500	6020	12990	6800	4590	4770	4500	3430	52840
1958-59	2840	2380	1870	1750	2720	2180	1460	1370	1210	1040	928	1140	20990
1959-60	1150	1030	1070	1200	1180	1140	960	1040	778	670	624	598	11440
1960-61	677	895	889	850	791	843	698	668	578	522	502	489	8400
1961-62	463	519	1100	930	4020	2680	1950	1340	1170	988	885	970	17020
1962-63	1500	1510	1440	1360	1350	1340	1180	1160	899	760	688	793	13980
1963-64	807	803	891	904	778	801	1240	900	704	605	535	527	9500
1964-65	557	651	750	807	674	742	1830	1270	889	694	606	590	10060
1965-66	593	16990	8220	7590	3710	3260	3360	2860	2310	2060	1960	1720	54620
1966-67	1550	1520	10350	4130	3080	4410	5500	6580	4270	3550	3710	2630	51280
1967-68	2190	2630	2900	2040	1840	2040	1640	1560	1280	1180	1160	1110	21570
1968-69	1200	1250	1280	34640	23540	25190	14890	10450	8940	8030	6610	4340	140360
1969-70	3430	2730	2400	2260	2530	3150	2020	1670	1460	1230	1140	1210	25230
1970-71	1060	1590	2230	2090	1850	1630	1480	1360	1120	986	930	867	17200
1971-72	932	1020	2720	2270	1500	1270	1120	1040	910	841	813	809	15250
1972-73	877	1050	1150	1270	4710	4520	3740	2660	2050	1720	1480	1620	26840
1973-74	1900	1940	1750	3360	2160	3490	2380	1880	1450	1320	1280	1220	24140
1974-75	1350	1450	1550	1390	1390	2120	1860	1650	1240	1090	984	922	17010
1975-76	964	984	1040	1050	1920	1960	1490	1340	1040	914	875	1670	15240
1976-77	1310	1010	1080	1540	1020	1150	1050	1700	1320	1030	1480	897	14570
1977-78	968	1010	1750	10390	14050	37470	15690	13860	9780	8030	5970	4850	123800
1978-79	3860	2960	3040	3740	3950	5340	6510	6570	6080	4380	3800	3580	53810
1979-80	3240	2460	2040	6850	37590	20460	8970	10080	8650	7030	6250	4470	118100
1980-81	3880	2810	2530	2230	1830	2540	1870	1490	1140	978	897	847	23060
1981-82	1010	1170	1210	1590	1510	3200	4710	3050	2160	1730	1490	1530	24360
1982-83	1990	2500	3290	3560	8920	21930	10410	11280	10700	9590	6370	5370	95910
1983-84	4420	3660	4160	3470	2570	2420	2090	2010	1770	1470	1500	1140	30690
1984-85	1300	1340	2220	1970	1570	1580	1320	1220	1090	1000	1040	972	16620
1985-86	1030	1690	1700	1650	3030	3880	3190	2170	1780	2030	1930	2050	26130
1986-87	1890	1710	1530	1880	1210	1590	1150	990	797	722	621	598	14690
1987-88	876	1470	1880	2050	1550	1580	1590	1350	1170	1020	926	851	16310

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
MEAN	1623	1772	1967	2746	3510	4836	3326	2891	2472	2084	1872	1672	30652
MEDIAN	1300	1450	1550	1750	1830	2060	1950	1770	1450	1230	1160	1140	20990
MEAN DAILY	52	59	63	89	124	156	111	93	82	69	60	56	84
MAX	4420	16990	10350	34640	37590	48280	15690	13860	10700	9590	6610	5370	140360
YEAR	1983	1965	1966	1969	1980	1938	1978	1978	1983	1983	1969	1983	1968-69
MIN	463	519	470	675	674	742	698	668	578	522	502	489	7760
YEAR	1961	1961	1950	1951	1965	1965	1961	1961	1961	1961	1961	1961	1950-51

Lytle Creek near Fontana (8 Mi North of Fontana)
Station Number 11062000
Drainage Area 46.3 square miles
Elevation 2380 feet (slightly lower gage sites before 1963)
Period of Record 1919 to present
No regulation upstream, SoCal Edison and Fontana Union Water Co
divert and collect Lytle Creek flow within 2 and 1/2 miles upstream

WATER YEAR ENDING SEP 30	MEAN DAILY FLOW CMBND CFS	PEAK FLOW CFS	DATE	MAX DAILY CFS	DATE	COMBINED RUNOFF AC-FT	UNDVRTD RUNOFF AC-FT	DIVERTED RUNOFF AC-FT	PERCENT DIVERTED
1919	24.6			48	OCT04	17800	0	17800	100
1920	36.6			329	MAR02	26500	1950	24550	92.6
1921	29.1			160	MAR13	21100	100	21000	99.5
1922									
1923	34.5			55	OCT01	25000	0	25000	100
1924	21.7			42	MAR27	15700	0	15700	100
1925	14.6			34	APR05	10600	0	10600	100
1926	20.3			354	APR06	14700		14700	100
1927	46.6			1370	FEB16	33800	7090	26710	79
1928	23.2			42	FEB04	16800	0	16800	100
1929	17.5			53	MAR10	12700	0	12700	100
1930	21			57	MAY04	15200	0	15200	100
1931	18.3	417	APR26	108	APR26	13300	0	13300	100
1932	39.7	865	FEB08	659	FEB09	28800	4500	24300	84.4
1933	24.3	100	JAN19	55	JAN19	17600	100	17500	99.4
1934	18.2	560	JAN01	250	JAN01	13200	920	12280	93
1935	38.3	1500	APR08	296	APR08	27780	3500	24280	87.4
1936	28.8	730	FEB02	148	FEB02	20890	1280	19610	93.9
1937	70.8	1250	FEB14	480	FEB06	51350	16190	35160	68.5
1938	143	25200	MAR02	8960	MAR02	103900	68200	35700	34.4
1939	36.1	568	SEP25			26180	1880	24300	92.8
1940	35.5			327	JAN08	25760	1650	24110	93.6
1941	102			573	MAR04	74180	36990	37190	50.1
1942	37.2			76	DEC10	26970	640	26330	97.6
1943	90	4800	JAN23	1310	JAN23	65260	31070	34190	52.4
1944	67.4		FEB22	338	FEB22	48830	10440	38390	78.6
1945	44.4		FEB02	204	FEB02	32220	1550	30670	95.2
1946	41.6		MAR30	571	MAR30	30150	4640	25510	84.6
1947	45.1	1000	NOV20	440	DEC26	32730	6960	25770	78.7
1948	21.4	140	APR03	49	APR29	15490	100	15390	99.4
1949	16.4	200	JAN20	26	MAY	11900	70	11830	99.4
1950	15	207	DEC19	73	DEC19	10860	314	10546	97.1
1951	10.7	65	APR28	17	APR28	7760	33	7727	99.6
1952	46.8	1500	JAN16	469	JAN16	33930	17130	16800	49.5
1953	24.4	98	DEC01	54	NOV15	17710	2000	15710	88.7
1954	23.6	780	JAN25	123	JAN25	17140	2750	14390	84
1955	20.4	114	NOV11	69	NOV11	14800	320	14480	97.8
1956	18.6	964	JAN26	382	JAN26	13450	1370	12080	89.8
1957	16.6	575	JAN12	204	JAN13	12060	1230	10830	89.8

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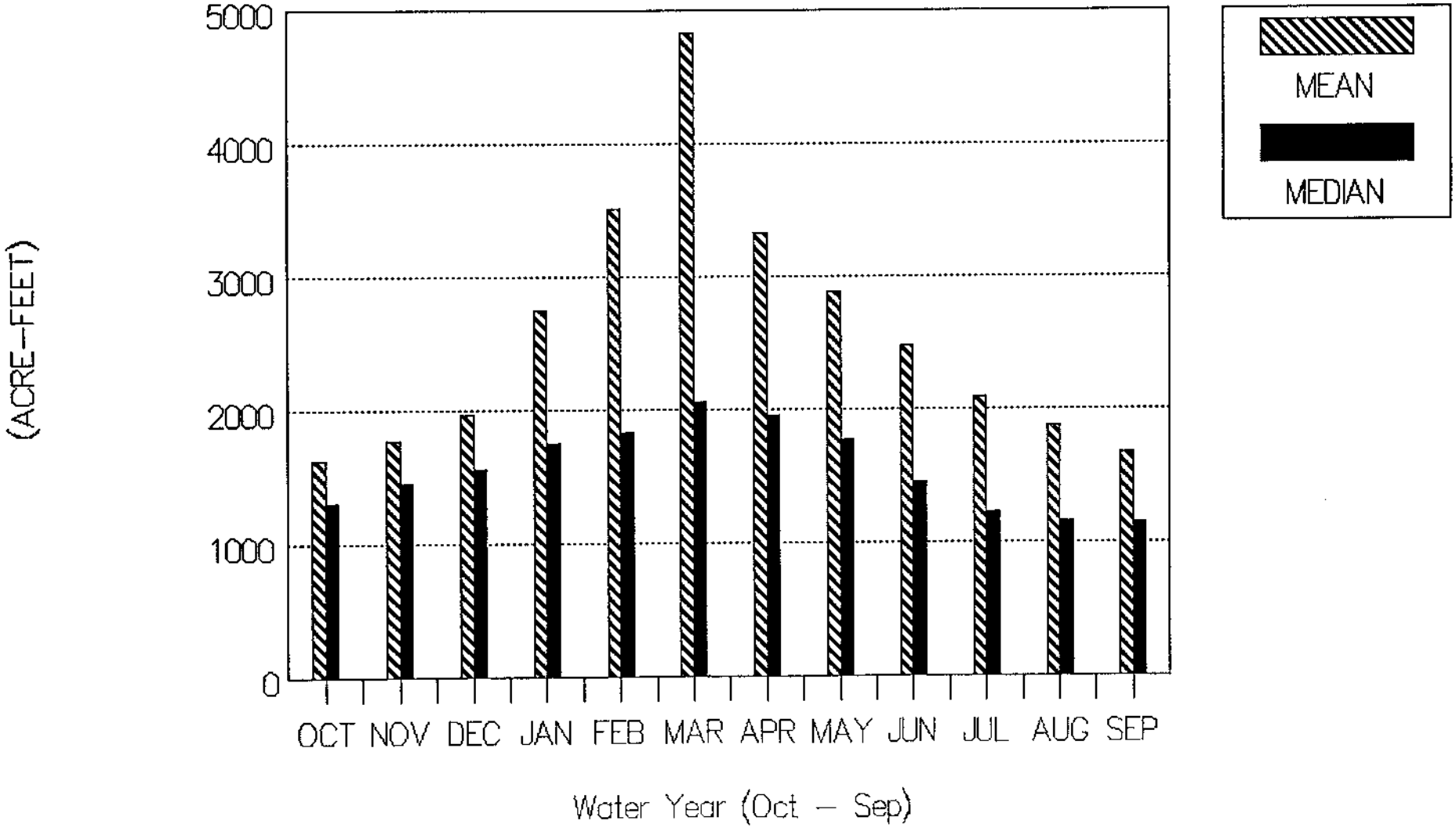
No regulation upstream, SoCal Edison and Fontana Union Water Co
divert and collect Lytle Creek flow within 2 and 1/2 miles upstream

WATER YEAR ENDING SEP 30	MEAN DAILY FLOW CMBND CFS	PEAK FLOW CFS	DATE	MAX DAILY CFS	DATE	COMBINED RUNOFF AC-FT	UNDVRTD RUNOFF AC-FT	DIVERTED RUNOFF AC-FT	PERCENT DIVERTED
1958	72.9	1190	APR03	687	APR03	52840	35400	17440	33
1959	29	832	FEB16	276	FEB16	20990	3660	17330	82.6
1960	15.8	96	JAN10	27	JAN10	11440	48	11392	99.6
1961	11.6	102	JAN26	27	JAN26	8400	91	8309	98.9
1962	23.5	760	DEC02	180	FEB09	17020	4360	12660	74.4
1963	19.3	122	FEB10	75	FEB10	13980	345	13635	97.5
1964	13.1	277	APR01	122	APR01	9500	381	9119	96
1965	13.9	80	APR09	49	APR10	10060	332	9728	96.7
1966	75.3	9120	DEC29	3010	NOV23	54620	36330	18290	33.5
1967	70.7	7200	DEC06	2260	DEC06	51280	33130	18150	35.4
1968	29.7	336	NOV19	138	NOV19	21560	7540	14020	65
1969	194	35900	JAN25	8330	JAN25	140300	128100	12200	8.7
1970	34.8	145	FEB28	92	MAR01	25210	7350	17860	70.8
1971	23.7	1100	NOV29	116	DEC21	17200	2880	14320	83.3
1972	21	1360	DEC24	373	DEC24	15250	2880	12370	81.1
1973	37	1580	FEB11	945	FEB11	26840	9360	17480	65.1
1974	33.3	266	JAN07	166	JAN07	24140	5400	18740	77.6
1975	23.5	199	MAR06	81	MAR08	17010	868	16142	94.9
1976	21	403	SEP10	92	SEP11	15240	899	14341	94.1
1977	20.1	305	JAN03	139	AUG17	14570	1500	13070	89.7
1978	171	8600	MAR04	3510	MAR04	123800	105700	18100	14.6
1979	74.2	356	MAR27	199	MAR27	53810	27570	26240	48.8
1980	163	10330	FEB16	2830	FEB16	118100	91630	26470	22.4
1981	31.8	266	JAN29	90	JAN29	23060	5580	17480	75.8
1982	33.6	835	MAR17	369	MAR17	24360	7820	16540	67.9
1983	132	4000	MAR02	1530	MAR02	95910	78990	16920	17.6
1984	42.3	420	DEC25	200	DEC25	30690	13530	17160	55.9
1985	22.9	253	DEC27	135	DEC27	16620	1980	14640	88.1
1986	36	372	JAN30	203	FEB15	26130	11180	14950	57.2
1987	20.3	243	JAN04	102	JAN04	14690	2050	12640	86
1988	22.5	480	JAN17	208	JAN17	16310	3560	12750	78.2
AVERAGE	42.3					30652	12397	18255	59.6
MAXIMUM		35900		8960		140300	128100	37190	
DATE			25JAN69		02MAR38	WY 1969	WY 1969	WY 1941	

Average Discharge, Creek only, 70 years: 18.1 cfs (13110 acre-feet per year)
Average Discharge, Combined creek and diversions, 85 years (WYs 1899, 1905-88):
45.0 cfs (32,600 acre-feet/year)
Maximum Discharge on record, Creek only: 35,900 cfs on Jan. 25, 1969
(same maximum for creek and diversions)
Minimum Discharge on record, combined creek and diversions: 0.12 cfs (ave. daily)
for June 21 and 22, 1976

