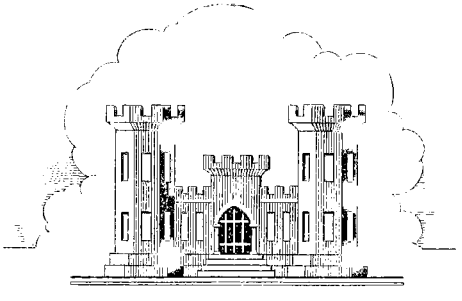
LADM NO. 1130-2-29

SANTA ANA RIVER BASIN (AND ORANGE COUNTY), CALIFORNIA

FLOOD CONTROL

OPERATION AND MAINTENANCE MANUAL FOR CARBON CANYON DAM AND CHANNEL



U. S. ARMY ENGINEER DISTRICT, LOS ANGELES
CORPS OF ENGINEERS
OCTOBER 1962

LADM NO. 1130-2-29

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES, NOVEMBER 1962

FOREWORD

1. This manual prescribes standard procedures for the operation and maintenance of the federally constructed Carbon Canyon Dam and Channel, Santa Ana River Basin (and Orange County), California. All previously issued operation and maintenance manuals for this project are superseded by this manual.

2. The Dams Section of the Design Branch, Engineering Division, is responsible for the preparation of this manual and for keeping the manual up-to-date. Suggested revisions should be forwarded through channels to that section.

FOR THE DISTRICT ENGINEER:

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LJW

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OPERATION AND MAINTENANCE MANUAL

FOR

CARBON CANYON DAM AND CHANNEL

SANTA ANA RIVER BASIN (AND ORANGE COUNTY), CALIFORNIA

SECTION 1 - INTRODUCTION

1.01. Authorization. The Carbon Canyon Dam and Channel comprise one of the units of the flood control project for the Santa Ana River Basin and Orange County, California, authorized by act of Congress, Public Law 738, Seventy-fourth Congress, approved 22 June 1936, as amended by act of Congress, Public Law 761, Seventy-fifth Congress, approved 28 June 1938.

1.02. Project location. The Carbon Canyon Dam is located in Orange County, California, about 8 miles northeast of the cities of Fullerton and Anaheim and about 12 miles north of the city of Santa Ana. (See drawing, file no. 126/2, exhibit F)

1.03. Principal structures. The principal structures of the project include (a) an earthfill embankment; (b) the outlet works, including an approach channel, an intake structure with slide gates, a transition section, an outlet conduit, a tower and control room, an access bridge to the tower, and a house for the standby generator; (c) a detached spillway, consisting of an approach channel, a control section and a drop structure with bucket; and (d) a rectangular reinforced concrete channel.

1.04. Protection provided. The project provides protection against floods to a highly developed area on the coastal plain in Orange County. This area includes (a) valuable residential, commercial, and industrial properties in and near the cities of Anaheim, Stanton, and Garden Grove, and the community of Los Alamitos; (b) many citrus groves; and (c) part of the Los Alamitos Naval Air Base.

1.05. Design memorandums. Detailed descriptions and computations are given in the following reports issued by the Corps of Engineers, U. S. Army Engineer District, Los Angeles:

a. Design Memorandum No. 1 - Hydrology for Carbon Canyon Dam and Channel, dated April 1957.

b. Design Memorandum No. 2 - General Design for Carbon Canyon Dam and Channel, dated August 1957.

c. Design Memorandum No. 3 - Real Estate for Carbon Canyon Dam and Channel, dated May 1957.

d. Supplemental Report to Design Memorandum No. 3, Real Estate for Carbon Canyon Dam and Channel, dated September 1957.

e. Design Memorandum No. 4 - Embankment Foundation for Carbon Canyon Dam, dated August 1958.

1.06. Construction history. Construction of the project was accomplished under the following contract, copies of which are on file in the office of the District Engineer, U. S. Army Engineer District, Los Angeles.

Contractor: Oberg Construction Corporation, Northridge, California.

Contract number: DA 04-353-CIVENG-59-144.

Work started: April 1959.

Work completed: 9 May 1961.

Accepted by the United States: 9 May 1961.

