IV - WATERSHED CHARACTERISTICS

4-01 GENERAL CHARACTERISTICS

Hansen Dam is located on the edge of San Fernando Valley on Tujunga Wash, a principal tributary of the Los Angeles River system. The San Gabriel Mountain Range forms the northern drainage divide of the watershed and reaches an elevation of over 7,124 ft. NGVD upstream of Big Tujunga Dam, the largest structure in the Hansen Dam watershed. The drainage divide on the west is formed by the ridge between the Lopez Dam and Hansen Dam watersheds. On the east, the drainage divide is the high ridge between the Hansen Dam watershed and that of the upper San Gabriel River watershed. To the south Tujunga Wash flows across a broad alluvial fan and urbanized valley area before emptying into the Los Angeles River downstream of the dam. Little Tujunga Creek, the other major tributary in the watershed, joins Big Tujunga Creek within Hansen Reservoir. The longest watercourse in the watershed is the Big Tujunga Creek mainstem. It has a length of 31.5 miles, and an average slope of 148 ft. per mile (0.028).

4-02 TOPOGRAPHY

Approximately 140 square miles of the 152 square mile drainage area above Hansen Dam consists of steep, mountainous terrain, dissected by deep, narrow ravines containing the numerous watercourses tributary to this watershed. The remainder of the watershed consists of a relatively flat alluvial fan surface and valley fill area, much of which is occupied by urban development. Elevations in the mountains vary from 7,124 ft. at Pacifica Mountain (the highest point in the watershed) to 990 ft. at the dam site.

4-03 GEOLOGY

Hansen Dam is located in a basin formed by a series of tiered bluffs descending from the San Gabriel Mountains in the north to the dam site in the south. The Hansen Dam Basin foundation is comprised of alluvium consisting of sand, gravel, and boulders. Overbank areas tend to consist of the same material with somewhat larger amounts of silt and clay in the matrix. The dam itself is tied into two outcrops of Modelo sandstone. Soils at the dam tend to be well-graded alluvial materials receptive to the growth of vegetative cover. Soils in the mountains tend to be shallow, stony, and poorly developed.

4-04 SEDIMENT

Sediment production within the Hansen Dam watershed varies considerably, depending primarily on the terrain. In the urbanized valley areas, sediment production is at a minimum, and may be expected to decline even further with a continued increase in areas devoted to urban uses. In the steep mountainous segment of the watershed, sediment production can be quite high, particularly following periods in which wildfire impacts the watershed, and also following periods of high-intensity rainfall. The fire history of Hansen Dam watershed was computed to have burned 95 percent of the watershed over a period from 1878 through 1975. On September 9-12, 1968, the Limerock Fire burned 2,846 acres which included the entire western side of Little Tujunga Creek. This burn contributed sediment and debris to the January 24-28, 1969 storm runoff. Subsequent small fires in the watershed also occurred along the Little Tujunga Creek and Lopez Canyon drainages making the northwest edge of the Hansen Dam watershed the most likely source of much of the debris problems within Hansen Reservoir. On November 23-27, 1975 the Mill Fire burned 6,370 acres along a stretch from Hansen Dam watershed to Pasadena. This fire burned 95 percent of the area between Hansen Dam and Big Tujunga Dam as well as acreage behind Big Tujunga Dam. Subsequent runoff events in 1978, 1980, and 1983 have carried excess debris and sediment due to fire damage. Big Tujunga Dam and Reservoir initially intercepts much of the sediment produced by the 82.3 square miles drainage area upstream of Hansen Dam. Slucing of this sediment has not been permitted by the Corps because no agreement for sediment removal from Hansen Reservoir has been made with Los Angeles County Flood Control District.

Reservoir surveys for Hansen Dam were performed in September 1940, July 1941, October 1943, November 1945, January 1962, August 1969, October 1978, July 1982 and April 1983. Pertinent parts of Eng Form 1787, Reservoir Sediment Data Summary for Hansem Dam, are given on plates 4-1A, B. The plates show an average sedimentation rate of 255 ac-ft per year for the period 1940-1978. An average sedimentation rate has not been determined after 1978 because of the approximations of sediment removal and the inconsistancies with the 1982 survey. See section 3-06.

The loss in storage capacity due to sediment deposition within Hansen Reservoir amounts to 28.9 percent of total gross (1940) storage capacity as of April 1983. This figure would exceed 31 percent had it not been for excavation performed since 1982 to restore capacity.