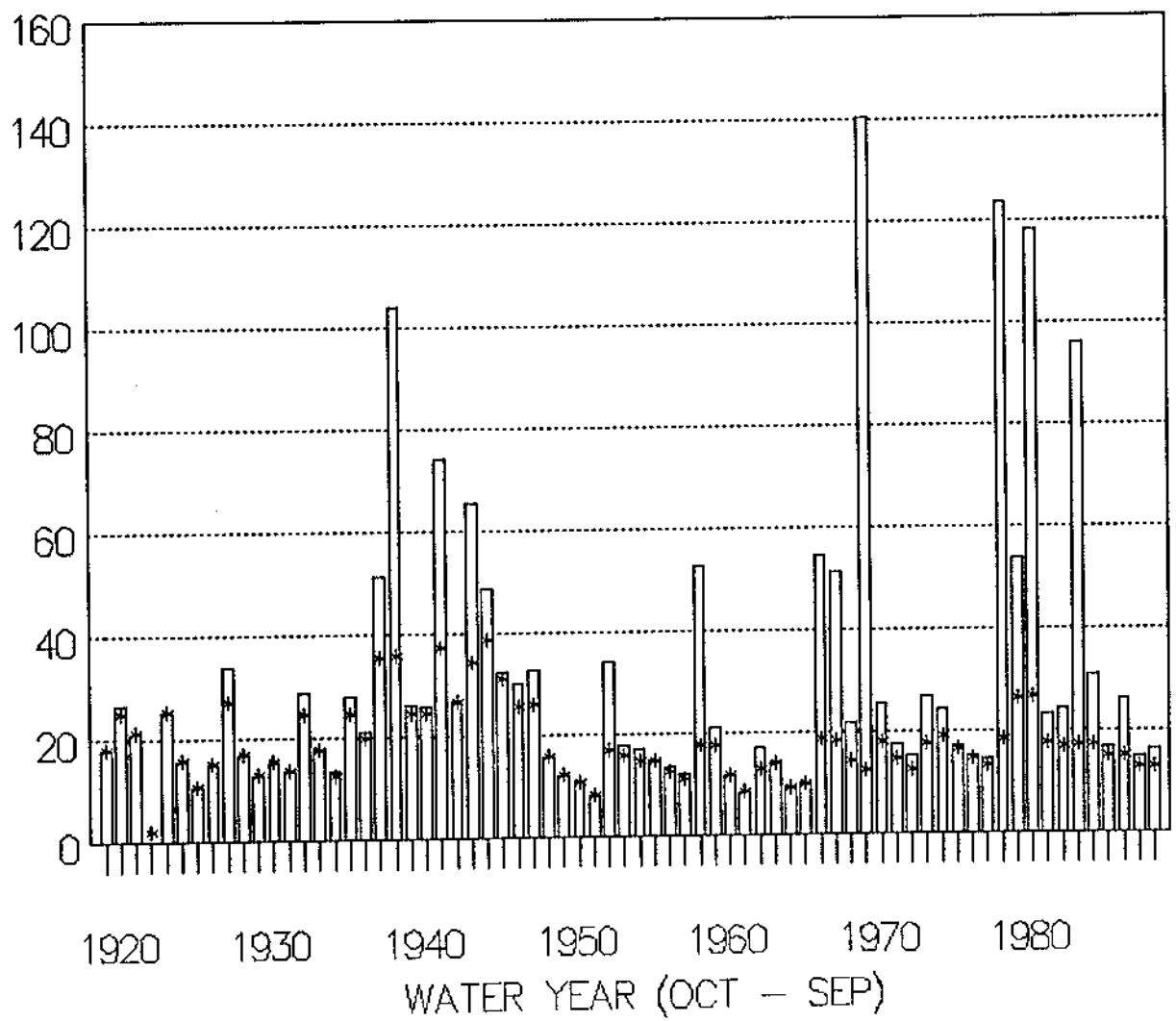
LYTLE CREEK NEAR FONTANA

AVERAGE MONTHLY DISCHARGE (1918 – 1988)



LYTLE CREEK NEAR FONTANA

Discharge (1919 to 1988)



DIVERTED FROM LYTLE CREEK BY SO CAL EDISON AND FONTANA UNION WATER CO.

NO REGULATION UPSTREAM, BUT DIVERTED WITHIN 2 1/2 MILES UPSTREAM OF LYTLE CREEK INTAKE STRUCTURE

RAINGAUGES
IN OR NEAR LYTLE-CAJON CREEKS

Precipitation Stations in Lytle Creek Basin[1]

Recording Rain Gages	Source[2]	Elev. ft.	Period of Record	ID
Cajon West Summit	HPD	4779	1945-pr	8-0-386
Lytle Creek Ranger Station	HPD	2730	1927-pr	8-0-158
Lytle Creek Foothill Blvd.	HPD, LATS	1160	1948-pr	8-0-376
Devore FireStation	LATS	2080		
Lytle Creek Ranger Sth.	HPD	2730	1922-pr	8-0-158
Non-recording Rain Gages				
Fontana 5N	CD	2023	1954-84	
Devore	SBCFCD	2435	1927-pr	
Cajon Junction	SBCFCD	3118	1944-pr	8-0-367
Panorama Point	SBCFCD	3775	1935-pr	8-0-160
Lake Arrowhead	CD	5203	1940-pr	8-0-266

Precipitation Stations near Lytle Creek Basin

Recording Rain Gages				
Wrightwood	SBCFCD	6038	1957-pr	
Crestline FS2	HPD	4900	1971-pr	
San Bern Cty Fld Cont Dist Ofc	LATS	1040		8-0-327
Demens Creek Debris Basin	LATS	1900		
Mount Baldy Forest Serv. Station	LATS	4300		8-0-29
Running Springs	HPD	5965		8-0-213
Non-recording raingages				
Del Rosa Ranger Station	SBCFCD	1580	1954-pr	8-0-186B
Day Canyon	SBCFCD	2576	1946-pr	8-0-371
San Bernardino County Hospital	CD	1125	1870-pr	8-0-24A

1 LOCATIONS SHOWN ON PLATE 7

2 LEGEND: CD
HPD
LATS
SBCFCD

MONTHLY PRECIPITATION AMOUNTS (IN INCHES)

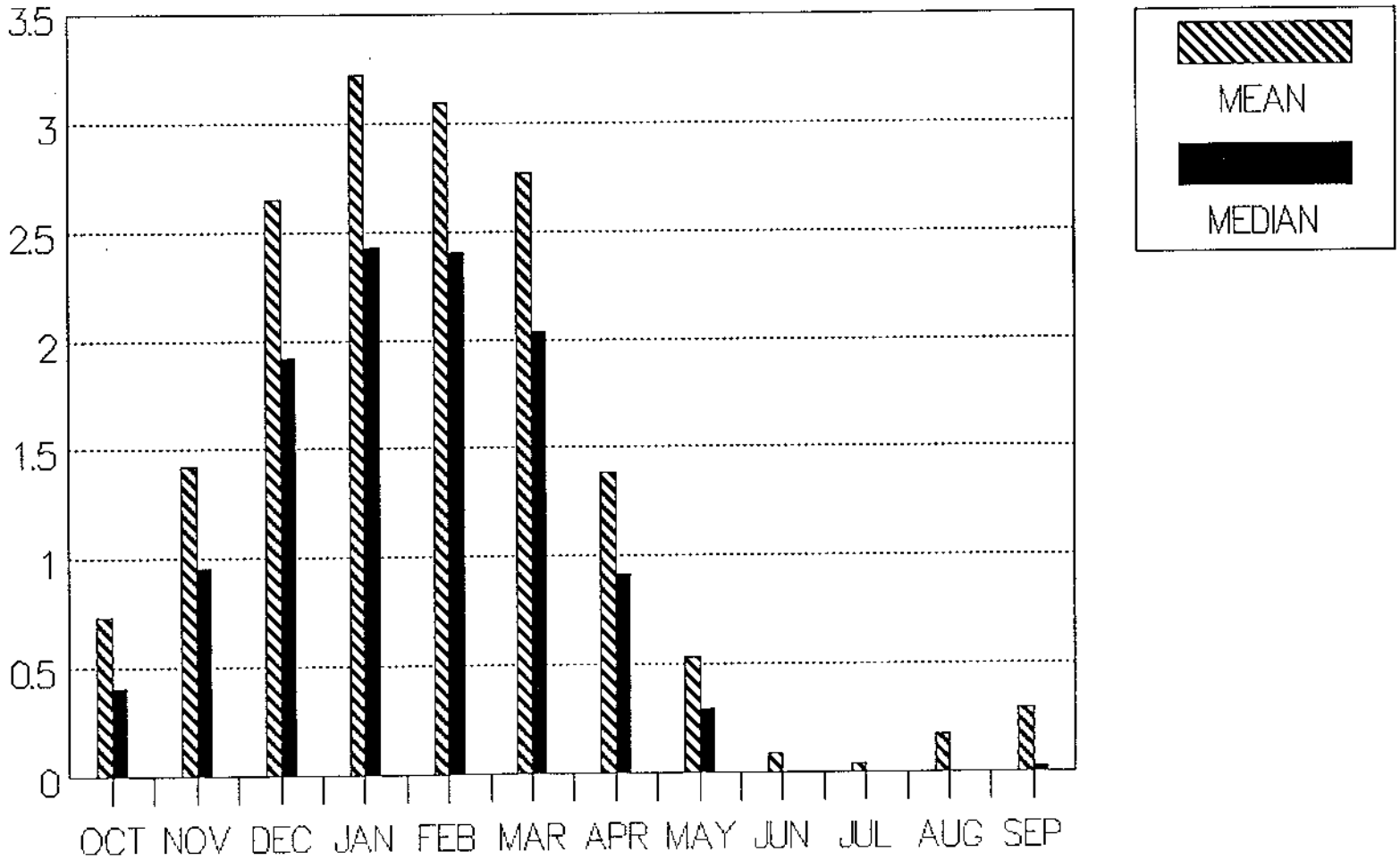
SAN BERNARDINO COUNTY HOSPITAL

STATION NO. 8-0-24A (PLATE 7)