1.07. Pertinent data:

Dam:

Type		earthfill
Top elevation	feet, m.s.l.	499
Streambed elevation	feet, m.s.l.	400
Crest length	feet	2,610
Crest width	feet	20
Max. height above streambed	feet	99

Outlet works:

Type		concrete gated
Number and type of gates		2 hydraulic slide
Size of gates	feet	5 x 6.5
Gate sill elevation	feet, m.s.l.	403
Conduit length	feet	549
Conduit opening size	feet	4.75 x 7
Conduit capacity, free flow watersurface at spillway crest	c.f.s.	1,270

Spillway:

Type		detached broadcrest

Spillway: Continued		
Crest elevation	feet, m.s.l.	475
Crest Length	feet	125
Surcharge above crest (spillway design flood)	feet	18.7
Capacity at surcharge elevation	c.f.s.	36,800
Reservoir:		
Storage allocation below spillway crest:		
Flood control	acre-feet	5,870
Debris storage	acre-feet	1,500

Area and capacity tabulation:

	area acres	gross capacity acre-feet
Spillway crest	224	7,370
Max. water surface	316	12,330
Top of dam	339	14,130

Drainage area	square miles	19.3
Standard project flood:		
Total volume	acre-feet	8,030
Peak inflow	c.f.s.	9,300
Peak outflow	c.f.s.	1,000
Maximum probable flood:		
Total volume	acre-feet	10,600
Peak inflow	c.f.s.	56,000
Peak outflow	c.f.s.	36,800

SECTION 2 - GENERAL PROCEDURES

2.01. Approved regulations:

a. Emergency Employment of Army Resources EM 500-1-1, dated 1 August 1961.

b. Emergency Flood Control Activities (under PL 99/84) Annex A to EM 500-1-1, dated November 1961.

c. Project Operation Maintenance Guide EM 1130-2-303, dated 20 June 1960.

d. Firefighter's Training Manual, dated October 1950.

e. General Safety Requirements EM 385-1-1, dated 13 March 1958.

f. Motor Vehicle Inspection - Technical Manual 38-660-1, Operator's Maintenance Instructions & Procedures for Administrative Motor Vehicles, dated 16 April 1957.

g. Fire Prevention Code N.B.F.U.

h. National Electrical Code N.F.P.A.

i. Reservoir Regulation Manual for Carbon Canyon Dam and Channel.

j. Chemical, Biological, Radiological Monitoring Responsibilities, EM 500-1-1, Annex D, Part II, Civil Defense (to be published).

2.02. Purpose of manual. The purpose of this manual is to supply the dam tender and the district operating personnel with instructions for proper inspection, operation, and maintenance of the Carbon Canyon Dam and Channel, Santa Ana River Basin. These instructions will insure the continuous maintenance of structures and equipment and their operation in such a manner and at such times as will obtain optimum benefits.

2.03. Definitions. Specialized terms used in this manual are defined as follows: (a) Engineering Division, Construction Division and Real Estate Division refer to organizations within the U. S. Army Engineer District, Los Angeles. (b) Flood season refers to the period from 15 October to 15 April when most past floods have occurred. (c) All elevations refer to mean sea level datum, as in abbreviation m.s.l.

2.04. Reference drawings and manuals. Drawing file numbers in this manual refer to "as constructed" drawings which are included as exhibit F and separately bound. Drawings, manuals, and instructions of manufacturers' equipment are listed in exhibit G and are on file in the district office and at the project.

2.05. Functions of the Construction Division. Operation and maintenance and all inspections are under the supervision of the Construction Division, with the exception of those for hydrologic installations (see section 8). The general duties include the following:

a. Key personnel shall be trained in order that regular inspection, operation, and maintenance work will be performed efficiently and to insure that unexpected problems related to flood control may be handled in an expeditious and orderly manner. They shall become familiar with the provisions of this manual, the construction specifications and the "as constructed" drawings.

b. There shall be no encroachment or trespass which will adversely affect the efficient operation or maintenance of the project. The Chief, Construction Division, shall therefore cause notices and signs to be posted at conspicuous places along the project right-of-way directing public attention to this requirement and he shall arrange for the prosecution of offenders and report actions taken to the District Engineer. All trespasses or violations of outgrants discovered by Construction Division personnel shall be reported to the Real Estate Division.

c. The Construction Division reviews plans and furnishes comments to the Real Estate Division on requests from public or private interests for collateral use of land and water areas and performs inspections during construction to assure compliance with approved plans.

d. The Chief, Construction Division, shall establish a file of all reports and records concerning the maintenance and operation of the project works.

