II - DESCRIPTION OF PROJECT

2-01 Location. Prado Dam is located on the lower Santa Ana River, approximately 30.5 miles upstream of the Pacific Ocean. The dam is in Riverside County, California approximately 2 miles west of the City of Corona. Portions of the reservoir are in Riverside County and San Bernardino County. The Santa Ana River watershed has an area of 2,450 sq-mi. Ninety-two percent of the watershed (i.e., 2,255 sq-mi) is located upstream of Prado Dam (Plate 2-01).

2-02 Purpose. Prado Dam serves as the principal regulating structure on the Santa Ana River. The original project purposes were to prevent flooding in northwestern Orange County and to provide water conservation for Orange County.

With passage of the Flood Control Act of 1944 (PL 78-534), non-federal participation in the administration of recreational facilities was initiated at Corps Projects. With passage of the Fish and Wildlife Coordination Act (PL 85-62) and the National Environmental Policy Act (NEPA) (PL 91-190), the Corps is required to consider the environmental impacts of new projects and changes to existing projects. Consultation and coordination with such agencies as the U.S. Fish and Wildlife Service and State Wildlife agencies are conducted in preparation of Environmental Impact Statements and Environmental Assessments.

2-03 Physical Components. Prado Dam consists of an earth-filled embankment, outlet works, and a detached reinforced concrete spillway. A general plan of the dam and spillway is shown in Plate 2-02. A brief description of the various features of Prado Dam follows.

a. Embankment. Prado Dam is a compacted multi-zoned earth-filled embankment with a crest length of approximately 2,200-ft, and a height of about 106-ft above the original stream bed (Plate 2-03). The top of the embankment is 30-ft wide and paved with asphaltic concrete, forming a roadway across the dam. The upstream face of the embankment has a slope of 1V on 3H for its lower 50-ft, and a slope of 1V on 2.5H for the remaining upper 56-ft. The downstream face of the embankment has a slope of 1V on 2.5H for the top 30-ft, and a 1V on 6H below elevation 495.0-ft. The upstream slope is revetted with a layer of 12-in. stone over 6-in. bedding material (Photo 2-1) and the downstream slope is covered with a 12-in. thick blanket of gravel.

b. Outlet Works. The outlet works are located in the west abutment of the dam and consist of (1) an approach channel, (2) a 195-ft long intake structure, (3) a 591-ft long double box conduit, and (4) a 366-ft long rectangular concrete outlet channel

(Plate 2-04a). The gated outlet discharge curves are shown in Plate 2-06a-d

(1) <u>Approach Channel</u>. The approach channel to the outlet works is located in the west abutment of the dam and is of irregular shape and variable width, with side slopes and invert of paved rock. A log boom is located upstream of the outlet works to prevent floating debris from entering the outlet works.

