VIII - EFFECT OF WATER CONTROL PLAN

8-01. General

The sole purpose of Sepulveda Dam is flood control, and by far the greatest effect and benefit of the dam is the protection of life and property downstream of the facility. The major aspects of flood control at Sepulveda Dam for both the reservoir and spillway design floods, as well as several major historical floods, are discussed in Section 8-02.

Any other effects or benefits of Sepulveda Dam are decidedly secondary to those of flood control, but they are briefly described in Sections 8-03 through 8-08.

8-02. Flood Control

a. Spillway Design Flood. The spillway of the dam was designed to pass, without danger to the dam or threat of overtopping the dam, the greatest rate of discharge that could be expected from the most severe combination of rainfall and runoff conditions that could reasonable occur. This hypothetical flood is called the Probable Maximum Flood.

(1) Original Criteria. The spillway at Sepulveda Dam was designed in 1939 for a peak outflow of 100,500 cfs, having a surcharge of 17.6 feet on the ogee crest (with crest gates at their lowest of 17.6 feet on the ogee crest (with crest gates at their lowest position–elevation 700 feet). An additional 7.4 feet of freeboard to handle runup by waves set the top of the dam at elevation 725 feet.

The spillway design flood resulted from a hypothetical four-day storm that produced 8.4 inches of rain during the maximum 24 hours, as averaged over the drainage area above Sepulveda Dam. Such a storm would result in a peak inflow of 177,000 cfs and a maximum impoundment of 28,700 ac-ft of water.

In a subsequent 1978 study, the adequacy of the Sepulveda Dam spillway was reviewed under the revised criteria. This led to the development of a revised Probable Maximum Flood.

(2) Revised Criteria. Plate 8-01 depicts the hyetograph (graph of incremental precipitation vs. time) of the revised Probable Maximum Precipitation over the drainage area above Sepulveda Dam, plus the hydrograph of the computed inflow, reservoir water surface elevation, and outflow that would result if such a storm were routed into Sepulveda Reservoir and through Sepulveda Dam.

The probable maximum precipitation is based upon a hypothetical 72-hour rain storm developed from the criteria published by the National Weather Service in Hydrometeorological Report No. 36, entitled, “Interim report - Probable Maximum Precipitation in California” (1961, revised 1969). This storm is then critically centered over the drainage area above Sepulveda Dam.

The judgements made for this revised spillway design flood include: reservoir initially full to elevation 710.0 feet (spillway crest with crest gates raised); the flood control outlet works completely blocked by debris; and initial infiltration rates (loss rates) over the 70% pervious portion of the drainage area at the constant low value of 0.12 inch per hour (for basin average effective infiltration rate of 0.08 inch per hour).

The revised Probably Maximum Flood generates a maximum inflow to Sepulveda Reservoir of 114,000 cfs late on the third day of the storm (see pl. 8-01). The maximum water surface elevation in the reservoir rises to 716.66 feet, storing 27,563 ac-ft behind the dam. At this time, the automatic crest gates will have lowered all the way down to 700 feet, and the computed maximum outflow would be 99,300 cfs.

b. Standard Project Flood. The Standard Project Flood represents the runoff event that would result from the most severe combination of rainfall and watershed conditions that are considered reasonably characteristic for the region in question.

For the rainfall to be used in the determination of the Standard Project Flood at a given site, a Standard project Storm is normally selected as the most severe reasonably characteristic storm of record within a climatically homogeneous region surrounding the site, and is then transposed to the drainage area above the target site.

For the drainage area above Sepulveda Dam, the storm of 21-25 January 1943, centered in the San Gabriel Mountains and foothills about 15 to 25 miles east-northeast of Sepulveda Dam, was selected (see Section 8-02.c.(10) for more discussion of this storm). The storm was transposed to the drainage area above Sepulveda Dam, using a transposition factor based upon the mean annual precipitation.