WATER YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
1869-70										0.00	0.00	0.02	
1870-71	0.09	3.11	0.89	6.91	2.21	0.19	0.34	0.11	0.07	0.00	0.04	0.13	14.09
1871-72	0.60	0.88	3.91	0.00	2.20	0.37	0.79	0.06	0.00	0.00	0.18	0.04	9.03
1872-73	0.00	1.17	4.40	6.51	1.25	0.51	0.84	0.21	0.00	0.00	1.06	0.02	15.97
1873-74	0.01	0.74	5.73	5.51	8.76	1.08	0.48	0.42	0.00	0.00	0.00	0.06	22.79
1874-75	1.82	1.88	2.30	7.20	0.15	0.22	0.07	0.05	0.00	0.00	0.00	0.00	13.59
1875-76	0.00	7.50	0.02	6.55	1.92	3.41	0.44	0.03	0.03	0.00	0.00	0.00	19.90
1876-77	0.20	0.40	0.00	3.50	4.01	0.83	0.26	0.30	0.00	0.00	0.00	0.00	9.52
1877-78	0.86	0.50	3.95	3.33	6.68	2.57	1.71	0.66	0.07	0.07	0.00	0.02	20.42
1878-79	0.14	0.05	4.70	3.59	1.00	0.50	1.20	0.24	0.03	0.11	0.02	0.01	11.59
1879-80	0.94	3.40	6.50	1.56	1.33	1.45	5.00	0.04	0.90	0.00	0.00	0.00	20.22
1880-81	0.14	0.67	8.80	1.40	0.36	1.66	0.46	0.01	0.00	0.00	0.00	0.00	13.50
1881-82	0.80	0.27	0.50	1.11	2.65	3.30	2.91	0.00	0.00	0.00	0.00	0.00	11.54
1882-83	0.10	0.15	0.45	1.60	1.10	2.82	2.95	0.00	0.00	0.19	0.00	0.53	9.89
1883-84	0.85	0.09	2.63	1.63	12.20	9.95	5.68	3.17	0.59	0.00	0.00	0.00	36.79
1884-85	0.00	0.11	3.75	2.79	0.11	0.28	1.89	1.69	0.19	0.00	0.00	0.00	10.81
1885-86	0.39	4.36	1.20	6.44	2.52	4.18	2.36	0.32	0.16	0.00	0.00	0.00	21.93
1886-87	0.00	0.11	0.61	0.39	6.44	4.41	1.90	0.42	0.22	0.11	0.04	0.09	14.74
1887-88	1.17	2.29	1.91	4.01	3.60	3.41	0.58	0.52	0.03	0.00	0.00	0.00	17.52
1888-89	0.05	4.12	4.64	0.93	1.50	6.55	2.05	1.13	0.00	0.17	0.63	0.11	21.88
1889-90	2.30	2.23	10.85	5.44	2.15	0.89	0.00	0.31	0.00	0.13	2.16	0.88	27.34
1890-91	0.58	1.27	3.02	0.00	7.78	0.06	0.53	1.67	0.00	0.00	0.91	0.93	16.75
1891-92	0.00 T	0.00 T	1.67	3.24	3.30	1.75	0.37	2.10	0.08	0.00	0.00 T	0.00	12.51
1892-93	0.16	1.02	2.23	4.53	3.37	8.00	0.48	0.03	0.00	0.20	0.00	0.05	20.07
1893-94	1.05	0.30	2.28	1.26	0.88	1.15	0.40	0.56	0.00	0.00 T	0.16	0.37	8.41
1894-95	0.15	0.00	7.25	7.39	1.14	3.44	0.64	0.44	0.00	0.00	0.00	0.00	20.45
1895-96	0.00	1.14	0.66	2.02	0.00	2.92	0.37	1.00	0.00	0.00 T	0.17	0.00	8.28
1896-97	2.10	0.98	1.09	3.40	5.40	3.41	0.08	0.11	0.00	0.00 T	0.00	0.13	16.70
1897-98	2.10	0.21	0.57	2.10	0.60	0.97	0.48	1.08	0.00	0.00	0.00	0.00	8.11
1898-99	0.03	0.05	0.44	2.03	0.51	3.22	0.07	0.19	0.95	0.00	0.00 T	0.01	7.50
1899-00	0.81	1.47	0.84	0.92	0.00	0.92	1.96	1.71	0.00 T	0.34	0.00	0.23	9.20
1900-01	0.36	5.10	0.00	3.48	4.58	0.43	0.56	1.23	0.05	0.00	0.27	0.07	16.13
1901-02	1.09	0.28	0.04	1.65	3.02	3.89	0.57	0.12	0.15	0.01	0.00	0.00	10.82
1902-03	0.09	1.94	1.94	1.96	1.67	6.47	3.10	0.24	0.00	0.00	0.15	0.46	18.02
1903-04	0.07	0.00	0.00	0.18	2.21	5.34	0.80	0.16	0.00	0.00	0.14	0.06	8.96
1904-05	0.32	0.00	1.03	3.92	6.58	6.00	1.18	1.55	0.00	0.00	0.00	0.13	20.71
1905-06	0.00	2.81	0.74	2.97	2.89	8.00	1.16	0.96	0.22	0.00 T	0.00 T	0.05	19.80
1906-07	0.01	2.42	7.12	6.33	2.14	4.58	0.16	0.11	0.25	0.00	0.00	0.00	23.12
1907-08	2.75	0.10	0.97	4.71	4.20	2.03	0.53	0.31	0.02	0.05	0.00	1.11	16.78
1908-09	1.45	0.26	0.66	7.49	3.76	2.29	0.17	0.02	0.10	0.00	1.28	0.00	17.48
1909-10	0.04	2.28	7.19	2.43	0.08	1.58	0.14	0.00	0.00 T	0.05	0.03	0.36	14.18
1910-11	1.04	0.54	0.03	6.58	4.22	2.52	0.48	0.49	0.00 T	0.00 T	0.00	1.47	17.37
1911-12	0.50	0.58	1.17	0.75	0.00	5.18	3.67	0.52	0.00	0.00	0.06	0.01	12.44
1912-13	1.42	0.47	0.01	1.69	5.26	0.63	0.66	0.48	0.39	0.19	0.05	0.02	11.27
1913-14	0.00	2.54	0.96	8.73	4.71	0.64	3.45	0.03	0.13	0.00 T	0.00	0.01	21.20
1914-15	0.91	0.26	2.98	4.99	5.52	1.25	2.29	1.43	0.00	0.00	0.53	0.05	20.21
1915-16	0.00	0.67	3.92	15.51	1.86	1.90	0.08	0.20	0.00	0.00	0.37	1.06	25.57
1916-17	1.80	0.03	2.81	3.24	2.70	0.19	0.97	0.62	0.00	0.21	0.04	0.00	12.61
1917-18	0.00 T	0.40	0.00	0.53	3.05	7.44	0.32	0.32	1.02	0.05	0.03	0.29	13.45
1918-19	0.89	1.95	1.72	0.52	3.79	2.60	1.08	0.70	0.00	0.02	0.14	2.37	15.78
1919-20	0.67	1.20	0.90	0.62	4.78	6.15	1.36	1.07	0.00	0.00	0.00	0.18	16.93
1920-21	1.76	0.26	1.41	3.94	1.03	3.85	0.69	3.34	0.00	0.00	0.00	1.10	17.38
1921-22	1.10	0.11	10.62	6.60	3.75	2.45	0.75	1.27	0.00	0.02	0.02	0.00	26.69
1922-23	0.46	2.04	3.16	1.88	1.09	0.50	1.86	0.01	0.00	0.00	0.02	0.13	11.15
1923-24	0.34	0.96	1.84	0.85	0.20	4.51	2.49	0.00 T	0.00	0.00	0.00	0.02	11.21
1924-25	1.02	1.15	2.18	0.36	0.69	2.05	1.77	1.07	0.58	0.00 T	0.00	0.01	10.88
1925-26	2.29	1.02	1.49	0.92	3.14	1.08	9.38	1.07	0.03	0.00	0.00 T	0.00	20.39
1926-27	0.02	2.18	3.08	1.36	9.83	2.66	0.94	0.40	0.08	0.00	0.00	0.00	20.55
1927-28	3.27	1.09	3.39	0.74	2.65	1.30	0.51	1.10	0.00	0.00	0.00	0.00	14.05
1928-29	0.82	1.10	1.99	2.28	1.89	1.60	2.41	0.00	0.12	0.00	0.00	0.53	12.74
1929-30	0.05	0.00	0.00	5.12	1.16	3.30	1.08	2.32	0.00	0.00	0.00	0.00	13.53
1930-31	0.89	2.22	0.00	2.88	3.99	0.45	3.55	1.26	0.07	0.00	1.16	0.15	16.62
1931-32	1.25	3.06	4.54	1.86	8.83	0.16	0.82	0.01	0.12	0.00	0.00	0.00	20.65
1932-33	0.28	0.00	3.51	5.37	0.22	0.47	2.16	0.95	0.20	0.00	0.05	0.00	13.21
1933-34	0.24	0.38	6.31	2.55	2.40	0.67	0.14	0.00	0.24	0.00	0.01	0.14	13.08
1934-35	2.44	1.63	4.24	3.77	1.30	3.24	1.70	0.21	0.00	0.00	1.28	0.02	21.83
1935-36	0.40	0.35	0.71	0.01	11.12	2.19	1.02	0.00	0.00	0.09	0.00	0.06	15.95
1936-37	4.63	0.25	8.24	3.58	8.64	5.43	0.60	0.00	0.07	0.00	0.00	0.00	31.45
1937-38	0.00	0.02	3.44	2.12	6.48	10.10	2.46	0.65	0.09	0.42	0.00	0.04	25.82
1938-39	0.67	0.06	6.48	3.43	2.29	1.87	0.85	0.06	0.00	0.00	0.04	2.22	17.97
1939-40	0.79	1.01	0.57	5.54	4.21	1.53	2.42	0.00	0.00	0.00	0.00	0.00	16.07
1940-41	1.89	0.95	7.34	2.57	9.05	9.65	3.82	0.25	0.38	0.00	0.54	0.00	36.44
1941-42	2.61	0.70	5.88	0.57	1.14	2.04	3.16	0.06	0.00	0.00	0.21	0.00	16.37
1942-43	0.71	0.55	1.66	9.76	5.46	6.07	3.04	0.00	0.07	0.00	0.00	0.02	27.34
1943-44	1.33	0.31	7.27	1.39	7.71	2.06	1.71	0.00	0.11	0.00	0.00	0.02	21.91
1944-45	0.00	6.05	1.37	0.42	4.39	5.29	0.58	0.20	0.00	0.00	0.94	0.04	19.28
1945-46	0.48	0.05	6.22	0.21	1.44	2.49	0.64	0.10	0.00	0.33	0.00	0.61	12.57
1946-47	1.46	6.84	3.78	0.50	1.02	1.11	0.91	0.33	0.13	0.00	0.00	0.26	16.34
1947-48	0.09	0.00	1.60	0.09	2.45	2.66	2.66	0.30	0.84	0.00	0.00	0.00	10.69
1948-49	1.36	0.00	2.87	4.84	3.14	0.89	0.02	1.29	0.00	0.00	0.00	0.00	14.41
1949-50	0.12	2.37	2.17	2.52	2.48	1.07	0.88	0.20	0.03	0.00	0.00	0.00	11.84
1950-51	0.03	1.79	0.00	3.16	0.81	0.61	1.73	1.22	0.00	0.03	0.03	0.22	9.63
1951-52	0.70	1.42	7.10	6.40	0.53	5.53	1.96	0.00	0.00	0.06	0.00	0.50	24.20
1952-53	0.00	3.42	3.29	1.85	0.31	1.47	2.16	0.30	0.00	0.00	0.03	0.00	12.83
1953-54	0.07	0.86	0.31	7.07	2.57	4.90	0.30	0.01	0.13	0.08	0.00	0.00	16.30
1954-55	0.00	3.02	1.25	4.46	1.72	0.42	0.73	1.55	0.04	0.08	0.00	0.01	13.28
1955-56	0.00	1.72	1.49	7.28	0.47	0.01	1.70	0.58	0.00	0.21	0.00	0.00	13.46
1956-57	0.53	0.00	0.43	6.34	1.92	0.95	1.10	2.26	0.28	0.00	0.00	0.00	13.81
1957-58	2.53	0.77	4.29	1.81	6.64	6.38	3.88	0.54	0.00	0.00	0.38	0.88	28.10
1958-59	0.14	0.16	0.00	1.35	4.01	0.00	0.46	0.23	0.00	0.00	0.02	0.22	6.59
1959-60	0.02	0.73	2.64	3.30	2.91	0.98	1.17	0.36	0.00	0.00	0.00	1.05	13.16
1960-61	0.58	2.25	0.17	0.75	0.00	1.65	0.17	0.25	0.00 T	0.00	0.18	0.00	6.00
1961-62	0.00 T	1.41	2.11	2.32	5.58	1.74	0.02	0.67	0.00 T	0.00	0.00	0.00	13.85
1962-63	0.14	0.00 T	0.34	0.77	3.12	1.61	2.42	0.00	0.48	0.00	0.02	4.42	13.02
1963-64	1.58	2.66	0.27	1.65	0.32	2.26 E	0.77	0.39	0.15	0.02	0.00	0.07	10.14
1964-65	0.11	2.35	1.25	0.69	0.27	1.70	5.40	0.15	0.10	0.10	0.02	0.58	12.72
1965-66	0.00	8.47	4.23	0.84	1.65	0.69	0.13	0.16	0.00	0.01	0.00	0.12	16.40
1966-67	0.44	1.48	9.14	4.39	0.00	2.07	4.24	0.40	0.21	0.00	0.39	0.20	22.96
1967-68	0.00	3.04	2.19	1.05	0.49	2.41	1.18	0.29	0.10	0.26	0.12	0.00	11.13
1968-69	0.17	0.36	1.07	13.64	12.50	1.35	1.08	1.21	0.07	0.12	0.00 T	0.22	31.79
1969-70	0.10	1.50	0.10	1.31	2.15	3.46	0.45	0.07	0.10	0.02	0.03	0.00	9.29
1970-71	0.02	3.57	3.36	0.95	0.60	1.11	1.13	1.01	0.02	0.00 T	0.00	0.00 T	11.97
1971-72	2.30	0.27	5.87	0.00	0.05	0.00	0.13	0.22	0.22	0.00	0.25	0.31	9.62
1972-73	0.43	3.32	1.92	3.39	5.66	3.58	0.08	0.04	0.00 T	0.00	0.02	0.00	18.46
1973-74	0.09	1.42	0.14	6.88	0.28	3.00	0.78	0.05	0.00	0.00	0.00	0.02	12.66
1974-75	0.96	0.17	2.92	0.35	2.37	4.33	1.81	0.22	0.23	0.00	0.00	0.13	13.49
1975-76	1.17	0.74	0.58	0.00	4.80	1.63	1.32	0.30	0.12	0.08	0.00	5.12	15.86
1976-77	0.10	0.59	1.01	2.93	0.68	1.51	0.00	2.70	0.03	0.00	2.40	0.00	11.95
1977-78	0.05	0.24	4.37	6.31	6.86	9.65	2.31	0.04	0.00	0.00	0.01	0.63	30.47
1978-79	0.19	2.50 E	2.75 E	4.18 E	3.65	4.68	0.00 T	1.01	0.13	0.00	0.00 T	0.00 T	19.09
1979-80	2.31	0.15	0.10 E	8.96	9.88	5.47	0.94	0.04	0.00	0.00	0.00	0.00	27.85
1980-81	0.70	0.00 T	0.58	4.33	0.88	2.69	1.08	0.19	0.00	0.00 T	0.00 T	0.00	10.45
1981-82	0.69	1.15	0.50	4.69	2.01	6.01	1.64	0.52	0.04	0.00	0.02	1.09	18.36
1982-83	0.24	4.35	2.31	5.41	4.90	7.46	3.22	0.05	0.00 E	0.00	3.72	0.68	32.34
1983-84	2.15	3.55	3.23	0.19	0.22	0.35	0.49	0.00	0.02	0.36	0.09	0.16	10.81
1984-85	0.24	1.36	5.45	1.67	1.00 E	1.82	0.00 E	0.03	0.04	0.00 E	0.00	0.20 E	11.81
1985-86	0.51	4.01	0.57	1.43	4.32	4.52	0.86	0.00	0.00	0.26	0.02	1.36	17.86
1986-87	0.26	0.79	1.70	1.64	1.07	2.01	0.24	0.00	0.00	0.09	0.13	0.15	8.08
1987-88	3.54	2.44	1.72	1.77	0.90	0.76	2.46	0.12	0.00	0.00	0.00	0.07	13.78
1988-89	0.00	0.56	5.54	0.75 E	2.52	1.87	0.00 T	0.47	0.00				
1989-90													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
SUM	86.71	169.61	315.23	379.96	368.19	329.41	164.55	63.24	10.42	4.54	20.61	35.11	1935.85
YEARS	119	119	119	119	119	119	119	119	119	119	119	119	118
MEAN	0.73	1.43	2.65	3.22	3.09	2.77	1.38	0.53	0.09	0.04	0.17	0.30	16.41
MEDIAN	0.40	0.95	1.92	2.43	2.40	2.04	0.91	0.29	0.00	0.00	0.00	0.02	14.57
MAX	4.63	8.47	10.85	15.51	12.50	10.10	9.35	3.34	1.02	0.42	3.72	5.12	36.79
YEAR	1936	1965	1889	1916	1969	1938	1926	1921	1918	1933	1983	1976	1883-84
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00 1960-61
YRS W/0.00	19	11	8	4	5	2	5	16	64	85	63	46	
PERCENT	16	9	7	3	4	2	4	13	54	71	57	39	

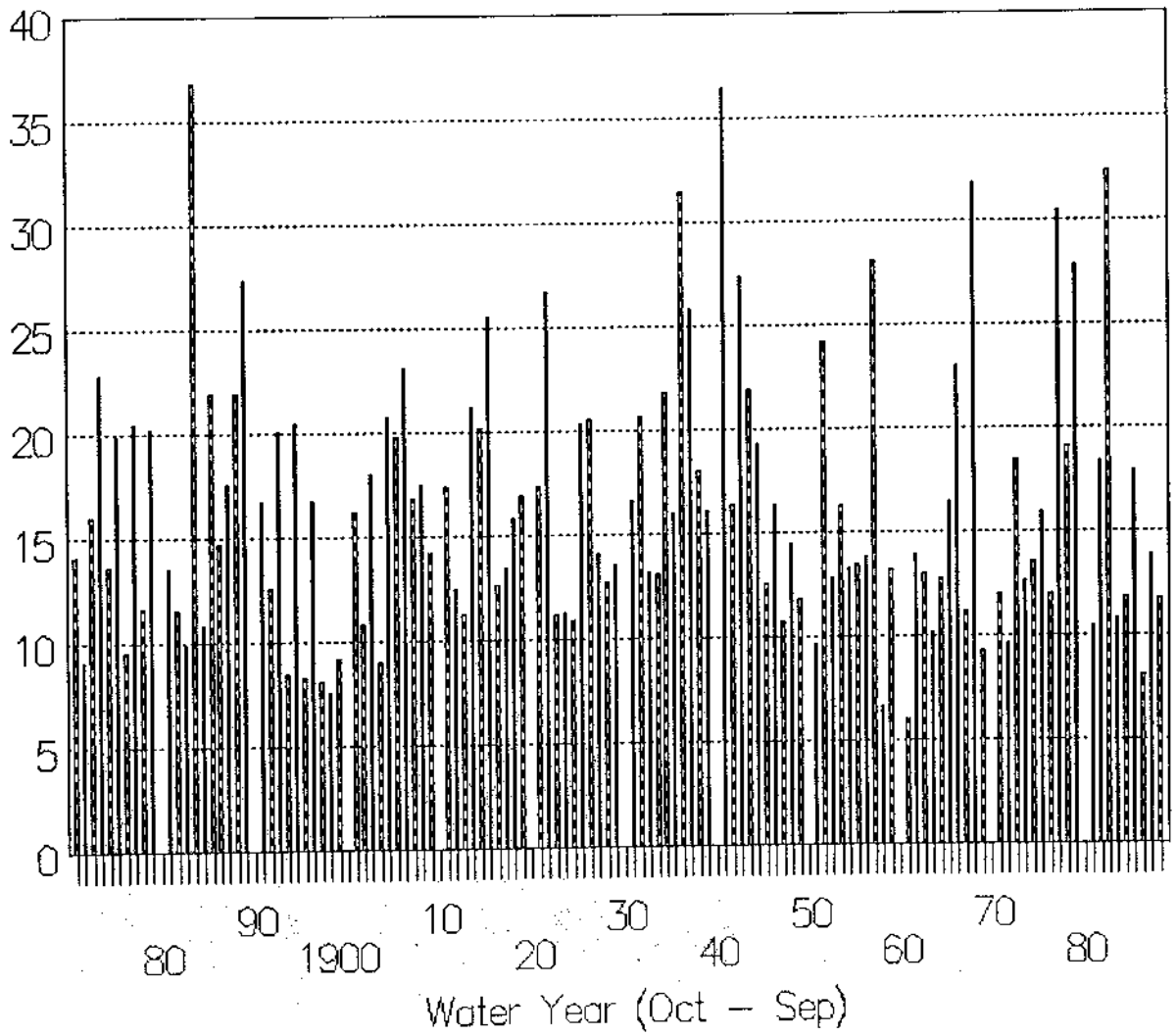
SAN BERNARDINO

Monthly Precipitation (1870–1989)