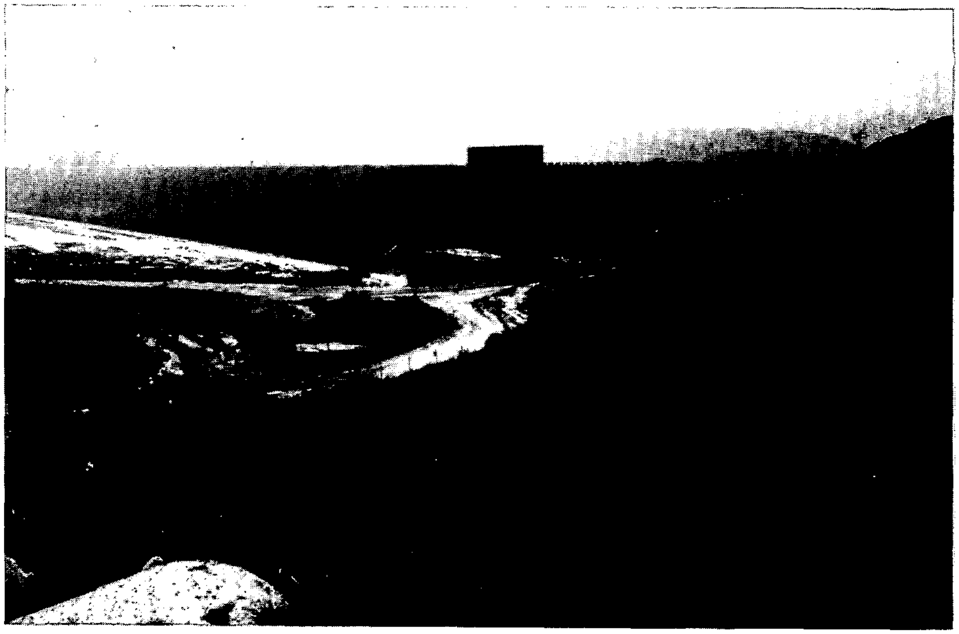

Photo 2-1: Prado Dam - Upstream Embankment

(2) <u>Intake Structure</u>. The intake structure is formed by two gravity-type concrete walls and a reinforced concrete invert (invert elevation is 460.0-ft). The center portion of the intake structure is divided into six bays by five concrete piers (Plate 2-04b). A 7-ft wide by 12-ft high cable operated tractor gate is at the downstream end of each bay (Plate 2-04c). On each side of the intake structure is a 5.5-ft diameter ungated conduit. Both ungated outlets have been permanently sealed with a collar and steel cap bolted in place. The west ungated outlet was sealed in October 1946, and the east ungated outlet was sealed in May 1969. A 90-ft long transition section joins the six gated bays and two ungated conduits with the double box conduit.

At the request of the Orange County Flood Control District (OCFCD), a 5-ft diameter steel pipe encased in reinforced concrete was placed beneath the double box conduit. The steel pipe was originally used to collect groundwater from under the reservoir and pass it under the dam to the downstream channel. This scheme was abandoned and in 1981 rights for use of the pipe were transferred to SAWPA which currently uses it to carry brine and industrial wastes from Riverside and Chino to a wastewater treatment facility in Fountain Valley. This wastewater line is known as the Santa Ana Regional Interceptor or SARI Line.

The trash racks, located in front of each bay, can only be removed when the reservoir is dry. A crane must be brought into the basin to remove them. Photo 2-2 shows the intake structure and control tower.

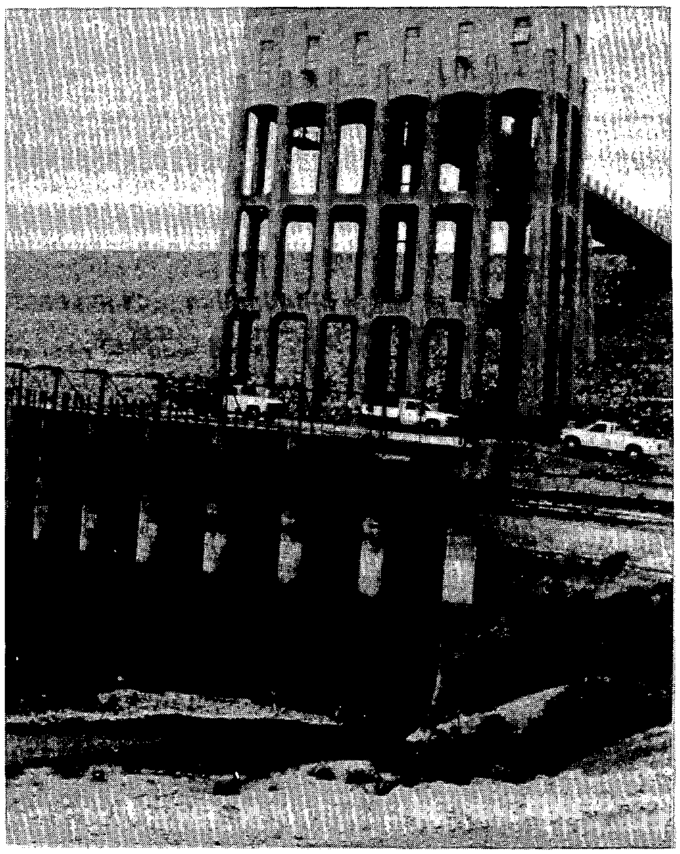

Photo 2-2: Prado Dam - View of the approach channel and intake structure

(3) Double Box Conduit. The double box conduit consists of two box conduits, each being 13.5-ft high by 13.5-ft wide. The maximum design capacity of each box conduit is 8,500 cfs (Plate 2-06d).

(4) **Outlet Channel**. The outlet channel consists of (a) a rectangular channel, (b) a transition chute, and (c) a stilling basin (Photo 2-3).

Photo 2-3: Prado Dam - Outlet Channel

(a) **Rectangular Channel**. The rectangular section is 126-ft long and 31-ft wide, with side walls that are 18.5-ft high. The invert elevation is 459.0-ft at the north end and 457.7-ft at the south end.

(b) **Transition Chute**. The transition chute is 80-ft long, having a variable width which increases from 31- to 70-ft. The side walls vary in height from 18.5-ft at the upper end to 33-ft at the lower end, and the invert slopes from elevation 457.7-ft at the north end to elevation 439.0-ft at the south end. A battery of eight 3-ft high by 3.5-ft wide reinforced concrete baffle piers extends across the channel at elevation 439.0-ft.