As with the Probable Maximum Precipitation, the portion of the basin impervious to infiltration was set at 30% (with the pervious portion thus at 70%). The infiltration rate for the pervious portion of the basin was determined to average 0.16 inches per hour (for an effective infiltration rate of 0.11 inches per hour). The reservoir was judged to be empty at the start of the Standard Project Storm, but rapidly fills up during the storm and runoff.

Plate 8-02 depicts the hyetograph of the Standard Project Storm and the inflow, storage, and outflow hydrographs of the Standard Project Flood at Sepulveda Dam. The maximum inflow to the dam was computer to be 50,000 cfs on the second day of the storm. Shortly thereafter, the water surface elevation in the reservoir would reach a maximum of 713.52 feet, with 22,492 ac-ft of water stored behind the dam. At the same time, the combined outflow through the ungated outlets and over the spillway (with crest gates partially lowered) would be 41,300 cfs. Under a Standard Project Flood (using modern criteria, with modern watershed conditions), the downstream channel(16,900 cfs capacity) would overflow, inundating a highly urbanized area.

c. Other Floods

(1) 21-25 January 1943. The storm of 21-25 January 1943 was in many respects the most severe of record in the coastal drainages of southern California. It occurred as a series of warm Pacific cyclones from Hawaii, collided with a cold storm moving south from British Columbia, producing strong winds and heavy rain over most of California.

Plate 8-04 depicts the rainfall and runoff of this storm. The total 21-25 January precipitation ranged from less than 8 inches in the northern and western San Fernando Valley to more than 25 inches in the Santa Monica Mountains southwest of Sepulveda Dam. Rainfall was heaviest during the first hour of 22 January, with a less intense but long-lasting period of generally heavy rain during the last six hours of that day.

Because of unseasonably dry antecedent conditions, infiltration rates were high at the beginning of the storm This is reflected in a relatively moderate peak inflow rate to Sepulveda Dam following the intense burst of rain early on 22 January (pl.8-04). Progressive saturation of the ground, brought on by prolonged and increasingly heavy rain on 22 January, resulted in an increasing rate of inflow late in the day. The maximum of the computed mean hourly inflow values was 12,700 cfs during the first hour of 23 January.

The maximum water surface elevation of 669.29 feet was reached several hours later, then 6,341 ac-ft water was stored behind the dam. The maximum outflow released to the channel downstream was 2,710 cfs near mid-day 23 January.

(2) 20-24 February 1944. The storm of late February 1944 developed as a cold storm from the north moved into southern California and intensified. The rainfall of the 20-24 February 1944 even t actually began on 19 February (pl. 8-05), but the reservoir did not begin to rise until early 20 February. Rainfall intensities fluctuated over the light to moderate range until early 22 February, when a 4-hour period of heavier rain resulted in a major acceleration of inflow to Sepulveda Dam.

Because of fairly substantial antecedent precipitation, infiltration rates began relatively low, and dropped even further during the course of the vent. By the time of the heaviest rain of early 22 February, the ground was largely saturated. As a result of this, the peak in the mean hourly inflow to Sepulveda Dam was 15,900 cfs early 22 February; and the maximum water surface elevation o f697.92 feet, with 5,070 ac-ft of water stored behind the dam, occurred about 4 hours later. The maximum outflow of 4,740 cfs occurred at that time.

It might be noted that it was during this even t that a documentation of the rise and fall of the crest gates was made (see Sections 2-03.d.(2)(a) 1b, and pls. 2-16 and 2-17).

(3) 23-27 January 1969. The period of 18-27 January 1969 was exceptionally wet throughout southern California, as a series of warm storms from south of Hawaii were funneled into this area. After moderate to heavy rain 18-22 January, followed by a one-day break, rain resumed 23 January, with several moderate rain bands and one long-lasting, heavy band that climaxed early 25 January (see pl. 8-06). The total precipitation for the period of 23-27 January to southern California ranged from 5-8 inches in the coastal lowlands to more than 25 inches in the San Gabriel Mountains.