2.06. Functions of the Engineering Division.

a. The Engineering Division performs engineering reviews of all plans and furnishes engineering comments to the real estate division on requests from public or private interests for collateral use of project lands.

b. It conducts periodical condition surveys of the project. These surveys serve a two-fold purpose to (1) ascertain the condition of the various parts of the project and (2) to see if all the repairs and improvements have been carried out that were previously recommended.

c. It shall train key personnel in the operation of service gates, hoists, standby power units and communication facilities and in the operation and maintenance of hydrologic installations and flood fighting equipment. They shall become familiar with this manual, the LADM 500-1-1, Emergency Flood Control Activities, the Reservoir Regulations Manual, and the "as constructed" drawings.

d. It prepares and executes all flood fighting plans and through the Hydrology & Reservoir Regulation Section, directs the dam tender or his assigned alternate in the operation of the gates. It keeps records of reservoir stages, inflow to the reservoir, releases through the outlet structures and spillway overflow.

e. The Engineering Division is responsible for the inspection, servicing, and maintenance of all hydrologic installations. Their routine inspections will be done by the dam tender.

f. The supervision and maintenance of radio installations is also a function of the engineering division.

2.07. Functions of the Real Estate Division.

a. The Real Estate Division processes all permits, licenses, easements, or leases through appropriate channels and administers completed instruments.

b. It insures compliance through periodic inspections and acts upon all violations of outgrants.

c. It furnishes to the Construction Division, copies of all permits, licenses, easements or leases.

2.08. Functions of the U. S. Geological Survey. By agreement between the Corps of Engineers and the U. S. Geological Survey, the latter will service the outflow gaging station, make discharge measurements and compile and publish the outflow records in the U. S. Geological Water Supply papers.

2.09. Inspections and maintenance.

a. By the Construction and Engineering Divisions: Periodic inspections shall be made by the Chief, Construction Division, or his authorized representative in cooperation with the Chief, Engineering Division, or his authorized representative, as required, in order to determine maintenance measures necessary to insure serviceability of the works in time of flood. Such inspections shall be made immediately following each major highwater period, and at intervals not to exceed 6 months and at such times as may be necessary. Immediate steps shall be taken to correct dangerous conditions disclosed by such

inspections and regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the chief of the division. All repairs shall be made in accordance with standard engineering practice, to line and grade and in accordance with details shown on "as constructed" drawings, exhibit F.

b. By the dam tender: Periodic routine inspections of structures and equipment and of the project area shall be made by the dam tender or his assistants to determine maintenance measures that are required. These inspections during the non-flood season shall be made at intervals of not more than 90 days; during the flood season, beginning 15 October, at intervals of not more than 30 days; also immediately following each flood. More frequent inspections shall be made if required for the safety and efficient maintenance of some features of the project. During each inspection, items requiring maintenance shall be checked and described on the inspection check lists included as exhibit C. After each inspection, one set of the inspection lists shall be promptly submitted to the Chief, Maintenance Section, who will route it to the Design Branch, Engineering Division; one set shall be submitted to the Chief, Operations Branch; and one set shall be retained by the dam tender. Maintenance shall be performed by the dam tender if feasible. If maintenance requires hiring additional labor or equipment, the dam tender shall submit to the Chief, Operations Branch, a list of proposed maintenance measures. Normal maintenance shall be made without delay during the non-flood season.

c. Safety Branch inspection. All first aid activities in connection with flood emergencies are under the supervision of the Chief, Safety Branch. At the beginning of each flood season and periodically thereafter, as required, he will inspect the project, see that proper equipment is at hand, and see that the dam tender and his assistants are adequately instructed in first aid procedures and safety. Appropriate equipment includes (but is not limited to) standard first aid kits and such items as blankets, stretchers, safety belts, life lines and kapok vests. Grappling irons are provided from the base yard and gas detectors and oxygen deficiency lamps (Wolf lamps) are provided by the Los Angeles District Office.

2.10. Duties of the dam tender. The dam tender or his assistant is required to perform the following duties:

a. Be present at the dam when rainfall or runoff is occurring;

b. See that all equipment at the project, including recording and indicating gages, gate mechanism, power units, radio, etc., is in operating condition;

c. Perform routine test operations;

d. Operate the gates in accordance with instructions from the Hydrology & Reservoir Regulations Section;

e. Follow the fixed gate operation schedule posted in the control house in the absence of communications with the Hydrology & Reservoir Regulations Section or in the absence of a representative from that group;

f. Service all gages and recorders, wind the clocks, install new records paper, etc;

g. Guard the project against vandalism, sabotage and fires;

h. Guard against unsafe conditions in the project area;

i. Report on trespassing and encroachment of right-of-way;

j. Maintain routine records, including water surface elevations, outflow gage heights, precipitation amounts, gate openings and logs on prescribed forms.

2.11. Routine test operations. The dam tender or his assistants shall test-operate the service gates and electrical facilities in the control house every 30 days and the standby power unit every 15 days. Test operation reports (exhibit D) shall be completed in triplicate after each test. One copy shall be promptly submitted to the Chief, Engineering Division, one copy to the Chief, Construction Division, and one copy shall be retained by the dam tender.