4-05 CLIMATE

The climate of the drainage area above Hansen Dam is generally temperate and semi-arid, with warm, dry summers and cool, moist winters.

a. Temperature. Average daily minimum/maximum winter temperatures (in degrees Fahrenheit) range from about 40/65 near the dam to about 20/45 in the higher mountains. The corresponding summer temperatures are about 65/95 and 55/80, respectively. All-time low/high extremes in temperature are about 15/120 near the dam, and about -15/105 in the highest mountain valleys.

Plate 4-2 shows average and extreme temperature data for Burbank, California (located about 8 miles south of Hansen Dam), the nearest station with complete climatological data. The regular U.S. Weather Bureau station at Burbank was closed in 1965, so the climatological data on plate 4-2 extends only through 1964.

b. Precipitation. Plate 4-3 (from LACDPW) shows the mean annual precipitation over the Hansen Dam drainage area. Within the drainage area, mean annual precipitation ranges from slightly more than 15 inches near the dam to more than 36 inches in the San Gabriel Mountains southeast of Big Tujunga Dam.

Plate 4-2 lists the mean and maximum observed monthly precipitation for Burbank, California. Plate 4-4 lists the same for Hansen Dam and for 3 stations within the Hansen drainage basin. These plates indicate that there can be great year-to-year variability in monthly, as well as annual precipitation. Not listed on these plates are the minimum observed monthly precipitation values, which for most stations are at most 0.01 or 0.02 inches for every month of the year.

Plate 4-5 is a precipitation depth-duration-frequency tabulation for the centroid of the watershed above Hansen Dam. In it are listed the computed point-value precipitation depths for durations of from 5 minutes to 24 hours, and for return periods of from 2 to 100 years. Data for this table were obtained from National Oceangraphic and Atmospheric Administration (NOAA) Atlas 2.

1. Winter Storms. Most precipitation in southern California coastal drainages occurs during the winter season, primarily from November through early April, as mid-latitude cyclones from the northern Pacific Ocean move inland over the area. Most of these storms are the general winter type, characterized by hours of light-to-moderate precipitation, but with many heavy showers and thunderstorms within the storm system.

2. Summer Storms. Two types of summer storms can affect southern California, although they are relatively rare.

(a) Local Thunderstorms. During humid periods between July and September, the deserts and eastern mountains of southern California experience occasional thunderstorms. On a few occasions, these may drift westward into the coastal drainages, including the Hansen Dam watershed. These thunderstorms can at times result in very heavy rain for short periods of time over small areas.

(b) General Storms. General summer storms in southern California are quite rare, but on occasion a tropical storm from off the west coast of Mexico can drift far enough northward to bring rain, occasionally heavy, to southern California, sometimes with very heavy thunderstorms embedded. The season in which these storms are most likely to occur is mid-August through early October, although there have been some effects in southern California from tropical storms as early as late June and as late as early November.

On rare occasions, southern California has received light rain from non-tropical general summer storms, some of which have exhibited some characteristics of general winter storms.

3. Snow. Snow in southern California is relatively uncommon at elevations below 4,000 ft. and is extremely rare below 2,000 ft. Although even the valley floor has experienced light snow on isolated occasions, snowfall and snowmelt are not considered to be a significant hydrologic factor in the Hansen Dam drainage.

c. Evaporation. Few formal studies of evaporation have been made in the San Fernando Valley. Because Hansen Reservoir is normally dry, with any impoundments generally lasting less than 24 hours, evaporation is not a major consideration at this site. Studies for nearby locations indicate that mean daily evaporation ranges from about one-tenth inch in winter to about one-third inch in summer. On days of very strong, dry Santa Ana winds, evaporation can be considerably greater than one inch.

d. Wind. The prevailing wind in the San Fernando Valley is the sea breeze. This gentle onshore wind is normally strongest during late spring and summer afternoons, with speeds in the western San Fernando Valley typically 10 to 15 miles per hour.

The Santa Ana is a dry desert wind that blows from out of the northeast, most frequently during late fall and winter. This type of wind does not normally occur when water is impounded behind Hansen Dam. The characteristic low humidities and strong gusts of Santa Ana winds (which can exceed 70 miles per hour at times) usually create very high fire hazards, but can also be instrumental in drying a saturated watershed, thus reducing the flood hazard from later events.

Rainstorm-related winds are the next most common type in southern California. Winds from the southeast that are ahead of an approaching storm average 20-30 mph, with occasional gusts to more than 40 mph. West to northwest winds that are behind storms can sometimes exceed 35 mph, with higher gusts.