SAN BERNARDINO

Water Year Precipitation



MONTHLY PRECIPITATION AMOUNTS (IN INCHES)

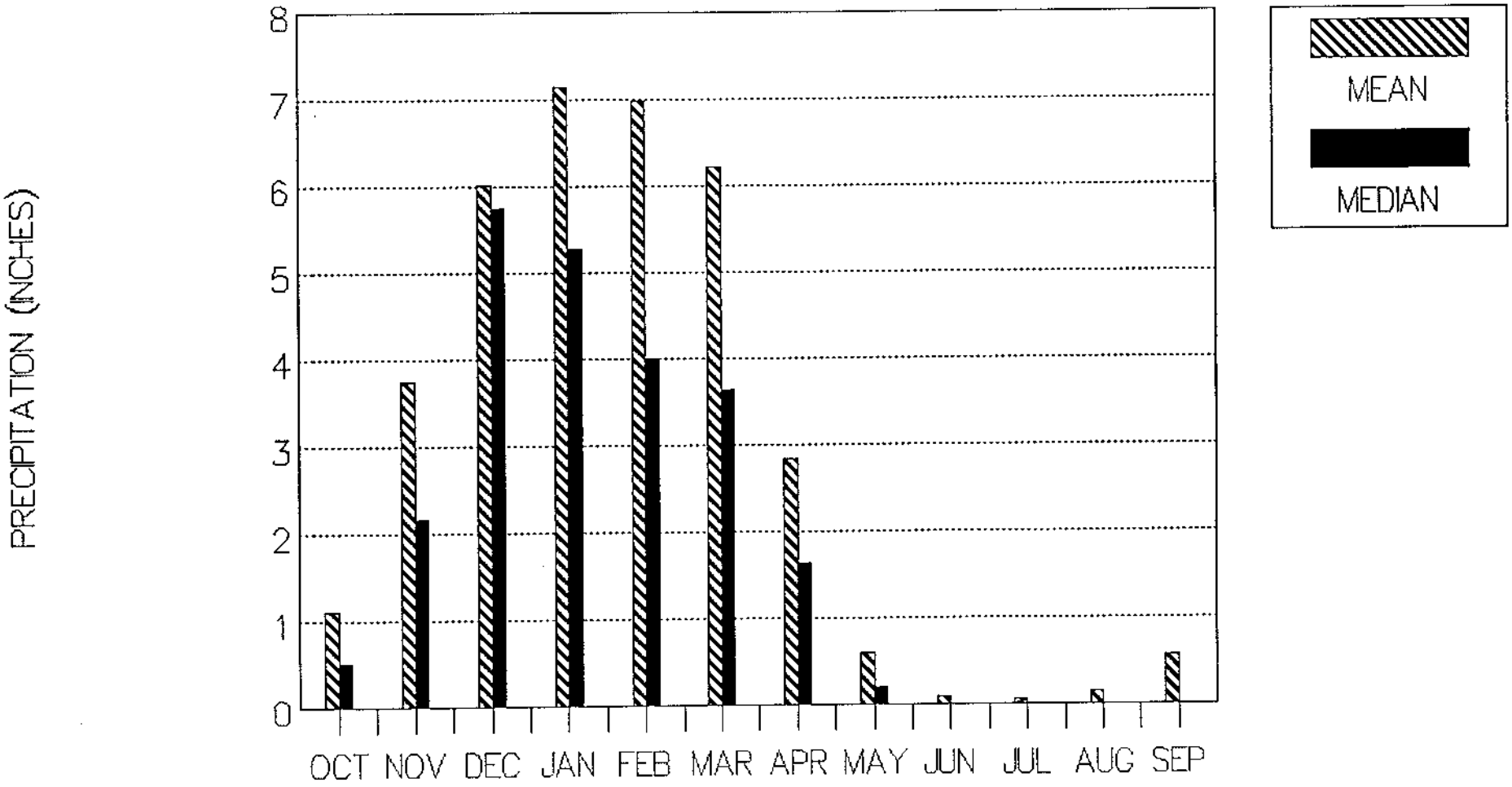
LYTLE CREEK RANGER STATION PRECIPITATION RECORD
ELEVATION 2730 FEET
STATION NO. 8-0-158 (PLATE 7)

WATER YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
`1930-31				4.35	5.64	0.35	7.85	0.77	0.00	0.00	0.59	0.45	
`1931-32	1.98	7.51	10.15	3.12 P	13.25 P	0.00 P	0.70	0.00 T	0.86	0.00	0.00	0.00 P	37.57
`1932-33	0.19	0.00	3.26 P	12.24 P	0.44 P	0.99 P	0.59	1.46	0.09	0.00	0.11	0.02	19.39
`1933-34	0.92	0.05	14.35 P	6.18 P	4.79 P	0.16 P	0.07 P	0.16 P	0.67	0.00	0.10	0.22	27.67
`1934-35	6.59	2.69	8.06	6.67 P	5.32 P	5.64 P	6.33 P	0.26 P	0.00	0.00	0.43	0.00 T	41.99
`1935-36	0.25	0.77	0.87	0.09 P	16.92	2.76	2.62	0.00	0.00	0.00 T	0.00	0.00	24.28
`1936-37	3.75	0.33	19.52	6.68	9.16	12.60	0.41	0.23	0.00	0.00	0.00	0.00	52.68
`1937-38	0.00	0.00	7.82	5.51	20.83	19.19 P	3.00 P	1.73 P	0.00 T	0.00	0.00 T	0.00	58.08
`1938-39	1.03	0.14	14.46	4.83	2.47	3.49	2.28	0.18	0.00	0.00	0.00 T	9.62	38.50
`1939-40	0.60	0.32	1.36	11.39	10.21	4.42	3.72	0.00 T	0.00	0.00	0.00	0.00	32.02
`1940-41	3.02	1.65	14.27	5.28	18.89	20.78	10.29	1.31	0.00	0.00	0.29	0.00	75.78
`1941-42	3.46	1.28	12.79	0.81	3.06	3.55	5.36	0.13	0.00	0.00	0.73	0.00	31.17
`1942-43	2.08	1.17	1.49	28.00	11.58	11.55	2.38	0.00	0.00 T	0.00	0.00	0.12	58.37
`1943-44	1.54	1.09	13.73	2.57	22.00	3.83	3.71	0.27	0.32	0.00	0.00	0.00	49.06
`1944-45	0.18	15.04	1.99	0.70	9.93	11.07	0.62	0.25	0.04	0.00	0.68	0.00	40.50
`1945-46	0.50	0.22	12.84	0.69	2.65	13.76	0.81	0.12	0.00	0.17	0.00	0.24	32.00
`1946-47	2.71	21.12	7.62	1.57	2.03	1.89	0.69	0.19	0.10	0.00	0.00 T	0.19	38.11
`1947-48	0.12	0.01	6.48	0.02	7.08	5.62	5.55	0.11	0.72	0.00	0.00	0.00 T	25.71
`1948-49	0.62	0.06	6.90	12.01	3.58	2.55	0.00 T	0.98	0.00	0.00	0.00 T	0.00 T	26.70
`1949-50	0.33	5.18	6.82	5.73	3.00	2.46	2.95	0.22	0.00	0.00	0.00	0.08	26.77
`1950-51	0.70	3.66	0.00 T	4.44	1.45	0.62	3.13	0.16	0.00	0.00	0.00	0.26	14.42
`1951-52	2.77	2.57	11.86	18.82	0.19	17.48	2.67	0.00	0.00	0.00	0.00	0.39	56.75
`1952-53	0.00	9.69	5.75	4.14	1.20	2.09	0.90	0.72	0.00	0.00	0.00	0.00	24.49
`1953-54	0.00 T	1.44	0.38	16.46	6.62	10.49	0.28	0.00	0.04	0.07	0.04	0.00	35.82
`1954-55	0.00	3.92	2.97	7.69	2.21	0.56	1.88	3.00	0.00	0.00	0.00	0.00	22.23
`1955-56	0.00	2.50	1.31	12.41	1.21	0.00	3.53	1.69	0.00	0.20	0.00	0.00	22.85
`1956-57	0.30	0.00	1.50	12.66	3.99	1.76	1.49	1.66	0.20	0.00	0.00	0.00	23.56
`1957-58	3.09	1.97	7.46	3.85	14.41	10.84	13.55	0.10	0.06	0.00	0.05	0.26	55.64
`1958-59	0.22 T	0.50	0.00	4.40	12.57	0.00	1.35	0.00	0.00	0.00	0.00	0.20	19.24
`1959-60	0.00	0.42	2.85	6.77	3.32	1.22	3.90	0.06	0.00	0.00	0.00	0.00	18.54
`1960-61	1.53	5.70	0.37	2.83	0.00	2.12	0.43	0.00 T	0.00	0.00	0.11	0.00	13.09
`1961-62	0.00 T	5.34	5.74	5.55	13.88	2.75	0.08	1.26	0.10	0.00	0.00	0.00	34.70
`1962-63	0.22	0.00 T	0.00	1.26	5.82	3.09	3.42	0.00	0.01	0.00	0.00	3.76	17.58
`1963-64	1.07	4.38	0.32	5.16	0.09	3.64	3.70	1.44	0.31	0.00	0.00	0.00	20.11
`1964-65	0.65	3.41	3.06	1.36	0.42	0.98	12.26	0.09	0.03	0.16	0.00	0.28	22.70
`1965-66	0.00	22.80	11.19	1.06	2.99	0.60	0.09	0.17	0.00	0.00	0.00	0.24	39.14
`1966-67	0.14	4.50	15.38	7.08	0.03	9.01	8.75	0.35	0.11	0.00	0.03	0.45	45.83
`1967-68	0.00	8.02	2.89	2.12	1.92	3.86	1.63	0.19	0.01	1.25	0.00	0.00	21.89
`1968-69	0.46	0.96	1.67	44.47	21.62	2.02	1.47	1.14	0.06	0.15	0.00	0.00	74.02
`1969-70	0.00 T	2.92	0.07	2.32	4.48	7.75	0.78	0.00	0.18	0.12	0.00	0.00	18.62
`1970-71	0.47	7.34	8.28	1.25	1.82	2.02	1.25	1.72	0.00	0.50	0.00	0.00	24.65
`1971-72	1.54	0.92	15.91	0.00	0.22	0.00	0.49	0.20	0.19	0.00	0.10	0.22	19.79
`1972-73	0.54	6.36	3.50	5.68	18.62	9.97	0.00	0.20	0.00	0.00	0.00	0.00	44.87
`1973-74	0.29	5.15	1.02	16.66	0.00 T	8.19	0.35	0.09	0.00	0.00	0.00	0.00	31.75
`1974-75	2.20	0.30	5.90	0.70	4.59	11.53	3.81	0.82	0.04	0.00	0.00	0.00 T	29.89
`1975-76	1.18	1.70	0.64	0.00	13.72	5.05	1.63	0.28	0.27	0.07	0.03	5.13	29.70
`1976-77	0.12	0.79	1.77	8.81	0.64	3.26	0.04	7.15	0.00	0.00	2.56	0.00	25.14
`1977-78	0.03	0.35	11.80	17.94	21.93	29.74	5.12	0.01	0.00	0.00	0.00	2.10	89.02
`1978-79	0.18	4.99	6.54	13.82	7.35	14.29	0.00	0.50	0.00	0.00	0.04	0.00 T	47.71
`1979-80	2.20	0.15	0.12	26.12	30.89	11.36	1.29	1.39	0.03	0.01	0.00	0.00	73.56
`1980-81	0.18	0.00	1.43	6.20	2.24	7.62	1.73	0.32	0.00	0.00	0.00	0.62	20.34
`1981-82	0.52	5.35	1.52	9.05	2.49	16.60	5.71	0.23	0.00	0.06	0.25	1.22	43.00
`1982-83	1.01	11.74	7.54	12.26	12.84	17.17	9.42	0.12	0.08	0.00	1.29	2.70	76.17
`1983-84	3.48	6.25	8.05	0.60	0.57	0.43	1.01	0.01	0.05	0.09	0.41	0.07	21.02
`1984-85	0.30	4.89	18.35	1.37	3.10	3.84	0.12	0.24	0.08	0.15	0.00	0.31	32.75
`1985-86	1.06	9.16	3.18	5.21	11.10	10.16	2.10	0.04	0.02	0.14	0.00	3.48	45.65
`1986-87	0.50	2.03	1.41	4.92	2.27	3.92	1.16	0.19	0.00	0.01	0.00	0.06	16.47
`1987-88	7.46	4.13	6.23	5.84	2.21	1.50	6.92	0.65	0.00	0.00	0.59	0.02	35.55
`1988-89	0.00	2.29	6.25	1.50	4.54	2.84	0.00	0.32					
`1989-90													
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
SUM	64.28	217.22	348.99	421.22	412.39	367.03	167.37	34.88	4.67	3.15	8.43	32.71	2044.60
YEARS	58	58	58	59	59	59	59	59	58	58	58	58	57
MEAN	1.11	3.75	6.02	7.14	6.99	6.22	2.84	0.59	0.08	0.05	0.15	0.56	35.87
MEDIAN	0.50	2.16	5.75	5.28	3.99	3.64	1.63	0.20	0.00	0.00	0.00	0.00	31.75
MAX	7.46	22.80	19.52	44.47	30.89	29.74	13.55	7.15	0.86	1.25	2.56	9.62	89.02
YEAR	1987	1965	1936	1969	1980	1978	1958	1977	1932	1968	1977	1939	1977-78
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.09
													1960-61
NO. YRS W/O	11	5	3	2	2	4	4	10	32	43	39	31	
PERCENT	19	9	5	3	3	7	7	17	55	74	67	53	