SECTION 3 - RESERVOIR AND EMBANKMENT

3.01. Reservoir. The flood control reservoir, at spillway crest, elevation 475.0, has a gross capacity of 7,370 acre-feet including an allowance of 1,500 acre-feet for sediment and debris storage. The reservoir can control the reservoir design flood, with a peak inflow of 9,300 cubic feet per second, to a maximum outflow of 1,000 cubic feet per second with the water surface at spillway crest. No storage for water conservation is provided. (See drawing, file no. 126/30, exhibit F)

3.02. Embankment. The embankment is a compacted earthfill structure with a crest length of 2,610 feet, a crest width of 20 feet, a maximum height of 99 feet above streambed, and an upstream and downstream slope of 1 vertical on 3.25 horizontal. The crest of the dam extends from north to south for about 750 feet, then continues in a southeasterly direction for about 1,860 feet. The upstream slope protection consists of a 6-inch filter blanket overlaid with a layer of dumped stone 1.5 feet thick. The part of the downstream toe of the dam that extends across the valley floor has toe protection consisting of a 6-inch filter blanket overlaid with stone facing 2 feet thick. (See drawings, file nos. 126/30 and 126/31, exhibit F)

3.03. Access roads. An access road leads from relocated Rose Drive south of the dam in a northerly direction to the top of the embankment. From this access road diverges a service road to the gaging station at channel station 386+86 and then goes in a southeasterly direction along the downstream toe of the embankment. An upstream service road connects the outlet works with the top of the dam. An access road extends along the power line of the Southern California Edison Company on the right bank of the reservoir. An access road from Rose Drive to the paved bank of the channel is provided near the bridge at station 368+00. Two access ramps are provided from Golden Avenue to the channel at both sides of bridge crossing near channel station 348+00. All have cable barricades at their entrance to prevent unauthorized entry and are maintained by the U. S. Government. (See drawings, file nos. 126/30, 126/38, 126/80 and 126/82, exhibit F)

3.04. Fencing. A fence, about 2,600 feet long, is erected 500 feet south of the axis of the dam, running along the right-of-way line mostly parallel to the dam. It consists of chain-link fabric supported on 1¼-inch diameter galvanized steel posts and braces with malleable fittings. Two strands of galvanized barbed wire are securely fastened to the posts above the fabric. Gates are provided where the fence crosses the roads. (See drawing, file no. 126/30, exhibit F)

3.05. Piezometers. There are 6 piezometers located at station 17+00 and 6 at station 22+00, equipped with meter boxes and Borden gage. (See drawing, file no. 126/32, exhibit F)

3.06. Inspections and maintenance. The dam tender or his assistants shall perform periodic inspections and maintenance and shall complete inspection check list no. 1, as shown in exhibit D. Maintenance work is described in detail in the following paragraphs:

a. Embankments. Maintenance methods for repair or reconstruction of the embankments shall depend upon the extent of the damaged section. If the embankment damage is small, sand and gravel or other coarse granular material may be placed in 6-inch layers to restore the embankments. If the damage is large, the fill shall be made in the same manner as the original construction; homogenous material from borrow pits approved for the project shall be placed in uniform horizontal layers not more than 6 inches in depth and compacted to a density equal to the original embankment section. Before making any repairs, see directions outlined in paragraph 2.06.

b. Rock paving and riprap. Damaged stone paving, spall blankets and riprap on the upstream side, the toes and rock-paved gutters shall be repaired promptly. Any indication of settlement, uplift or failure of the riprap structures, shall be reported by the Chief, Construction Division, to the Chief, Engineering Division, for recommendation on remedial action.

c. Access roads. Access roads and embankment berms shall be adequately maintained for vehicular travel so that ordinary maintenance of the project and flood-fighting operations will be facilitated.

d. Burrowing animals. Burrowing animals in or near the dam shall be exterminated. Their runways and dens shall be opened and thoroughly compacted at the same time they are backfilled. Trapping and poisoning may be used for the extermination of burrowing animals. Information about the best methods of animal extermination may be obtained from the county agricultural agent.

e. Hazardous obstructions. Reservation area used by authorized personnel shall be kept free from obstructions that may cause injury or impede inspections, maintenance, or flood-fighting operations. Materials and equipment shall be stored in such a way that they are not hazardous to personnel.

f. Fencing. All damage to the fencing shall be promptly repaired with new material. All posts shall be kept in good alinement.