4-06 STORMS AND FLOODS

All of the major inflow and impoundment events in the history of Hansen Dam have been the result of general winter storms.

Prior to the construction of the dam, there were a number of major storms and floods on Tujunga Wash and the Los Angeles River, including those of January 1862 (commonly refered to as the greatest storm in southern California history since records began in the late 1700's), February and March 1884, January and February 1914, January 1916, December 1921, February 1927, December 1933-January 1934, and February and March 1938. There was also one significant summer tropical storm that occurred in September 1939, but no widespread flooding in this area was caused by this event.

a. Storm and Flood of February-March 1938. The flood of 27 February-3 March 1938 was the most destructive of record on the Los Angeles River, Tujunga Wash, and many other streams in southern California. Its occurrence played a major role in the justification for the construction of Hansen Dam.

The storm developed as a series of low-latitude north Pacific disturbances, bringing several bands of intense rainfall to southern California during a 5-day period. The intense band of 1-2 March produced an estimated peak flow of 54,000 ft^3/s on Tujunga Wash, approximately 2,000 ft. below Hansen Dam (U.S.G.S. Gauge No. 11097000). This flow, combined with heavy runoff from the upper Los Angeles River and other tributaries, produced a very destructive flood on the Los Angeles River throughout the southeastern San Fernando Valley, downtown Los Angeles, and downstream locations.

b. Storms and Floods since 1941. Several of the major storms and floods that have occurred on Tujunga Wash since the completion of Hansen Dam in 1940 are discussed in section 8-02 of this manual.

4-07 RUNOFF CHARACTERISTICS

Runoff from the watershed is characterized by high flood peaks of short duration that result from high-intensity rainfall on the watershed. Flood hydrographs are typically of less than 12 hours duration and are usually less than 48 hours duration. Inflow rates drop rapidly between storms, and inflow during the dry summer season is usually less than 10 ft^3/s. Long-term average inflow to Hansen Dam for the period 1946 through 1988 is 27,450 acre-feet per year. Plate 4-6 lists the annual maximum of inflows, outflows, and contents at Hansen Dam from 1941 through 1986. Plates 4-7A and 4-7B display maximum peak inflow while plates 4-7C and 4-7D display the annual outflow for Big Tujunga Dam.

The greater Los Angeles area has historically experienced long-term wet and dry periods. Plate 4-8 illustrates the historic regional response of flood peaks from the 1870's to the 1970's.

In general, antecedent precipitation is required as a prerequisite for the occurrence of large floods from this watershed. With substantial antecedent precipitation resulting from a series of winter storms, precipitation loss rates may decrease to as low as 0.15 inch per hour by the end of a major storm. The basin unit hydrograph for the watershed between Hansen Dam and Big Tujunga Dam is shown on plate 4-9A; the unit hydrograph for the watershed above Big Tujunga Dam is shown on plate 4-9B.

4-08 WATER QUALITY

Because Hansen Reservoir is strictly a flood control project that rarely impounds water for more than 24 hours, it has no appreciable effect on water quality. The water quality of the runoff entering the reservoir is generally of poor quality. The water is characterized as hard with iron and manganese concentrations high. Routine base flow (usually less than 10 ft^3/s) is typically high in salinity content, whereas storm runoff is generally low in salinity content.

Two diversions exist for ground water recharge facilities. Hansen spreading grounds are used to recharge local base flow and captured storm runoff. Tujunga spreading grounds are used to recharge imported water.

4-09 CHANNEL AND FLOODWAY CHARACTERISTICS

The Tujunga Wash channel downstream from Hansen Dam is a rectangular concrete lined open channel. Channel capacities increase from 20,800 ft^3/s just below Hansen Dam to 28,200 ft^3/s at the confluence of the Los Angeles River (pl. 3-1). Travel times for significant flows are also shown on plate 3-1, and include a total time of 0.4 hours from Hansen Dam to the Los Angeles River. Plates 4-10 and 4-11 show the Big Tujunga Channel profile from Hansen Dam to the Los Angeles River.

4-10 UPSTREAM STRUCTURES

Big Tujunga Dam. The project is a water conservation and flood control facility of the LACDPW and is on Big Tujunga Creek, 15 miles above Hansen Dam. Exhibit C contains pertinent data on Big Tujunga Dam.

4-11 DOWNSTREAM STRUCTURES

a. Whittier Narrows Dam. This unique flood control facility was built by the COE in 1957 at the narrows of the San Gabriel River and Rio Hondo in Los Angeles County, just north of Pico Rivera (see pl. 2-1). The facility is Federally owned and is operated and maintained by the COE. Pertinent data for Whittier Narrows Dam are included in Exhibit D.