By the time of the 24-25 January rain, the ground throughout the Sepulveda Basin and elsewhere was heavily saturated, with a high runoff potential. The result was a peak in the mean hourly inflow to Sepulveda Dam of 16,800 cfs between 0600 and 0700 hours 24 January (pl. 8-06). The water surface in the reservoir peaked four hours later at 693.30 feet, with 2,945 ac-ft of water stored; and the maximum outflow of 11,825 cfs occurred at the same time.

(4) 28 February - 4 March 1978. The storm of late February and early March of 1978 was actually a series of low-latitude Pacific storms that moved into southern California from the west and southwest, dropping more than 10inches of rain in portions of the coastal drainages. Because of numerous heavy storms in January and February 1978, the ground in southern California was almost totally saturated by the time of the major February-March storm.

There were three major peaks of rain between 28 February and 5 March 1978: 28 February, 1 March, and 4 March (pl. 8-07). Each resulted in a sharp up-and-down pattern in the inflow, water surface elevation, and outflow at Sepulveda Dam. The third and largest peak, with four consecutive hours, each having rainfall over the watershed equal to or greater than 0.8 inch, resulted in a maximum hourly inflow of 25,670 cfs just before noon 4 March, followed shortly by a maximum reservoir surface elevation of 697.65 feet, with 5,253 ac-ft stored. The maximum outflow was 13,190 cfs just after noon.

(5) 15-17 February 1980. From 13 though 21 February 1980 a series of intense, warm Pacific storms moved into southern California from out of the west-southwest. The heaviest of these occurred on 16 February (pl. 8-08), in which an intense cold front nearly stalled directly over the western portion of the San Fernando Valley, bringing very heavy rain throughout the afternoon over the drainage area above Sepulveda Dam.

The intensity and total amount of this rainfall can be seen on plate 4-02, which depicts mass curves of accumulated precipitation for the date at Sepulveda Dam and at two stations within the watershed above the reservoir: On (Encino Reservoir) in the Santa Monica Mountains to the south, and the other (Aliso Canyon-Oat Mountain) in the foothills north of the San Fernando Valley. At each of these stations, rainfall rates approaching or exceeding 1 inch per hour were recorded for at least 3 consecutive hours.

With the ground nearly saturated from heavy rains in late January and again 13-15 February, the intense rain of 16 February resulted in the greatest inflow to, and storage of water behind, Sepulveda Dam ever recorded. From 1600 to 1700 hours on the 16^{th}, a mean hourly inflow of 58,970 cfs was computed; this included a maximum of 62,636 cfs recorded at 1625 hours.

As the result of this heavy inflow, and to some extent, the result of a temporarily reduced outflow because of the flooding problems on the downstream Los Angeles River channel, the water behind Sepulveda Dam reached an elevation of 705.10 feet at 1845 hours, with 11,503 ac-ft stored (also see section 2-03.e.(5)). At this time the downstream problems abated and all gated outlets were reopened, producing a peak outflow of 15,288 cfs (the largest ever recorded at Sepulveda Dam).

(6) <u>28 February - March 1983</u>. The storm period of later February and early March 1983 was the climax of a winter and spring of repeated intense, low-latitude Pacific storms that moved into southern California from the west. Plate 8-09 shows the precipitation , inflow, water surface elevation, and outflow at Sepulveda Dam from 28 February through 3 March.