T-TRACE
P-LYTLE CREEK POWERHOUSE DATA (LYTLE CREEK PH, ELEV. 2250 FEET,
PERIOD OF RECORD 1905 TO 1977, MEAN ANNUAL PRECIP (1905-60): 33.44"

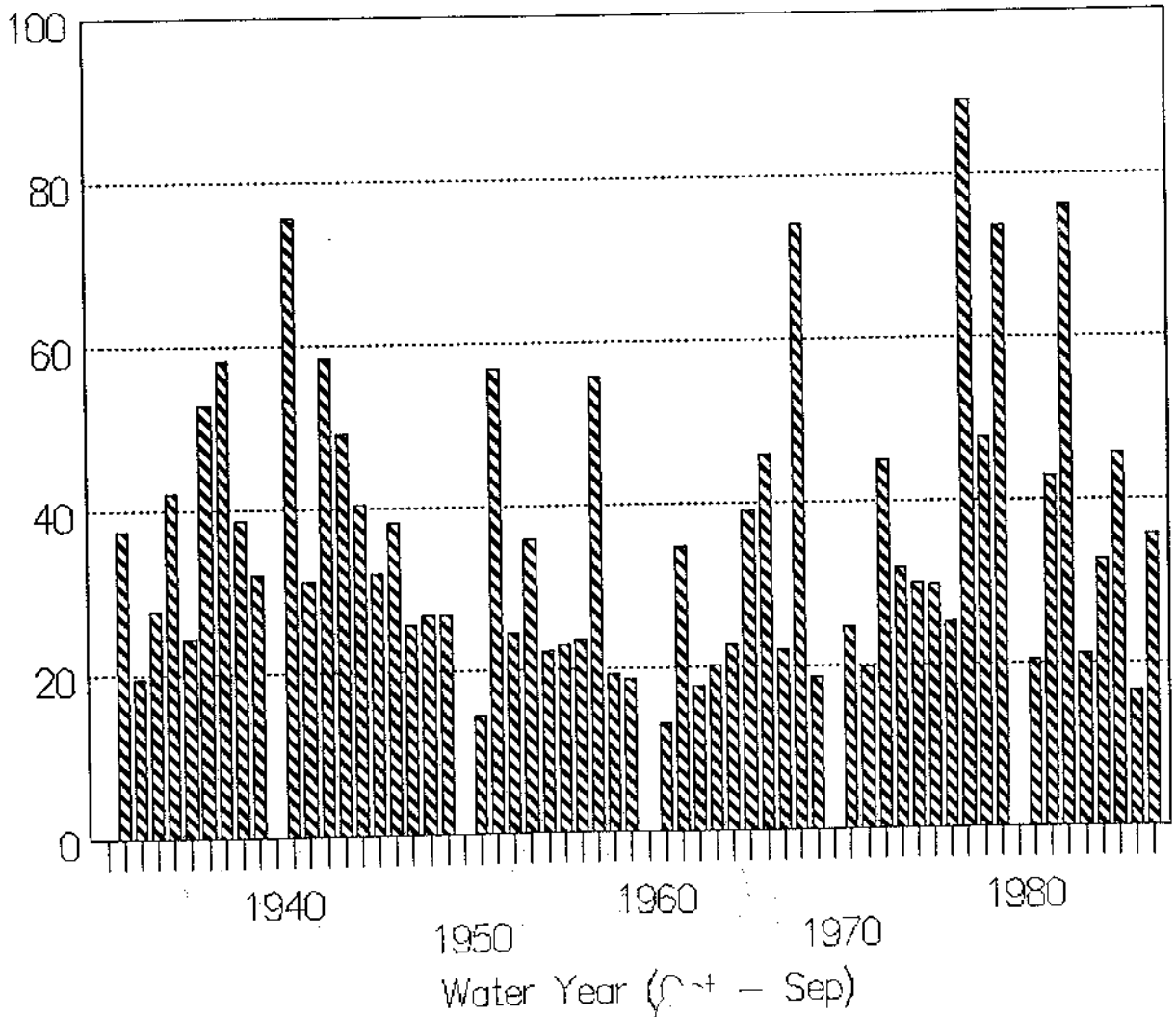
LYTLE CREEK RANGER STATION

Monthly Precipitation (1930–1989)



LYTLE CREEK RANGER STATION

Water Year Precipitation



Standard Project Flood Determination

The SPF for Lytle Creek was developed and presented in the 1964 Corps of Engineers Review Report for Flood Control, Lytle and Warm Creeks, San Bernardino County, California, October 30, 1964. (Plate 1,Ref.16)

A standard project flood is an estimated or hypothetical flood that might be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical region involved, excluding extraordinarily rare combinations. The magnitude of such a flood constitutes a reasonable appraisal of the flood-producing potentialities of the stream, and is considered a reasonable upper limit in determining the size of the flood for which flood-control improvements might be designed.

Estimates of the magnitude of the standard project floods in the areas considered in that report are based on calculations of runoff that would result if a storm having the characteristics of the storm of January 21-24, 1943, which centered in the Los Angeles area, were to center over the considered drainage areas. The estimates are also based on the assumption that future developments in the drainage areas would render much of the foothill and valley areas impervious to percolation and that the Lytle Creek channel would be paved at some future time from the mouths of Lytle Creek and Cajon Creek Canyons to the Foothill Boulevard inlet structure.

Floods of record.- Little information is available on the magnitude of floods before 1884. The largest flood of record during the period 1884 to 1962 occurred on February 23, 1891, at which time the peak discharge in the East Branch of Lytle Creek at the foot of "F" Street (present Colton Avenue crossing) in San Bernardino was estimated to be 30,000 cubic feet per second. No information is available regarding the flow along the West Branch of Lytle Creek at that time. However, assuming the same percent of total flow in the East and West Branches of Lytle Creek in 1891 as occurred in 1938, the peak discharge during the 1891 flood for Lytle Creek at Foothill Boulevard is estimated at 41,200 cubic feet per second. Large floods also occurred on March 2, 1938, and January 23, 1943, when estimated flows of 30,000 and 14,000 cubic feet per second, respectively, occurred on Lytle Creek at Foothill Boulevard. Other medium to large floods occurred in 1884, 1886, 1889, 1894, 1903, 1910, 1914, 1916, 1921, 1922, 1927, and 1958. After the 1964 SPF study was completed, other medium to large floods occurred in 1966, 1967, 1969, 1978, 1980 and 1983.

Floods along the Santa Ana River have generally occurred at the same time as floods along Lytle Creek. Estimates of discharges of the Santa Ana River at Riverside Narrows, near Riverside, Calif., indicate that the 1891 and 1938 floods were about the same magnitude - about 100,000 cubic feet per second.

Flood Characteristics - The rate of infiltration of rainfall in the mountainous parts of the drainage area is low, and the rate of runoff from the steep slopes is high. During periods of intense rainfall, runoff quickly concentrates in the canyons and discharges upon the alluvial cones. Heavy

loads of debris and silt are carried by the streams during large floods. Floodwaters emerging from Lytle Creek and Cajon Creek Canyons and the Devil Creek diversion, which empties into Cajon Creek at its confluence with Lytle Creek are effectively confined above Foothill Boulevard between the levees of the existing project.

Flood Frequencies - A study was made of the runoff records in and near the Lytle Creek basin during the 79-year period, 1884-1962, and the peak flows of all major floods were determined for Lytle Creek at Foothill Boulevard and for the Santa Ana River at Riverside Narrows. Lytle Creek flows were adjusted to reflect the 1958 diversion of Devil and Badger Creek (a small creek to the east of Devil Creek) to Lytle Creek. The Santa Ana River flow data for Riverside Narrows were adjusted to reflect average future conditions at a point downstream from Warm Creek.

Estimates Of Peak Discharge - Peak-discharge data used to develop the discharge-frequency curves for Lytle Creek at Foothill Boulevard and for the Santa Ana River at Riverside Narrows for the 79-year period 1884-1962 are given in the following table:

Estimated and recorded peak discharges for Lytle Creek at Foothill Blvd. 1884-1962 - Santa Ana River basin, Calif.

Floods in order of decreasing magnitude		Estimated discharge of record	Adjusted discharge*	Source of information
No.	Date			
		Cubic feet per second	Cubic feet per second	
1	Feb. 23, 1891	41,200	42,400	USGS - WSP-447***.
2	Mar. 2, 1938	30,000	31,300	(**).
3	Mar. 6, 1884	20,000	21,200	(***).
4	Jan. 27, 1916	15,500	17,100	USGS - WSP-426.
5	Jan. 18, 1916	16,000	16,400	Do.
6	Feb. 21, 1914	16,000	16,100	USGS - WSP-447.
7	Feb. 17, 1884	14,000	14,600	USGS - WSP-981.
8	Jan. 23, 1943	14,000	14,400	USGS - WSP-1315B.
9	Mar. 15, 1889	11,000	11,500	(***).
10	Dec. 25, 1889	10,000	10,600	(***).
11	Jan. 1, 1910	9,500	9,900	(***).
12	Jan. 19, 1886	9,000	9,500	(***).
13	Feb. 9, 1922	8,000	8,100	(***).
14	Apr. 1, 1903	7,000	7,500	(***).
15	Dec. 20, 1921	6,000	6,300	(***).
16	Dec. 19, 1894	6,000	6,300	(***).
17	Jan. 18, 1914	4,900	5,000	(***).
18	Feb. 16, 1927	3,500	3,800	(***).
19	Feb. 22, 1944	3,700	3,700	(***).
20	Jan. 26, 1890	3,500	3,700	(***).
21	Jan. 8, 1940	3,600	3,600	(***).
22	Mar. 4, 1943	3,400	3,400	(***).
23	Mar. 4, 1941	2,800	3,200	(***).
24	Mar. 22, 1893	3,000	3,100	(***).

* All discharges were adjusted to include the inflow from Devil and Badger Creeks, which were diverted into Lytle Creek in 1958.
** Computed by U.S. Army Engineer District, Los Angeles.
*** Estimated from discharges of tributaries and nearby streams.

The tables on pages B-24 - B-27 are extracted from the 1964 reference previously cited. Precipitation and runoff data were gathered from stations as shown on Plate 7 and identified in tables 2 & 3. Table 1 shows a summary of climatological data for San Bernardino (1870-1961); Table 2 gives identification of precipitation stations to determine the SPF; Table 3 gives information on stream gauges located within the Lytle-Cajon drainage area.

Determination Of The Standard Project Flood - The standard project flood was determined at each of the selected concentration points by the following procedure: (a) Determination of unit-time increments of precipitation for each subarea, (b) determination of effective precipitation by subtraction of loss rate, (c) determination of subarea surface-runoff hydrograph by application of subarea synthetic unit-hydrograph values to the unit-period effective precipitation, (d) determination of subarea total runoff hydrograph by addition of base flow and subtraction of channel-percolation losses, and (e) determination of total flood hydrograph for the concentration points by channel routing and combining subarea hydrographs as required.

Discharge-frequency curves for Lytle Creek at Foothill Boulevard and Santa Ana River downstream from Warm Creek were developed.(see plate B-1) The estimated frequencies of uncontrolled floods of various magnitudes for the two points are given in the following table:

Estimated flood frequencies - Lytle Creek at Foothill Blvd. and the Santa Ana River at Warm Creek, Santa Ana River basin, Calif.

NOTE: LYTLE CREEK AT FOOTHILL REPRESENTS INFLOW TO LYTLE CREEK INTAKE STRUCTURE

Number of times that flood would be equaled or exceeded in 100 years	Uncontrolled peak discharges	
	Lytle Creek at Foothill Blvd.	Santa Ana River downstream from Warm Creek
	Cubic feet per second	Cubic feet per second
0.30	*88,000	*227,000
0.36	80,000	218,000
0.64	60,000	178,000
0.97	48,000	150,000
1.2	42,000	136,000
1.8	33,000	110,000
2.6	.....	90,000
4.0	.....	65,000
5.5	.....	50,000
7.5	.....	38,000

* Standard project flood.

PERIOD OF RECORD: 1884-1962

NOTE: THE FOLLOWING SPF WAS DEVELOPED IN 1964.

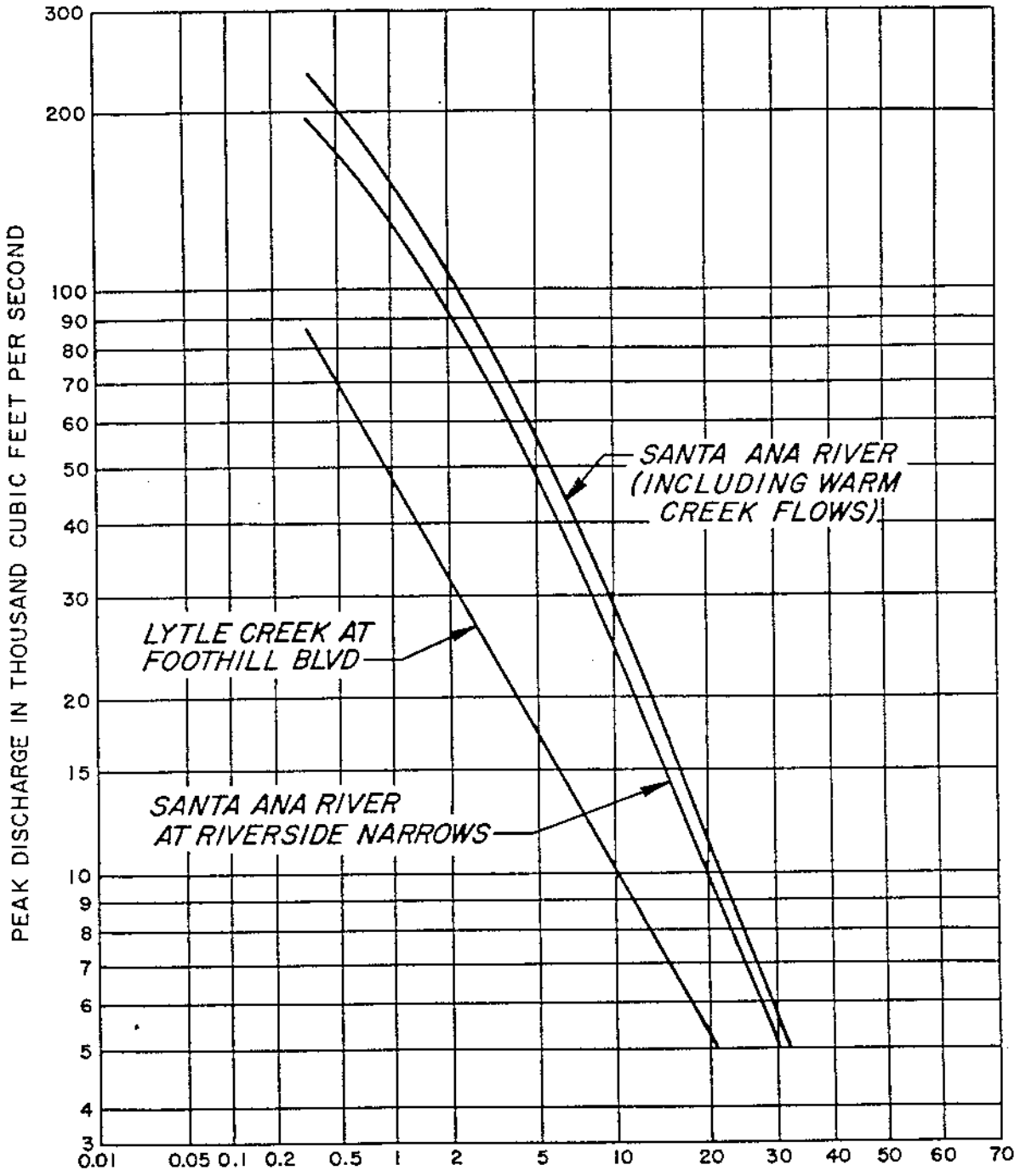
The peak discharges of the standard project flood at pertinent points on Lytle and Warm Creeks and on the Santa Ana River are given in the following table:

Estimated peak discharges of the standard project flood on Lytle and Warm Creeks and on the Santa Ana River, Santa Ana River basin, Calif.