This dam has the capability of diverting San Gabriel River inflow westward for discharge into Rio Hondo. During moderate and high reservoir impoundment behind the dam, the waters from the two rivers combine within the reservoir, and can be let out into either of the two downstream channels. Thus a major portion of, and at times the total inflow from the entire upper Rio Hondo and San Gabriel River drainages can, when necessary or desired, be passed into the lower Rio Hondo, and ultimately into the lower Los Angeles River. During significant flows, however, the outflow from Whittier Narrows Dam is normally discharged into both the Rio Hondo and the San Gabriel River. Thus, along with Hansen Dam, Whittier Narrows, and Sepulveda Dam are regulated to control floods on the lower reaches of the Los Angeles River.

b. Santa Fe Dam. This Federally owned, COE operated flood control facility is on the San Gabriel River upstream of Whittier Narrows Dam. It is regulated in conjunction with Whittier Narrows Dam, and thus, at times, indirectly in conjunction with Hansen and Sepulveda Dams.

c. Other Projects. There are numerous other water supply reservoirs upstream of Whittier Narrows and Santa Fe Dams on Rio Hondo, San Gabriel River, and their tributaries. These can be seen on plate 2-1, and pertinent data for these reservoirs are included in Exhibit D, page D-5.

4-12 RELATED STRUCTURES

a. Sepulveda Dam. Sepulveda Dam is a major flood control dam owned, operated, and maintained by the LAD. It was constructed in 1941. It is located on the Los Angeles River, 43 miles above the mouth of the river, and 6 miles above the confluence of Tujunga Wash and Los Angeles River. The dam is in the south central portion of the San Fernando Valley, just northwest of the junction of the Ventura Freeway (U.S. Hwy. 101) and the San Diego Freeway (I-405) (see pl. 2-1). Pertinent data for Sepulveda Dam is included in Exhibit D. There are other water supply reservoirs upstream of Sepulveda Dam. These can be seen on plate 2-1, and pertinent data for these reservoirs are included in Exhibit D.

b. Pacoima Dam. This project is a water supply and flood control facility of DPW and is located on Pacomia Wash upstream of Lopez Dam. Pertinent data for Pacomia Dam is included in Exhibit D. It was constructed in 1929.

c. Lopez Dam. This dam was constructed on Pacoima Wash in 1954 in the far northeastern San Fernando Valley, 6.4 miles above the confluence of Pacoima Wash with Tujunga Wash. This gated facility is owned by the Federal Government and maintained by the LAD as part of the overall Los Angeles County Drainage Area (LACDA) flood control project. Pertinent data for Lopez Dam is included in Exhibit D.

4-13 ECONOMIC DATA

a. Population. No population figures are tabulated specifically for the watersheds above or below Hansen Dam. The San Fernando Valley is estimated to have a population of approximately 1,081,000, according to the 1980 Census, with the 1987 population of the 500-year flood overflow area of 11 square miles along Tujunga Wash between Hansen Dam and the Los Angeles River estimated at 54,000. Portions of the following towns and cities are within this 500-year flood overflow area; Arleta, Pacoima, Panorama City, Sun Valley, Tujunga, and Los Angeles. The population of the greater San Fernando Valley, including Sunland, Tujunga, and Lakeview Terrace, is approximately 1,133,000.

b. Agriculture. Agriculture was at one time a major activity in the San Fernando Valley, but declined sharply between 1946 and the early 1970's, as urban growth in the valley displaced the existing farmland. There remains a very small amount of commercial agriculture in the far western valley, along with many small private orchards, vineyards, and vegetable gardens. There are a few remaining small private horse ranches in the northwestern San Fernando Valley.

c. Industry. Industry has increased dramatically in the San Fernando Valley since World War II and is scattered throughout all portions of the valley. There is little heavy industry concentrated in any portion of the San Fernando Valley. There are a number of moderate-sized factories in the central and northeastern portions of the valley, and a large amount of light industry (especially electronics and related fields) is scattered throughout all portions of the valley.

d. Flood Damages. Since completion of the dam in 1941, there has been relatively little in the way of damaging flows on Tujunga Wash. As of FY 86, approximately $176,384,000 in damages has been prevented, primarily to single family and multi family residential structures. Within the 500-year flood plain below Hansen Dam are; 355 light industrial structures, 886 commercial structures, and 122 public buildings. The value (1987) of these light industrial, commercial, and public buildings is $421,000,000.