During the course of the storm, there were several up-and-down fluctuations in each of these parameters, but the largest by far of these occurred during the morning go 1 march, when the maximum hourly inflow reached 38,676 cfs; the maximum water surface elevation reached 702.53 feet, storing 8,950 ac-ft; and the maximum outflow reached 14,397 cfs after a brief reduction during mid-morning to alleviate downstream channel problems. Each of these 1 March 1983 values (inflow, water surface elevation, contents stored, and outflow) represents the second greatest value of record (after February 1980) for the respective parameters at Sepulveda Dam.

d. <u>Comparison of Floods</u>. Plate 8-10 is a comparison of the floods discussed in Sections 8-02.a. through 8-02.c. Table 8-01 is a listing of the values depicted on plate 8-10 (as well as on pls. 8-01 through 8-09). The four diagrams of plate 8-10 (corresponding to the four columns of table 8-01) depict the maximum values of water surface elevation, reservoir capacity, the mean hourly inflow, and outflow for the six historical floods and the two design floods at Sepulveda Reservoir. In each of the diagrams of plate 8-10, the floods are arranged in ascending order, according to maximum water surface elevations and capacity.

In all four diagrams of plate 8-10, the Probable Maximum Flood (PMF) is clearly of greatest magnitude. The Standard Project Flood (SPF) is second, except for inflow, where the highest mean hourly inflow on 16 February 1980 exceeded that for the Standard Project Flood. The flood of 1 March 1983 is the second greatest historical flood in all four diagrams of plate 8-10 (fourth highest when the design floods are included). Based on recent hydrologic study conducted in February 1988 (see table 1-01; Draft: Los Angeles County Drainage Area Review: Part I, Hydrology Report), the maximum flood for which spillway flow will not occur is approximately the 80-year event (refer to table 4-08 and pl- 4-07).

It can ben seen from plate 8-10 and table 8-01 that although the maximum inflows of the 1943 and 1944 floods were not as high as those of 1969 and 1978, the maximum storage of water in 1944 was comparable to that of 1978 and was much greater in 1983 than it was in 1969. This is because the outflows were considerably more limited before the 1953 completion of the downstream Los Angeles River channel improvement (Sections 3-03 and 3-05) than they have been in recent years.

e. Hypothetical Dam Failure. Plate 8-11 depicts that areas of probable inundation downstream of Sepulveda Dam that could result in the extremely unlikely event of a failure of Sepulveda Dam with water impounded to the top of the spillway crest with crest gates raised (elevation 710 feet). The floodwaters would, in such a scenario, spread out across a broad zone on either side of the Los Angeles River, with widths exceeding one mile in some places. This inundation zone would narrow rapidly at a distance of about 5 miles downstream of the dam, would widen slightly again about three miles further downstream, and would eventually narrow and become confined to the river channel near downtown Los Angeles.

Travel times for such a dam-failure crest are shown on plate 8-11. The travel rates would be very rapid at first, reaching about 5 miles downstream within the first 30 minutes, but requiring 1 hour 50 minutes to reach the Ventura (U.S.-101) and Golden State (I-5) Freeway interchange, approximately 6 miles further downstream.

8-03. Recreation and Agriculture.

a. Recreation. None of the recreational facilities in Sepulveda Reservoir depend upon runoff water impounded behind the dam. Thus, there are no direct recreational benefits that result from the dam or its operation. The recreational facilities were constructed because the land within the reservoir could not be used for other purposes. Thus there is an indirect benefit of the project upon recreation.

The effects of the dam and its operation upon the recreational facilities within the reservoir are by necessity all negative, that is, some of these facilities are occasionally flooded by the impoundment of water behind the dam for flood control. These recreational facilities, however, were constructed and are operated with this understanding.

b. Agriculture. The same arguments cited above regarding recreation also apply to the agricultural products that are cultivated on Sepulveda Reservoir lands. Because the overall acreage of agriculture within the reservoir basin is small compared to the needs of the local population, the impact of Sepulveda Dam and its operation upon the overall food production and consumption in the region is negligible.

8-04. Water Quality

There are no benefits of Sepulveda Dam to the water quality of the Los Angeles River. On the other hand, Sepulveda Dam and its operation should not in any way contribute to the degradation of the water quality of the river.