Location	Peak discharges*
	Cubic feet per second
Lytle Creek:	
At Foothill Blvd	88,000
East Branch of Lytle Creek at Warm Creek	58,000
West Branch of Lytle Creek at Warm Creek	30,500
Warm Creek:	
Upstream from East Branch of Lytle Creek	**9,000
Downstream from East Branch of Lytle Creek	60,000
Downstream from West Branch of Lytle Creek	90,000
Santa Ana River:	
Upstream from Warm Creek	156,000
Downstream from Warm Creek	227,000

* Peak discharges are based on the assumption that much of the foothill and valley areas will be impervious to percolation due to future urban and commercial developments and that Lytle Creek would be a paved channel from the mouths of Lytle and Cajon Creek Canyons to the Foothill Blvd. inlet structure.
** Based on local storm of March 3-4, 1943.

Discharges for locations on the Santa Ana River downstream and upstream of Warm Creek were recomputed for subareas contributing downstream of Lytle Creek Intake Structure to account for increased impervious area than previously calculated. The 1969 COE General Design Memorandum No. 1 for Lytle and Warm Creeks San Bernardino County, California computed design values of 234,000 and 167,000 cubic feet per second respectively for these locations. Subsequent hydrologic studies performed in support of the Santa Ana River Project produced revised SPF and discharge frequency estimates on the mainstream Santa Ana River from those shawn above and in Plate B-1.



PERIOD OF RECORD: 1884-1962

SANTA ANA RIVER BASIN, CALIFORNIA
LYTLE AND WARM CREEKS
AND SANTA ANA RIVER

DISCHARGE-FREQUENCY CURVES

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
DESIGN MEMO. NO. 1 DATED: MAY, 1969

SOURCE: PLATE 1,REF.17

PLATE B-1

Table 1

Summary of climatological data at San Bernardino (station No. 8-0-24A)*, Lytle and Warm Creeks, Santa Ana River basin, Calif.

Month	Temperature (period of record 1891-1961)**			Precipitation (period of record 1870-1961)***		
	Mean monthly	Record highest	Record lowest	Mean monthly	Maximum monthly	Minimum monthly
	Degrees Fahrenheit	Degrees Fahrenheit	Degrees Fahrenheit	Inches	Inches	Inches
Jan.	47.0	92	17	3.26	15.51	0
Feb.	58.0	93	21	3.21	12.20	0
Mar.	56.2	97	26	2.73	10.10	0
Apr.	60.3	103	27	1.41	9.35	0
May	64.5	109	33	.58	3.34	0
June	70.5	116	37	.09	1.02	0
July	76.9	116	42	.03	.42	0
Aug.	76.8	116	42	.20	2.16	0
Sept.	72.9	115	36	.21	2.37	0
Oct.	65.4	107	29	.73	4.63	0
Nov.	58.1	99	24	1.29	7.50	0
Dec.	52.9	93	17	2.71	10.85	0

* See pl. 1 for location of station, which is numbered in accordance with quadrangle-index system of the U.S. Army Engineer District, Los Angeles, Corps of Engineers.

** Mean-annual temperature for period of record is 63.3 degrees Fahrenheit.

*** Mean-annual precipitation for period of record is 16.41 inches.

NOTE.--Above data from U.S. Weather Bureau climatological data.

STATIONS SHOWN ON PLATE 7

Table 2

Precipitation stations in and near drainage areas of Lytle and Warm Creeks, Santa Ana River basin, Calif.

No.*	Station**	Elevation	Geographic coordinates		Period of record		Complete years of record	73-year mean-seasonal precipitation***	Authority
			Latitude	Longitude	Recording gage	Non-recording gage			
		Feet	Degrees and minutes	Degrees and minutes				Inches	
8-0-11A...	Glenn Ranch	3,250	34-15	117-31	(##)	1899-1948	21	31.2	USWB.
8-0-11B...	Glenn Ranch	3,250	34-15	117-29	1942-63	(##)	22	(###)	Do.
8-0-12A...	Squirrel Inn No. 1	5,239	34-14	117-15	(##)	1919-63	44	42.7	SBCFCD.
8-0-12B...	Squirrel Inn No. 2	5,680	34-14	117-14	(##)	1931-63	32	40.6	Do.
8-0-15....	Lytle Creek Powerhouse	2,250	34-12	117-27	(##)	1906-63	57	34.2	USWB.
8-0-24A...	San Bernardino County Hospital.	1,125	34-08	117-16	(##)	1870-1963	93	16.9	Do.
8-0-24B...	Perris Hill	1,280	34-08	117-16	(##)	1935-63	28	16.9	SBCFCD.
8-0-25....	Santa Ana River PH No. 1	2,765	34-09	117-03	(##)	1904-63	59	26.8	USWB.
8-0-26....	Mill Creek No. 2	2,940	34-05	117-02	(##)	1903-63	60	22.8	Do.
8-0-27....	Redlands	1,318	34-03	117-11	(##)	1888-1963	75	14.8	Do.
8-0-29....	Camp Baldy	4,275	34-14	117-40	1927-63	1920-63	43	32.5	Do.
8-0-30....	Arrowhead Springs	2,000	34-11	117-16	(##)	1909-25	16	23.0	Do.
8-0-32....	Atopa Ranch-Reche Canyon.	1,750	34-00	117-15	(##)	1920-63	43	14.6	DWR.
8-0-77....	Kelly's Camp	8,300	34-14	117-36	(##)	1930-43	13	47.6	LACFCD.
8-0-98....	Bennett Ranch	1,850	34-10	117-27	(##)	1918-53	35	25.7	DWR.
8-0-99....	Lytle Creek Intake	2,360	34-12	117-27	(##)	1926-63	37	40.3	Do.
8-0-100...	Devore Ranch	2,500	34-14	117-25	(##)	1919-63	44	32.6	USWB.
8-0-101...	Devil Canyon Gate	1,880	34-12	117-20	1912-63	1912-63	41	23.4	SBCFCD.
8-0-103...	Devil Canyon-Panorama	3,758	34-14	117-19	1929-38	1929-38	9	29.4	DWR.
8-0-104...	Lake Arrowhead	5,150	34-15	117-12	(##)	1891-1940	49	35.8	LA Corp.
8-0-105...	Running Springs	6,050	34-12	117-06	(##)	1934-63	29	40.3	DWR.
8-0-106...	Lytle Creek PH No. 2	1,590	34-09	117-24	(##)	1926-43	16	19.2	Do.
8-0-107...	Lytle Creek Baseline	1,225	34-07	117-21	(##)	1926-63	37	17.7	Do.
8-0-108...	San Bernardino-Hanford	1,048	34-06	117-17	(##)	1929-63	34	14.6	USWB.
8-0-109...	Colton City Hall	975	34-04	117-19	(##)	1923-63	40	15.2	DWR.
8-0-110...	Highland - Corwin	1,340	34-08	117-13	(##)	1908-63	55	18.0	Do.
8-0-111...	Highland - Ewing	1,450	34-08	117-12	(##)	1924-45	20	18.1	Do.
8-0-112...	E. Highland - Orange	1,520	34-07	117-10	(##)	1947-63	16	19.1	Do.
8-0-113...	Santa Ana River PH No. 3	1,970	34-06	117-06	1939-63	1904-63	59	20.6	USWB.
8-0-114...	Redlands - Crafton Heights.	2,120	34-03	117-06	(##)	1930-63	33	16.3	DWR.
8-0-115...	Mentone - Crafton Orange Growers.	1,650	34-04	117-08	(##)	1929-63	34	16.4	Do.
8-0-124...	Crown Jewel - Redlands	1,225	34-05	117-13	(##)	1929-45	15	13.8	Do.
8-0-135A...	Yucaipa - Arnett	2,850	34-02	117-02	(##)	1924-45	20	18.8	Do.
8-0-135B...	Yucaipa - SBCFCD	2,705	34-01	117-04	1943-63	1943-63	20	(###)	SBCFCD.
8-0-137...	Redlands - Anderson	1,460	34-03	117-10	(##)	1930-63	33	14.4	Do.
8-0-147...	Colton - SCE Substation	940	34-03	117-19	(##)	1929-63	34	13.3	Do.
8-0-154...	Colton - SPRR	975	34-04	117-19	(##)	1877-1963	86	15.1	Do.
8-0-158...	Lytle Creek Ranger Sta	2,760	34-14	117-29	(##)	1930-63	33	37.8	USWB.
8-0-159...	Lytle Creek FUW Co	2,360	34-12	117-27	(##)	1925-63	38	32.8	Do.
8-0-160...	Panorama Meintenance	4,000	34-14	117-18	(##)	1935-45	7	29.8	DWR.
8-0-162...	Rialto - Adams	1,175	34-05	117-23	(##)	1940-63	23	16.7	Do.
8-0-154...	East Highland - Gold Buckle Assn.	1,400	34-07	117-10	(##)	1930-63	33	17.2	Do.
8-0-165B..	Redlands Junction	1,255	34-02	117-13	1935-63	1935-63	28	(###)	SBCFCD.
8-0-166A..	Craftonville - SPRR	1,759	34-04	117-08	(##)	1892-1918	26	15.2	USWB.
8-0-166B..	Crafton - SBCFCD	2,120	34-03	117-06	1927-63	1927-63	36	(###)	SBCFCD.
8-0-167...	Cajon Ranger Sta	2,900	34-19	117-29	(##)	1921-34	9	23.9	Do.
8-0-174...	Mill Creek Ranger Sta	2,750	34-06	117-02	(##)	1926-51	6	22.8	Do.
8-0-181R..	Devil Canyon	2,780	34-14	117-20	1937-44	1927-63	36	29.5	Do.
8-0-186B..	Del Rosa Ranger Sta	1,580	34-10	117-15	1943-63	1934-63	29	(###)	Do.
8-0-198...	Burton's Ranch	4,400	34-17	117-24	(##)	1904-15	11	42.3	LA Corp.
8-0-200...	Grass Valley	5,190	34-15	117-13	(##)	1893-1915	14	37.5	Do.
8-0-201...	Cajon Pass Summit No. 2	3,820	34-20	117-25	(##)	1904-15	9	17.2	USWB.
8-0-204...	Deep Creek	5,200	34-14	117-07	(##)	1893-1915	18	31.6	LA Corp.
8-0-205...	Morses	5,250	34-14	117-15	(##)	1892-1915	23	53.9	DWR.
8-0-209A..	Crestline	4,865	34-15	117-18	1940-53	1939-53	13	38.3	USWB.
8-0-210...	Devil Canyon USFS	2,781	34-12	117-18	1927-44	1927-44	9	31.1	Do.
8-0-213...	Running Springs 1 E	5,965	34-12	117-05	1939-63	1939-63	24	36.3	Do.
8-0-227...	Bloomington	1,100	34-04	117-24	(##)	1952-63	11	(###)	SBCFCD.
8-0-235...	Cajon Creek Muscoy Ranch	1,500	34-10	117-22	(##)	1928-38	7	22.7	DWR.
8-0-253...	Redlands - Ewing	1,750	34-09	117-13	(##)	1924-45	21	18.1	Do.
8-0-261...	Muscoy	1,267	34-08	117-20	(##)	1940-63	23	17.2	Do.
8-0-262...	Etiwanda - Moore	1,620	34-09	117-27	(##)	1948-63	15	19.2	Do.
8-0-266...	Lake Arrowhead	5,205	34-15	117-11	(##)	1940-63	23	43.7	USWB.
8-0-276...	Fleming's Mill	5,010	34-15	117-12	(##)	1893-1900	7	42.6	DWR.
8-0-278...	Talmadge	5,750	34-15	117-14	(##)	1893-1900	6	48.2	Do.

See footnotes at end of table.

STATIONS SHOWN ON PLATE 7

Table 2--Continued

Precipitation stations in and near drainage areas of Lytle and Warm Creeks, Santa Ana River basin, Calif.