(c) **Stilling Basin**. The stilling basin is 120-ft long, having a tapered cross section which increases in width from 70-ft to approximately 76-ft. Two staggered rows of baffle piers, that are 8-ft long by 3.5-ft wide and 5-ft high, are spaced at 3.5-ft intervals across the basin at elevation 439.0-ft. The baffle piers insure the formation of a hydraulic jump in the basin. The last 50-ft of the basin floor is paved with derrick stone, the voids of which have been grouted. The design capacity of the stilling basin is 10,000 cfs.

The stilling basin, which was designed to dissipate energy from flows of up to 10,000 cfs, normally only passes flows which range from 200 to 2,000 cfs. After years of passing these "low" flows, sediment settles and begins to fill the stilling basin. To ensure that the stilling basin can properly dissipate large flood control releases, the basin is periodically dredged. During May of 1989 the LAD had the stilling basin dredged to both ensure the proper functioning of the basin and to facilitate inspection of the stilling basin.

c. Control Tower. The control tower located on top of the inlet structure is of rigid frame design and consists of reinforced concrete columns and horizontal struts (Photo 2-4 and Plate 2-04b). The frame is constructed as an integral part of the intake structure. The control tower rises up 66-ft from the top of the intake structure at elevation 500.0-ft to the finished floor of the control house at elevation 566.0-ft. The vent stacks for the gate structure consist of two 3-ft diameter pipes supported by steel cross arms which extend to the adjacent center column of the tower. The overall height of the vents is 81-ft.

d. Control House. The control house, constructed of reinforced concrete, forms an integral part of the control tower. The overall outside dimensions are 67-ft by 19-ft with a height of approximately 17.5-ft. The finished floor elevation is 566.0-ft. The structure contains the gate hoists, stand-by generator, communications equipment, and traveling crane. Access from the dam to the control house is provided by a steel girder bridge (Photo 2-4).

e. Spillway. The detached spillway is constructed through a bluff forming the east abutment (Plate 2-05 and Photo 2-5). The approach channel to the spillway has a bottom width of 1,063-ft and side slopes of 1V on 2H at an invert elevation of 530.0-ft. The downstream 85-ft of the approach channel, near the ogee section, has concrete gravity walls that range from 5- to 31-ft in height. The spillway control section is a reinforced concrete ogee with a crest length of 1,000-ft (spillway crest is at elevation 543.0-ft). The spillway channel is a reinforced concrete trapezoidal section, varying in width from 1,000-ft at the ogee crest to 660-ft at the lower end. The face of the 1,147-ft long spillway channel has a slope of 4V on 1H. The spillway terminates with a 190-ft long chute with a flip bucket. To prevent undermining of the flip bucket, a concrete crib cutoff wall, about 92-ft in depth, was provided at the end of the spillway chute under the flip bucket. A discharge curve for the entire operating range of the spillway is shown on Plate 2-07.

f. Flood Control Basin. The March 1980 survey is the latest available source of reservoir elevation-storage information. Area-capacity relationships for Prado Dam are shown in tabular and graphical form on Plates 2-08 and 2-09, respectively. At spillway crest (WSE 543-ft) the reservoir covers 6,630 acres and has a gross capacity of 196,235 ac-ft.