The Donald D. Tillman Water Reclamation Plant (TWRP), constructed within the reservoir boundaries of Sepulveda Dam provides advanced secondary treatment of wastewater produced by the San Fernando Valley area (refer to section 2-06.d.). To date, reclaimed water is designated for the recreation lake, wildlife management, and irrigation. Sepulveda Flood Control Reservoir will in ono way supplement treatment of wastewater and because of potential inundation to TWRP, all flood control operation will have zero or negative net benefits on the plant.

8-05 Fish and Wildlife

The reservoir lands that constitute the Sepulveda Flood Control Basin provide open space and some natural riparian habitat in the middle of an extensive urban area, thereby providing very important wildlife habitat. A large portion of the Los Angeles River within the basin is one of only two reaches of the river that constitutes a soft-bottom channel, thus allowing a unique habitat to flourish. More than 200 species of birds, 20 species of mammals, 13 species of reptiles and amphibians, and 5 species of fish have been reported in the reservoir basin (see table 1-01; Sepulveda Basin Master Plan, Final Environmental Impact/Environmental Impact Statement, (March 1980), in addition see Planning Aid Report–A Reconnaissance Survey of Biological Resources in the Los Angeles County Drainage Area, prepared for U.S. Army Corps of Engineers, Los Angeles District, by U.S. Fish and wildlife Service, 1984).

Flooding within the reservoir basin is relatively uncommon (especially May-October) and is usually not prolonged, and therefore does not normally cause serious adverse impacts upon biological resources within the basin, although some impacts are inevitable. Wildlife taking refuge in burrows, or slow-moving species, such as the San Diego horned lizard, a Category 2 Federal Candidate Species, might be trapped and killed by flooding. If deviations from the reservoir regulation schedule for closing the gated outlets (pl. 7-02) should result in the flooding of greater areas of reservoir lands than would have otherwise been the case, then a greater number of animals may drown. Any deviations from the reservoir regulation schedule (pl. 7-02) occurring after approximately the beginning of April could disrupt the nesting of some birds, including some sensitive species: for example the Least Bell’s Vireo and the Yellow Warbler. The Blue Grosbeak is another species of interest which, although not uncommon in the western United States, is a rare nester in Los Angeles County and is found along this portion of the channel of the Los Angeles River.

Flooding within the reservoir basin also has a beneficial impact upon some wildlife. Large numbers of migratory waterfowl and shorebirds utilize low-lying flooded areas within the basin for wintering.

This manual is the first operational document written for Sepulveda Flood Control Reservoir since passage of the National Environmental Protection Act in 1969. An environmental assessment, prepared in conjunction with this manual, resulted in a Finding of No Significant Impact (FONSI). The FONSI was singed by Colonel Butler, District Engineer, Los Angeles District, on 21 May 1987, and is included as Exhibit G.

8-06. Water Supply

Since Sepulveda Dam is not operated for water supply, there are not direct effects or benefits of the dam or its operation upon the water supply of the San Fernando Valley or other parts of the greater Los Angeles Basin. There are no practical indirect benefits of Sepulveda Dam upon the downstream groundwater spreading facilities even through the flow rates on the Los Angeles River, past theses facilities, are at times reduced, and the duration of runoff prolonged, by the dam.

8-07. Hydroelectric Power

There is no existing or contemplated hydroelectric power generation at Sepulveda Dam.

8-08. Navigation

There is no navigation on the Los Angeles River or in Sepulveda Reservoir at any time.

8-09. Frequencies

a. Peak Inflow and Outflow Probability. Plate 4-06 is a graph of the inflow and outflow frequencies at Sepulveda Dam, computed from the 1985 Los Angeles County Drainage Area review study (see table 1-01; Draft: Los Angeles County Drainage Area Review: Part I Hydrology Report (February 1988)). The values of these curves at specific return periods are listed in table 4-08. The inflow curve, which was discussed in Section 4-07, is of course not affected by the water control plan for Sepulveda Dam, which has bearing only upon regulation of the outflow and consequently the impoundment of water behind the dam. This inflow curve, however, reflects the effects of the upstream Los Angeles River channel improvement, which has been in place for many years.