No.*	Station**	Elevation	Geographic coordinates		Period of record		Complete years of record	73-year mean seasonal precipitation***	Authority#
			Latitude	Longitude	Recording gage	Non-recording gage			
		Feet	Degrees and minutes	Degrees and minutes				Inches	
8-0-327...	San Bernardino County Garage.	1,040	34-07	117-12	1941-63	1941-63	22	(###)	SBCFCD.
8-0-355...	Strawberry Peak Lookout...	6,150	34-14	117-14	(##)	1953-63	10	(###)	CE.
8-0-367...	Cajon Junction.....	3,120	34-19	117-28	1943-63	1943-63	20	(###)	SBCFCD.
8-0-371...	Day Canyon.....	2,576	34-11	117-32	(##)	1947-63	16	(###)	Do.
8-0-376...	Lytle Creek - Foothill Blvd.	1,160	34-06	117-20	(##)	1947-63	16	(###)	USWB.
8-0-385...	Crestline-Lake Gregory....	4,425	34-14	117-16	1953-63	1953-63	10	(###)	Do.
8-0-386...	Cajon West Summit.....	4,780	34-23	117-34	1939-63	1939-63	24	(###)	Do.
8-0-387...	Etiwanda.....	1,390	34-08	117-31	1948-63	1948-63	15	(###)	Do.
8-0-388...	Blue Jay.....	5,400	34-13	117-14	(##)	1958-63	5	(###)	SBCFCD.
8-P-123...	El Casco Sta. - SPRR.....	1,874	33-59	117-07	(##)	1899-1918	19	(###)	USWB.
8-P-205...	Moreno Mutual Water Co. - Singleton.	2,295	33-58	117-02	(##)	1928-45	16	16.0	DWR.
8-P-206...	Moreno Mutual Water Co. - Hendricks.	1,550	33-55	117-10	(##)	1927-45	14	11.0	SCS.
8-P-292...	San Timoteo.....	1,603	33-58	117-07	(##)	1953-63	10	(###)	SBCFCD.
9-0-3.....	Holcomb.....	7,240	34-18	116-55	(##)	1909-18	9	17.8	DWR.
9-0-4.....	Big Bear Lake - Preston...	6,800	34-14	116-55	(##)	1931-42	11	24.4	Do.
9-0-6.....	Seven Oaks.....	5,057	34-11	116-57	(##)	1909-55	41	27.1	USWB.
9-0-8.....	Big Bear Lake - Rideout...	6,800	34-14	116-57	(##)	1928-43	12	32.0	DWR.
9-0-11....	Forest Home - Edison Intake.	5,100	34-05	116-56	(##)	1930-45	14	35.2	Do.
9-0-11B...	Mill Creek Intake.....	4,945	34-05	116-56	1948-63	1948-63	15	35.2	USWB.
9-0-12....	Raywood Flat.....	6,620	34-03	116-49	(##)	1931-63	32	36.3	Do.
9-0-13....	Big Bear Lake Dam.....	6,815	34-14	116-58	1940-63	1892-1963	71	37.2	Do.
9-0-14....	Camp Angelus.....	5,770	34-09	116-59	1939-63	1939-63	24	29.8	Do.
9-0-15....	Converse Nursery.....	6,000	34-12	116-54	(##)	1912-17	5	27.6	Do.
9-0-17....	Upper Mill Creek.....	5,600	34-05	116-55	1939-57	1939-57	18	38.7	Do.
9-0-25....	Santa Ana River - Filerea Reservoir.	4,230	34-10	116-57	(##)	1895-1902	7	30.8	DWR.
9-0-26A...	Oak Glen.....	4,900	34-01	116-56	(##)	1900-09	9	30.8	USDA.
9-0-26B...	Oak Glen.....	4,700	34-03	116-57	1934-63	1934-63	29	(###)	SBCFCD.
9-0-37....	Big Bear Lake F.D.....	6,745	34-15	116-55	(##)	1940-63	23	(###)	USWB.
9-0-38....	Big Bear Lake City.....	6,800	34-16	116-50	(##)	1942-63	21	(###)	SBCFCD.
9-0-40....	Oak Glen - SB 122.....	4,080	34-03	116-58	(##)	1952-63	11	(###)	Do.
9-0-41....	Oak Glen - SB 174.....	5,400	34-02	116-55	(##)	1957-63	6	(###)	Do.
9-P-1.....	Beaumont.....	2,613	33-56	116-59	1957-63	1888-1963	75	18.8	USWB.
9-P-8.....	Beaumont Pumping Plant....	3,045	33-59	116-58	1939-41	1911-63	52	22.2	Do.
9-P-71....	Beaumont 1 E.....	2,605	33-56	116-58	1939-57	1939-63	24	15.6	Do.

* Stations numbered in accordance with quadrangle-index system of the U.S. Army Engineer District, Los Angeles, Corps of Engineers.

** See pl. 1 for locations.

*** Computed to a common 73-year (1870-1943) mean by index-of-witness method.

\# CE indicates Corps of Engineers; DWR, Department of Water Resources; LACFCD, Los Angeles County Flood Control District; LA Corp., Lake Arrowhead Corporation; SBCFCD, San Bernardino County Flood Control District; SCS, Soil Conservation Service; USDA, United States Department of Agriculture; and USWB, United States Weather Bureau.

Not applicable.

Not computed.

Table 3

Principal stream-gaging stations and pertinent data in and near the drainage areas of Lytle and Warm Creeks, Santa Ana River basin, Calif.

Station No.	Stream	Location*	Drainage area	Period of record	Discharge of record: Average	Discharge of record: Peak Amount	Discharge of record: Peak Date
			Square miles		Cubic feet per second	Cubic feet per second	
1	Santa Ana River	At "E" Street bridge near San Bernardino.	469	1939-54	12.5	7,600	Jan. 24, 1943
2	...do	Near San Bernardino	302	1928-37, 1954-61	7.7	11,200	Feb. 6, 1937
3	...do	Near Mentone	202	1896-1961	30.0	52,300	Mar. 2, 1938
4	San Timoteo Creek	Near Loma Linda	125	1954-61	1.3	1,050	Apr. 1, 1958
5	...do	Near Redlands	123	1926-61	1.4	7,460	Mar. 2, 1938
6	Warm Creek	Near Colton	259	1920-61	43.6	27,500	Do.
7	City Creek	Near Highland	19.8	1919-61	8.0	6,900	Do.
8	Plunge Creek	Near East Highlands	16.6	1919-61	5.7	5,340	Do.
9	Mill Creek	Near Mentone	51.7	1939-61	3.1	1,500	Dec. 23, 1945
10	...do	Near Craftonville	39.9	1919-38, 1947-54	12.5	18,100	Mar. 2, 1938
11	Little San Gorgonio Creek.	Near Beaumont	2.6	1948-61	.1	320	Aug. 23, 1955
12	Lytle Creek	(West Branch) at Colton.	(**)	1928-45	.8	13,000	Jan. 23, 1943
13	...do	(East Branch) at San Bernardino.	(**)	1929-57	5.3	21,500	Mar. 2, 1938
14	...do	Near Fontana	46.9	1918-61	10.5	25,200	Do.
15	Lone Pine Creek	Near Keenbrook	15.0	1919-38, 1949-61	1.2	6,180	Do.
16	Cajon Creek	Near Keenbrook	40.9	1919-61	8.6	14,500	Mar. 2, 1938
17	Devil Canyon Creek	Near San Bernardino	6.2	1911-14, 1919-61	1.7	3,320	Do.
18	East Twin Creek	Near Arrowhead Springs.	8.6	1919-61	4.5	3,360	Do.
19	Waterman Canyon Creek.	...do	4.6	1911-14, 1919-61	2.6	2,350	Do.

* See pl. 1 for location.
** Indeterminate.

NOTE.--Above data are from records published in the U.S. Geological Survey Water Supply Papers.

STATIONS SHOWN ON PLATE 7

Larger Floods - The Lytle Creek Intake Structure was not designed to detain or attenuate floodwaters. No storage is dedicated for flood control and no reservoir routings were done in the original design. The structure solely diverts flows into the two improved downstream channels, the West and East Branch.

Current standards for dam construction require that a hypothetical probable maximum flood (PMF) be routed through the project to ensure its adequacy against overtopping. This standard was not used for this diversion structure, however, the possible occurence of larger-than-design floods was accounted for by providing gate settings for the West Branch tainter gate that controls outflow to channel capacity for as long as possible. The wider East Branch Channel has more space (100 ft wide channel compared to 40 ft for the West Branch Channel) in the freeboard allowance of 2 ft to pass larger-than-design flows. The Intake Structure could pass 133 percent of the SPF peak flow before being overtopped.

EXHIBIT C

TAINTER GATE AND BACKUP GENERATOR

OPERATION INSTRUCTIONS

GATE OPERATING INSTRUCTIONS
LYTLE CREEK INTAKE STRUCTURE

Uncover Seismic Machine
Put Paper in Drum (Set Paper On Graff at 20.4 - Use Slot)
Put Springs Around Drum (2 Each)
Put Pencil in Holder
Start Seismic Machine

(1) Fill Out Forms (Date,Time,etc.) Set Control Box (Near Engine) Left Handle Up
(2) Start Gate DOWN (Takes About 20 Minutes) Record Time annnd Reading
(3) When Gate is Down --→ Amber Light Comes On - Record Time and Reading

IF RED LIGHT COMES ON - STOP AND BACK UP

(4) Start Gate Up (Takes About 20 Minutes) Record Time and Reading
(5) When Gate is UP --→ Amber Light Comes On Record Time and Reading

IF RED LIGHT COMES ON - STOP AND BACK UP

Shut Off Power - Both Handles Down
- Both End Switches Down And Center Switch Up

BACKUP GENERATOR INSTRUCTIONS

* IF MOTOR STARTS WITH POWER ON - PANEL *
WILL BE BLOWN OUT (It Has Happened)

Turn On Gasoline
Turn On Switch (Turn Switch)
Choke
Push Top And Bottom Buttons Simultaneously To Start
After Warm Up Throtal To 1250 R.P.M.
Adjust Voltage To 240 Volts - Check All Three (3) Phases

Edison - 4(SW) UP
1(SW) DOWN

Motor - 4(SW) DOWN
1(SW) UP

Start Gate Down - Record Time And Reading
Proceed As In Steps 1 through 5

Start Gate UP - CHECK MOTOR FOR RPM LEVEL AND VOLTAGE 1250 RPM
240 Volts

Record Time And Reading

Stop At Starting Point (20.4)

Put In Gallons of Gasoline Before And After Running Motor
Motor Uses About 4 Gallons of Gasoline And Runs
For About 1 Hour Per Test

Left Handle On Control Panel - Center Position
Right Handle On Control Panel - UP Position

End Switches - UP
Center Switch - DOWN

WHEN LEAVE - LEFT HANDLE IN CENTER POSITION *

SOURCE: SBCFCD

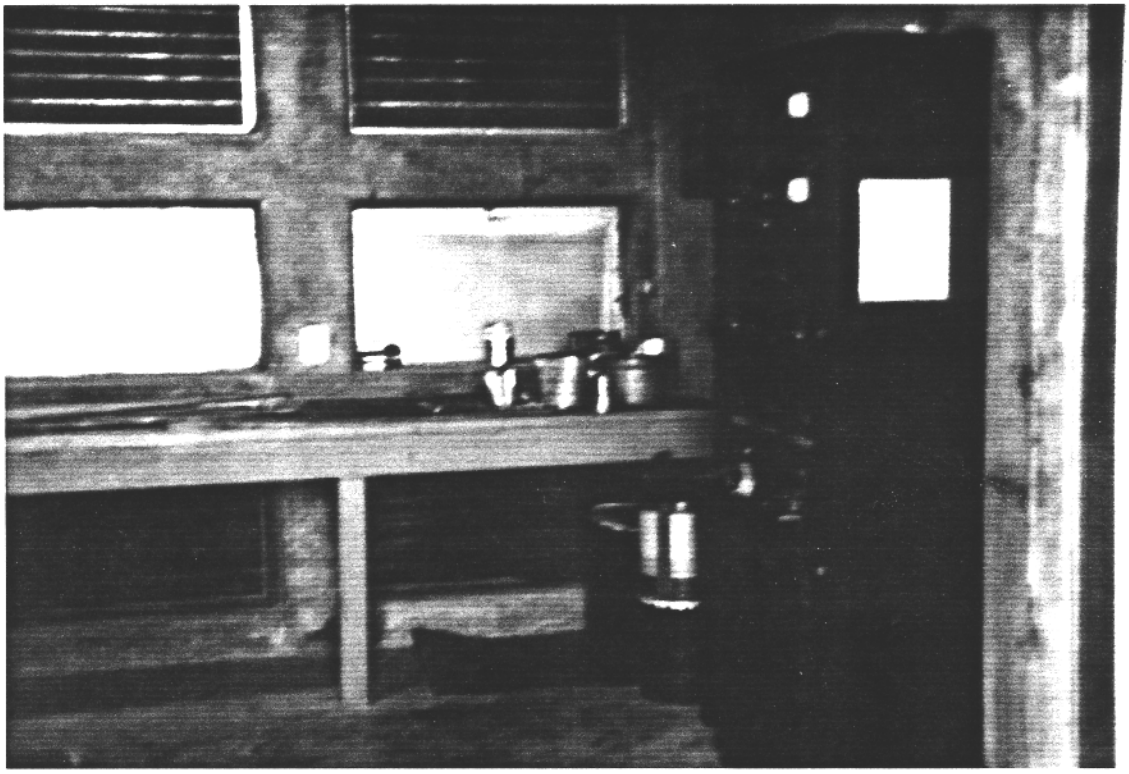


Figure C-1 Interior Of Lytle Creek Intake Control House Showing Electrical Pannel For Commercial Power To Operate Tainter Gate.

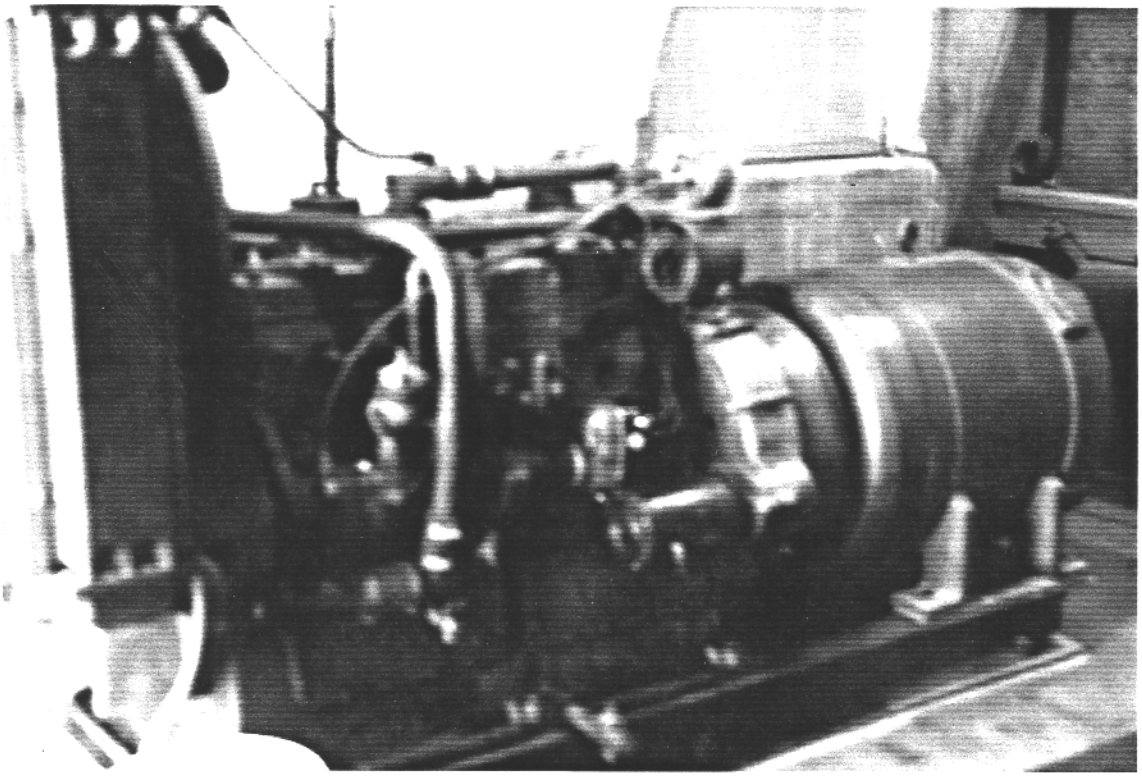


Figure C-2 Interior Of Lytle Creek Intake Structure Control House Showing Backup Power Generator.