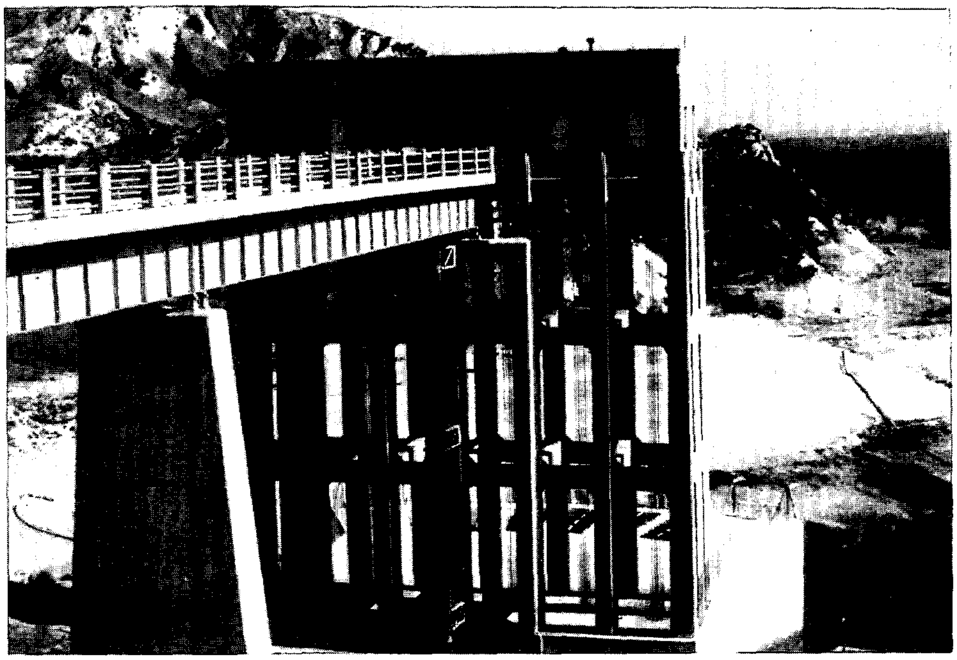

Photo 2-4: Prado Dam - Control Tower

2-04 Related Control Facilities. There are currently four dams within the Santa Ana River watershed which provide some degree of flood control. Prado Dam, San Antonio Dam, and Carbon Canyon Dam are owned and operated by the U.S. Army, Corps of Engineers, LAD. All of the allocated storage at these three facilities is solely for flood control purposes. The fourth dam is the Villa Park Dam which is owned and operated by the OCEMA. The storage at this facility has been allocated for both flood control and water conservation proposes. Exhibit B contains Pertinent Data Sheets for San Antonio, Carbon Canyon, and Villa Park Dams. A pertinent data sheet for Prado Dam is located on the inside front cover of this manual. In addition to these four dams, there are over 100 other water storage facilities within the Santa Ana River watershed having storages which range from 5 ac-ft to 182,000

Photo 2-5: Prado Dam - Spillway

ac-ft. These other facilities affect the flow of the Santa Ana River, but they do not provide any control of flood flows. Table 2-1 is a summary of the major water storage facilities within the Santa Ana River Watershed. Plate 2-10 is a schematic of the Santa Ana River Watershed showing the relative locations of the listed facilities.

Prado Dam is the primary flood control facility within the Santa Ana River Watershed. During flood events, Prado Dam is operated as a component of the Santa Ana River flood control system. Using real-time telemetry, and weather and runoff forecasts, releases from Prado Dam are coordinated with releases from San Antonio Dam and Carbon Canyon Dam to attain maximum flood protection for areas below these facilities.

2-05 __Real Estate Acquisition__. Prado Reservoir encompasses an area of just under 9,000 acres from the invert at WSE 460-ft to the take line at elevation 556-ft. At the time of construction the guidelines regarding land acquisition required that the government attempt to acquire all lands in fee title up to the spillway crest at 543-ft and attempt to acquire flowage easements for lands between the spillway and the take line at WSE 556-ft. The results of the land acquisition resulted in the government acquiring 6,577 acres in fee title and 3,059 acres of flowage easements. A total of 9,636 acres, therefore, are under some form of Federal Government control. Plate 2-11 shows the 556-ft contour (original take line) and various existing land uses within and adjacent to the reservoir.

Table 2-1

Major Water Storage Facilities
Within the Santa Ana River Watershed

Location	Drainage Area (sq-mi)	Storage (ac-ft)	Flood Control Capability
Prado Dam	2,255.0	196,235	Yes
San Antonio Dam	27.0	7,703	Yes
Carbon Canyon Dam	19.3	6,614	Yes
Villa Park Dam	20.4	16,044	Yes
Big Bear Lake	38.0	63,381	No
Railroad Canyon Res.	641.0	11,459	No
Lake Elsinore	52.0	122,500	Overflow/ Pumped*
Miller Basin	14.2	23	No
Santiago Dam	63.2	25,000	No
Santiago Cr. Gravel Pits	9.1	13,299	No
Lake Mathews	40.0	182,804	No
Lake Hemet	67.0	14,000	No
Lake Perris	10.0	100,000	No

* Lake Elsinore acts as a natural sump for the San Jacinto River sub-basin. Flows from Lake Elsinore only occur during major flood events, when the lake is either pumped or actually overflows into Temescal Creek.

2-06 <u>Public Facilities</u>. Since passage of the Flood Control Act of 1944 (PL 78-534) the Corps has encouraged non-Federal participation in the administration of recreational opportunities provided at Corps projects. The Corps has entered into leases which permit state and local development and administration of recreation areas at Civil Works Projects. In addition to recreational development, public utilities and private businesses have been located within the reservoir. Table 2-2 is a listing of recreational facilities and Table 2-3 is a list of other noteworthy public and private facilities within the Prado Flood Control Basin.

Table 2-2

Recreational Facilities at
Prado Reservoir

Owner or Lease Holder/Facility
San Bernardino County
El Prado Golf Course
Tiro Shooting Range
Prado Recreation Inc.
Prado Regional Park
Riverside County
Splatter S. Duck Club Building
Prado Basin Park
City of Corona
Corona Municipal Airport
Butterfield Park
Orange County Water District
Raahauge's Hunting Club

Table 2-3

Noteworthy Public and Private Facilities
at Prado Reservoir

Facility
Prado Petroleum Co. Oil Wells
City of Corona Wastewater Percolation Ponds
Chino Basin Water District Wastewater Treatment Plant #2
City of Corona Wastewater Treatment Plant