The outflow curve of the plate 4-06, on the other hand, does reflect the Sepulveda Dam water control plan, including the gate operation schedule shown in plate 7-02. The sharp break in the slope of the curve reflects the fact that (according to the current settings) the crest gates are set to begin to lower when the water surface reaches elevation 712 feet, with the outflow rate thus increasing rapidly for any additional rise to the reservoir water surface (pl.2-19).

b. Pool Elevation Duration and Frequency. Plate 4-07 is the computed filling frequency curve for Sepulveda Dam, based upon, and adjusted for, 1980 conditions. These conditions include percent of impervious cover in the drainage area above Sepulveda Reservoir, runoff routing conditions, and the gate operation schedule of the water control plan. The values of the curve at specific return periods are listed in table 4-08. As with the outflow frequency curve (pl. 4-06), the relatively sharp change in slope of the filling frequency curve (pl. 4-07) reflects the fact that the crest gates begin to lower as the reservoir water surface exceeds elevation 712 feet, thus reducing the rate of additional impoundment of water within the reservoir for a given increase in flow.

c. Key Control Points. Exhibit F is a set of four stage/discharge rating tables for stream gauges on the Los Angeles River between Sepulveda Dam and the Pacific Ocean. These ratings, which were furnished by Los Angeles Country Department of Public Works, are graphically depicted on plate 5-02. The stages, or gauge heights, and the corresponding discharges in Exhibit F and plate 5-02 range from zero at the bottom of the low-flow channel to approximately the channel capacity of the river at each location (refer to pl. 2-04).

As one measure of comparison, table 8-02 lists the peak discharges at each of the four gauges listed in Exhibit F for several of the greatest floods of record. It should be noted that none of these historical floods has exceeded channel capacity at any of the gauges, although during the flood of 16 February 1980, water reached the top of the levees near the gauge on the Los Angeles River below Wardlow Road (see Section 4-12.d. and Photograph 4-03), apparently as the result of a local hydraulic instability.

8-10. Other Studies

a. Examples of Regulation. Discharge frequency values presented in this manul were derived from ongoing (1985) investigations in the U.S. Army Corps of Engineers Los Angeles County Drainage Area Study. Preliminary analyses in this study have been applied to evaluate Sepulveda Dam and have been considered in preparing the water control plan. The Interim Report on Hydrology and Hydraulic Review of Design Features of Existing Dams for Los Angeles County Drainage Area Dams, dated June 1978, presents the derivation of the Probable Maximum and Standard Project Floods used in this manual.

b. Channel and Floodway improvement. No floodplain management studies addressing the downstream channel have been conducted by the U.S. Army Corps of Engineers since the downstream channel was constructed. Several Flood Insurance Studies have been completed to date by the Corps of Engineers and Los Angeles County Flood Control District (now part of the Department of Public Works) for the Federal Emergency Management Agency. These studies show no downstream flood problem. Currently (1988) the Corps of Engineers is conduction an ongoing review study of the entire Los Angeles County Drainage Area system in order to reassess the adequacy of flood protection provided by the downstream channels. This study does show that there is a potential for flooding on the Los Angeles River for floods having a return period of approximately 50 years (see pl. 4-06 and table 1-01; Draft: Los Angeles County Drainage Area Review: Part I, Hydrology Report (February 1988)).

Table 8-01. Comparison of Historical Floods and Design Floods, Sepulveda Reservoir.