EXHIBIT D

USACOE SUGGESTED FORMS FOR

DATA REPORTING

EXAMPLE OF SEMIANNUAL REPORT

Executed copies of the permit documents issued are inclosed for your files.

e. The status of maintenance measures indicated in the previous report as being required or as suggested by the representatives of the Commander is as follows:

(Statement of maintenance operations, item by item with percent completion)

f. The fiscal statement of the superintendent's operations for the current report period is as follows:

(Labor Material Equipment Overhead Total)

1. Inspection

_____

2. Maintenance

_____

3. Flood-fighting operations

_____

Total

_____

Respectfully submitted

_____
Superintendent of Works

FLOOD CONTROL BASIN OPERATION REPORT

Reports Control Symbol
SPLCO – 7

Name **Month** **Year**

Day	Reservoir W.S. Elev			Outlet channel		Gate operation																	OPERATOR
						Time	Gate opening in feet																
	Time	Type of Gage	Gage reading in feet	Time	Gage height in feet		No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11	No.12	No.13	No.14	No.15	No.16	

REMARKS:

SPL FORM 1 DEC 72 19 EDITION OF 1 MAR 55 MAY BE USED

FIGURE D-1

RECORD OF CALLS ☐ Radio ☐ Telephone

DATE

LOCAL TIME	FROM		TO		CHECK REPTBLE CALLS*	MESSAGE OR REMARKS
	PERSON AND/OR CALL SIGN	TELEPHONE AND CITY	PERSON AND/OR CALL SIGN	TELEPHONE AND CITY		

*Reportable telephone calls include collect calls, charge calls and long distance calls that can not be dialed without a code number. Calls are chargeable to MA 3-1311 unless otherwise indicated.

SPL FORM 29 APR 59 188 PREVIOUS EDITIONS ARE OBSOLETE

FIGURE D-2

RAINFALL RECORD

STATION					☐ HOURLY ☐ DAILY		DATE
HR	DA	TIME OF READING	GAGE READING	STORM TOTAL	SEASON TOTAL	OBSERVER	REMARKS (SNOW, TEMP., ETC.)
0000	1						
0100	2						
0200	3						
0300	4						
0400	5						
0500	6						
0600	7						
0700	8						
0800	9						
0900	10						
1000	11						
1100	12						
1200	13						
1300	14						
1400	15						
1500	16						
1600	17						
1700	18						
1800	19						
1900	20						
2000	21						
2100	22						
2200	23						
2300	24						
2400	25						
	26						
	27						
	28						
	29						
	30						
	31						
TOTAL							

SPL FORM OCT 65 31

FIGURE D-3

RECORD OF DATA FROM DIGITAL RECORDERS

NAME OF DAM

DATE	TIME	WATER SURFACE	GAGE HEIGHT	PRECIPITATION	OPERATOR

SPL FORM 1 FEB 77 648

FIGURE D-4

EXHIBIT E

ENVIRONMENTAL ASSESSMENT

Finding of No Significant Impact

Standing Instructions to the Project Operator for Water Control

Lytle Creek Intake Structure

Lytle-Cajon Creeks

San Bernardino County, California

I have reviewed the environmental assessment that has been prepared for the Standing Instructions to the project Operator for Water Control, Lytle Creek Intake Structure, San Bernardino County, California(attached). The significant resources potentially affected include biological resources, cultural resources, land use, air quality, traffic and noise. I have considered the agency comments obtained both formally and informally, and find that the impacts that would result from the proposed action are not significant, and that an environmental impact statement is not required.

22 Jan 91
Date

CHARLES S. THOMAS
Colonel, Corps of Engineers
District Engineer

LYTLE CREEK INTAKE STRUCTURE ENVIRONMENTAL ASSESSMENT

1. LOCATION. The Lytle Creek basin comprises 173 square miles in the north-central part of the Santa Ana River, which itself comprises 2470 square miles. Lytle Creek rises in the San Gabriel mountains near San Antonio Peak and flows southeastward about 30 miles to Warm Creek, which empties into the Santa Ana River near Colton. Near Foothill Boulevard, Lytle Creek divides into two channels: the West Branch, which is an improved concrete channel (design capacity, 30,000 cubic feet per second) extending through Colton to Warm Creek, and the East Branch, an improved concrete channel (design capacity: 58,000 cubic feet per second) extending through San Bernardino to Warm Creek The Lytle Creek basin, which lies in San Bernardino County, is located about 60 miles east of Los Angeles City Hall. The basin, which extends northward and westward from the Santa Ana River at Colton to the San Bernardino and San Gabriel mountains, has a maximum length of 27 miles and a maximum width of about 11 miles. The western portion of the city of San Bernardino and the eastern part of the city of Colton are in the basin.

2. PROPOSED ACTION. Produce Standing Instructions To The Project Operator for Water Control for the Lytle Creek Intake Structure consistent with regulations and guidelines set forth in EM 1110-2-3600 p. 8-20 and Exhibit A, to present a reservoir regulation schedule. Standing Instructions are intended to insure coordination with COE water management procedures after ownership of the structure, built by the COE, was turned over to the County of San Bernardino.

The Standing Instructions To The Project Operator For Water Control for Lytle Creek Intake Structure includes a revised rating and regulation schedule for conveying federal (Corps of Engineers) instructions to the County of San Bernardino officials operating the structure for flood control. The structure was built by the COE and later turned over to San Bernardino County Flood Control District. To insure operations compatible with regional COE flood control strategies, Standing Instructions are issued to accompany the previous Operation and Maintenance Manual. Standing Instructions consist of instructions applicable to damtenders, power plant superintendents, resource managers, etc. Any physical operating constraints are clearly outlined to ensure that water control features are operated in a safe manner and within design limitations during all phases of the project life. These instructions are kept separate from O&M manuals. The operation plans will apply to physical operation and not to water control.

3. ALTERNATIVES.

1. NO ACTION. This alternative would not quantify the rating curves applicable to flows through the Intake Structure after modification of the East Branch Channel in 1976. Applicable

discharges expected at specific elevations at the Lytle Creek Intake Structure will be unknown to San Bernardino County Flood Control District.

2. IMPLEMENT THE REGULATION SCHEDULE. This alternative would properly quantify the flood flows into both East and West Branches of Lytle Creek and subsequently to the mainstem of the Santa Ana River itself. This project is an integral part of the comprehensive flood-control plan for the SAR drainage area, and would prevent all but minor damage from a flood of SPF (standard project flood) to the urban places downstream.

4. AFFECTED ENVIRONMENT.

4.1. Biological Resources. Biological field surveys were conducted in association with preparation of both 1979 and 1983 Environmental Assessments for construction projects in those years; the biological environment within the channel was discussed in both those documents and is very briefly in this document.

a. Vegetation. Downstream from the stabilizer at station 3090+00, a sparse growth typical of dry, sandy, disturbed areas called shrubby riparian is located on the river floor. Species observed include white sweet clover(Melilotus albus), everlasting(Gnathalium spp), sunflower(Helianthus annus), scale broom (Lepidospartum squamatum) , tree tobacco(Nicotiana glauca) and prickly pear cactus (Opuntia littoralis). A remnant area of scattered cattail(Typha latifolia), with giant reed(Arundo donax), willow (Salix goodingii), and mulefat (Baccharis glutinosa) along with sedges(Cyperus spp.) and mugwort(Artemesia douglasiana) occurs on either side of the notched, grouted stabilizer.

b. Wildlife. The channel provides habitat for small mammals, birds, lizards and probably snakes. Standing water may, periodically, provide habitat for bullfrogs(Rana catesbiana). Some smaller mammals such as raccoon(Procyon lotor), and coyote(Canis latrans) are also likely to traverse the site. Almost certainly, feral and house pets prey on riparian wildlife, reducing their numbers and altering ecosystem structure.

c. Threatened, Endangered, or Otherwise Sensitive Species. No obligate riparian nesting birds or threatened or endangered species were observed on field surveys of the study area. Since shrubby riparian vegetation is without the understory characteristic of willow woodland associations, it would be unlikely to find yellow-warbler(Dendroica petechia), yellow-breasted chat(Icteria virens), or least Bell's vireo(Vireo belli pusillus), all of which are dependent on that substrate for habitat. Although not observed in the project area, the bald eagle(Halieetus leucocephalus) and peregrine falcon(Falco peregrinus anatum) as well as other more common raptors are known to visit similar sites. The endangered plants, slender-horned spineflower (Centrostegia leptoceros) and Santa Ana river wooly-star(Eriastrum densiflorum spp. sanctorum) have not been found in the locality by U.S. F.& W.S. for years.

B. Water Quality. The city of San Bernardino operates a wastewater treatment plant near the confluence of East Twin ana Warm Creeks and the Santa Ana River. The treated water is monitored by the city of San Bernardino to ensure its conformance with State Water Quality Control Board standards. No effects of any kind are anticipated to water quality in the Santa Ana River.

C. Cultural Resources. 36 CFR 800.2(0),Section 106 in the regulations implementing Section 106 of the National Historic Preservation Act states that "standing instructions" do not constitute an undertaking.

5. ENVIRONMENTAL EFFECTS

A. Biological Resources. No impacts are anticipated on vegetation or animal populations, endangered or otherwise.

B. Water Quality. No impacts of any kind are anticipated to water quality in the Santa Ana River drainage area.

C. Cultural Resources. A cultural resource survey by the Archeological Research Unit, University of California, Riverside (December 1975), disclosed no cultural resource sites in the project area. Therefore, no impacts to cultural resources will be initiated.

D. Relationship to Environmental Protection Statutes. All applicable environmental statutes and requirements have been considered in the preparation of this environmental assessment. The proposed project boundaries (with the exception of the area within an existing federal project for which an E.I.S. was prepared in 1972 in accordance with the requirements of National Environmental Policy Act of 1969. The COE has coordinated with the appropriate agencies concerning requirements applicable to the current Study, including U.S. Fish and wildlife Service and California Division of Fish and Game.

E. Revisions in the regulation schedule are to accurately quantify the amount of water present at specific elevations at the Lytle Creek Intake Structure subsequent to modification and improvement of the East Branch channel in 1976. The impact is to adequately inform S.B.C.F.C.D. that a much larger flood is now controlled by the Lytle Creek Intake Structure than as first built in 1949. With both improved channels discharging flood waters, the Intake Structure now controls 52,000 c.f.s. before the tainter gate is operated. Originally only 30,000 c.f.s. was controlled. At elevation 1151, Tainter Gate operation on the West Branch channel continues as originally scheduled to hold flows on the West Branch up to 30,000 c.f.s., while the East Branch discharges controlled flows up to 58,000 c.f.s. Total controlled flows at the Lytle Creek Intake Structure are now at Standard Project Flood level of 88,000 c.f.s. Reregulation is necessary to quantify amounts of flood waters present, but has no impact on the physical environment at or near Lytle Creek Intake Structure.

6. CONCLUSION

Because the proposed action will have no significant impacts on the channel either in the project reach or downstream, a finding of no significant impact has been prepared and included in this assessment.

7. REFERENCES

Supplemental Environmental Assessment. Supplement to Design Memorandum No. 1 for Lytle and Warm Creeks, San Bernardino County, California. U.S. Army Corps of Engineers (Los Angeles District), March 1984.

Supplement to Design Memorandum No. 1 for Lytle and Warm Creeks, San Bernardino County, California. Santa Ana River Basin, Calif. Flood Control. U.S. Army Corps of Engineers (Los Angeles District), April 1984.

Supplemental Environmental Assessment To Design Memorandum No. 1 for Lytle and Warm Creeks, San Bernardino County, California. With Finding of No Significant Impact, 30 April 1984.

Review Report for Flood Control. Lytle Ana Warm Creeks, San Bernardino County, California. U.S. Army Engineer District, October 30, 1964.

Operation Ana Maintenance Manual for Lytle and Cajon Creeks. Santa Ana River Basin, San Bernardino County, California. Flood Control Project. Los Angeles District, Corps of Engineers, March 1950.

Definite Project Report on Lytle and Cajon Creeks, Channel Improvements. Santa Ana River Basin, Calif. U.S. Engineer Office, Los Angeles, CA., 1945.

Design Memorandum No. 1. General Design for Lytle Creek Levee. Devil, East Twin, Warm and Ladle Creeks, Calif. Corps of Engineers, U.S. Army, Los Angeles District, November, 1955.

EXHIBIT F

CHAIN OF CORRESPONDENCE FOR

APPROVAL OF STANDING INSTRUCTIONS

CESPD-ED-W (CESPL-ED-HR/29 May 90) (1110-2-240) 1st End Hsu/bg/5-1550
SUBJECT: Lytle Creek Intake Structure Standing Instructions

DA, South Pacific Division, Corps of Engineers, 630 Sansome Street, Room 720, San Francisco CA 94111-2206 16 NOV 1990

For Commander, Los Angeles District, ATTN: CESPL-ED-HR

1. Subject manual is approved subject to the enclosed comments and the following paragraphs. District should submit four copies of the final printing of Lytle Creek Intake Structure Standing Instructions as soon as practicable after completion.

2. We have concern with the lack of an alternate means of reading the water surface elevation. Basing all operations on the readings of the "official staff gage" which is exposed to damage by vandals (as has occurred at several sites) might present problems. Suggest an alternate float well gaging system be considered.

3. District is requested to provide this office its responses to all Division comments and concerns on the water control manual.

FOR THE COMMANDER:

Encl

JAY K. SOPER
Director, Engineering

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2711
LOS ANGELES, CALIFORNIA 90053-2325

REPLY TO
ATTENTION OF

CESPL-ED-HR (1110-2-240) 29 May 1990

MEMORANDUM FOR Commander, South Pacific Division, Attn: CESPD-ED-W

SUBJECT: Lytle Creek Intake Structure Standing Instructions

Enclosed are three copies of the Standing Instructions to the Project Operator for Water Control for your review and approval. The required Environmental Assessment (EA) for Lytle Creek Intake Structure will be forwarded shortly.

FOR THE COMMANDER:

ROBERT E. KOPLIN, PE
Chief, Engineering Division

Encls (3 copies)

CESPD-PD-R (1105) 10 August 1990

MEMORANDUM FOR CESPD-ED-W

SUBJECT: Lytle Creek Standing Instruction

1. Reference memorandum, CESPD-ED-W, 18 July 1990, SAB.

2. The subject document and EA have been reviewed in the Directorate of Planning. We have the following comments:

3. Public notification and public involvement in development of water control manuals is required (by ERs 1110-2-240 and 241) but is not documented by the district. That information should be made part of this package.

4. Environmental Assessment. The NEPA documentation provided is inadequate, and must be revised and resubmitted, in accordance with the following points:

a. False Proposed Action. The EA, a crude draft, takes as its purpose the assessment of "no construction or environmental modification" and finds, needless to say, that this will result in no significant impact. This is [redacted] completely unsatisfactory. The EA must be revised to assess the actual action -- the revisions or potential revisions in the regulation schedule.

b. No Draft FONSI. A draft FONSI must accompany the EA.

c. No Alternatives Considered. One of the requirements of NEPA is that alternatives be developed and that they be discussed in the EA.

d. No 404(b)(1) Evaluation. Paragraph 4D states that "the COE provided the State Regional Water Control Board (RWQCB) with pertinent information regarding the proposed action and requested state certification for the project." It is unclear why the proposed action would require state certification, but if it does, the EA must include information on discharge or fill and the 404(b)(1) evaluation must be included in the review package accompanying the decision document.

5. The point of contact in Environmental Analysis Division is Todd Snow, 705-1622.

BEVERLEY B. GETZEN, Chief
Environmental Analysis Division