	Plate No.	Water Surface Elevation (ft., NGVD)	Capacity (ac-ft)	Inflow* (cfs)	Outflow (cfs)
Probable Maximum Flood	8-01	716.66	27,563	114,000	99,300
Standard Project Flood	8-02	713.52	22,492	50,000	41,300
23 January 1943	8-04	699.29	6,341	12,700	2,710
22 February 1944	8-05	697.92	5,070	15,900	4,740
23 January 1969	8-06	693.30	2,945	16,800	11,825
4 March 1978	8-07	697.65	5,253	25,670	13,190
16 February 1980	8-08	705.10	11,503	58,970**	15,100
1 March 1983	8-09	702.53	8,950	38,676	14,397

*Maximum of mean hourly values.
**Maximum inflow for 25 minutes: 62,636 cfs.

NOTE: See plate 8-10 for graphical comparison of the values listed here.

Table 8-02. Peak Discharges of Record, Los Angeles River Below Sepulveda Dam.

Values are in cubic feet per second (cfs)

Name of Station	Date 1/25/69	2/10/78	2/16/80	3/01/83
Los Angeles River at Tujunga Avenue, F300-R	30,800*	30,100	27,625	27,625
Los Angeles River above Arroyo Seco, F57C-R	41,800	52,700**	52,200	44,500
Los Angeles River below Firestone Blvd., F34D-R	58,000	73,600	74,400**	61,400
Los Angeles River below Wardlow Road, F319-R	102,000	94,820	128,700*	81,800

*Greatest discharge of record.
**Greatest discharge since the construction of Sepulveda, Hansen, Santa Fe, and Whittier Narrows Dams in the early 1940's, and exceeded only by the flood of 3/02/38: 68,000 cfs (estimated) at F57C-R, and 79,000 cfs at F34D-R.

NOTE: See plate 5-01 for location of stations.

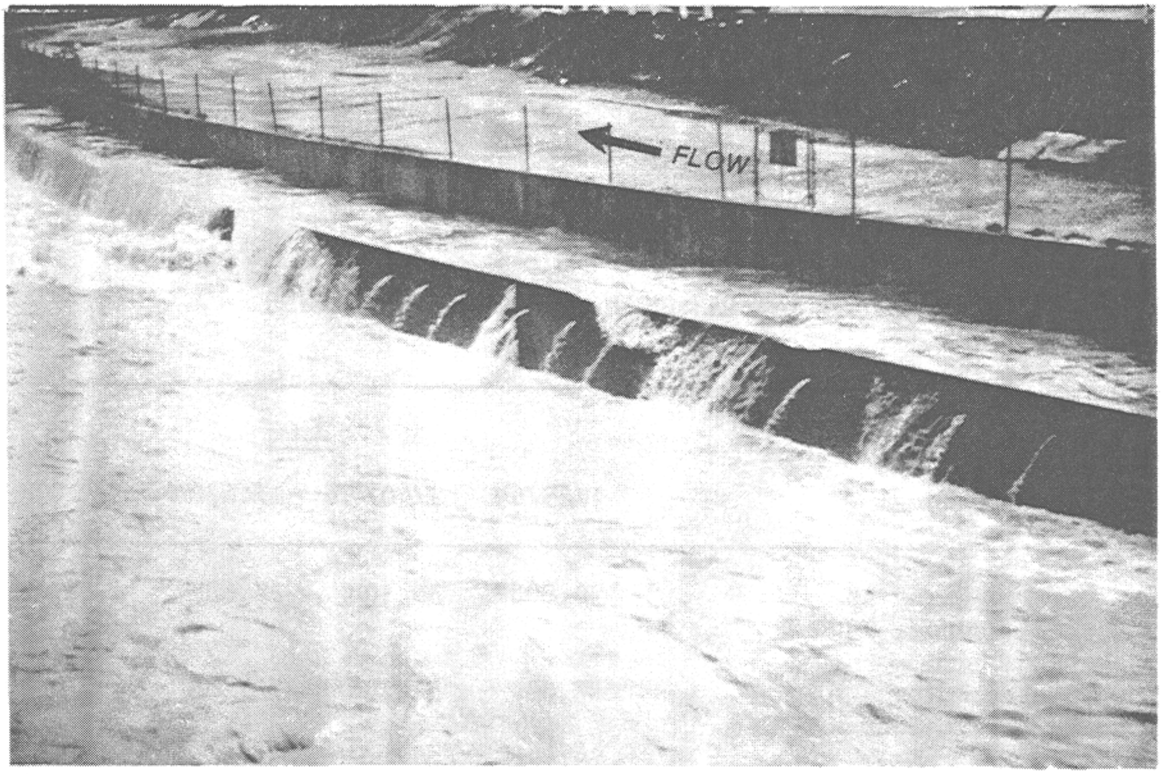

Photo No. 8-01. Flood of 1 March 1983, Los Angeles River at Whitsett Avenue Channel, Studio City (approximately 5 river miles below Sepulveda Dam).

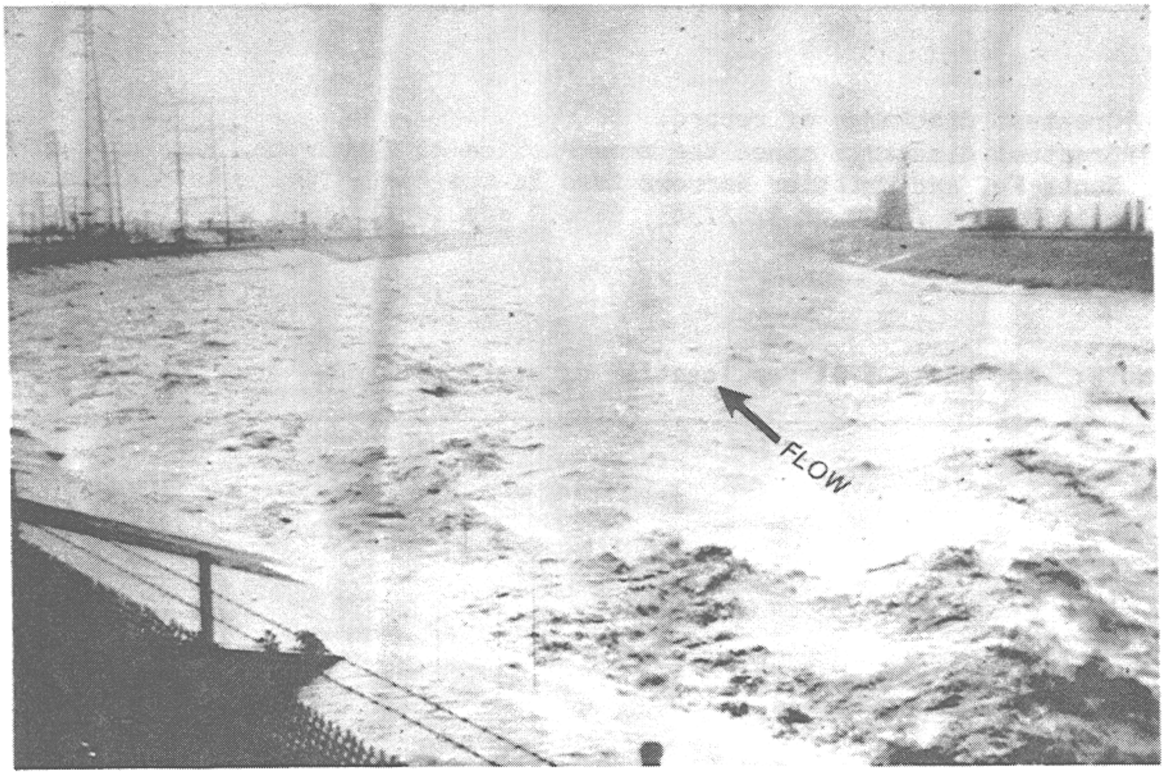

Photo No. 8-02. Flood of 1969 (most likely 25 January), Los Angeles River near downtown Los Angeles, approximately 22 river miles below Sepulveda Dam (view toward downstream).