All corner posts and braces shall be maintained firm in their concrete settings. Any sagging strands of barbed wire shall be immediately replaced. All painted posts shall be repainted if necessary to insure their serviceability. If any fastening chains or locks are missing, they shall immediately be replaced.

g. Piezometer readings. The dam tender shall take readings of the 12 piezometers at the same time the periodic routine inspections are made. The piezometer readings shall be submitted to the Foundation & Materials Branch of the Engineering Division for evaluation.

h. Miscellaneous. Minor structures and facilities, not specifically described in this manual, shall be inspected at the same time that major adjacent structures and facilities are inspected; maintenance work shall be performed in accordance with that prescribed for structures of similar material. The dam tender shall seek assistance from the Chief, Maintenance Section, when maintenance problems occur that are either beyond his experience or not described in this manual. The dam tender shall be familiar with approved safety measures and first aid treatment, which are under the supervision of the safety branch of the district.

SECTION 4 - OUTLET WORKS

4.01. General features. The outlet works is entrenched in the right abutment and consists mainly of the following: An approach channel; an intake tower; a transition; an outlet conduit; a control room; a floatwell; an access bridge; and a standby generator house. The outlet works is founded on soft bedrock, except for a short length of conduit at the downstream end which is founded on alluvium. For the outlet works plan, profile, and details, see drawings, file nos. 126/38 to 126/57 inclusive, exhibit F. Pertinent information on the outlet works is given in the following paragraphs.

4.02. Approach channel and trashrack. The approach channel is formed by reinforced-concrete retaining walls 15.5 feet apart and is about 80 feet long. Trashrack bars are provided just upstream from the gates to prevent sunken logs or other sunken material from entering the intake structure. (Approach channel is shown on drawing, file no. 126/41 and trashrack details on drawing, file no. 126/43, exhibit F)

4.03. Intake tower. The intake tower is a reinforced concrete structure, 18 feet by 20 feet inside and 82 feet 3 inches high, measured from the floor of the gate hoist chamber to the floor of the control room on top of the tower. It provides access to the gate cylinders and hydraulic pipe lines. If any part of the gate assembly requires repair, it can be disassembled and removed from the gate hoist chamber by hoisting through the tower to the control room and hauling over the access bridge on a dolly. Spiral stairways lead in stages from the gate hoist chamber up to the control room. Each stair landing is provided with 2 light fixtures. A float well pipe, 18 inches O.D., is attached to the north wall of the tower and 2 gate air vent pipes, 18 inches O.D., are attached to the south wall. An 8-inch square air duct connects to the 18-inch left gate air vent pipe under the control room floor and extends down to the gate chamber floor connecting to a ventilation fan which provides the gate hoist chamber with fresh air. Below the intake tower are two gated intake passages, each 5 feet wide and 6.5 feet high. On top of the tower, outlets are provided on the upstream side for 2 portable flood lights.

4.04. Transition. A reinforced concrete transition structure, 77.3 feet long, is constructed between the two rectangular gated passages and the single rectangular outlet conduit. It provides gradual changes in the direction of flow between the two intake passages and the outlet conduit. (See drawing, file no. 126/47, exhibit F)

4.05. Outlet conduit. The outlet conduit is a reinforced concrete structure 471.7 feet long. It is 4.75 feet wide and 7 feet high. The

conduit is constructed in sections 20 feet long. Rubber water stops are provided between the sections. Seepage collars are provided at stations 3+24.29, 3+80, 4+40 and at 20 foot centers from station 6+00 to 7+40. All flows from the outlet conduit discharge into the Carbon Canyon channel. (See drawing, file no. 126/47, exhibit F)

4.06. Control room. The control room on top of the intake tower is 18.5 feet wide, 20 feet long and 14 feet high. The floor elevation is 499.0. It contains two motor pumps mounted on top of a square oil tank; hydraulic control valves; a water stage recorder; gate position indicators and recorders; a rain gage; a toilet; a heater; a radio transmitter and receiver; and an opening for the top stage of the spiral stairway leading to the gate hoist chamber. Access from the roadway on the crest of the dam to the control room is provided by a service bridge. In the ceiling of the control room is an eyebolt which will provide means for lifting various parts of the gate assembly from the gate hoist chamber. (See drawings, file nos. 126/49 and 126/57, exhibit F)

4.07. Float well. The float well intake consists of a concrete intake sump, 5 feet square and 5 feet 6 inches deep, located near the upstream toe of the dam and the approach channel of the outlet works. It is provided with a vertical perforated intake pipe, a cleanout door and a communication pipe, 4-inch diameter and 99 feet long. The 4-inch pipe connects to a vertical float well pipe, 18 inches in diameter, which rises in the intake tower to the control room floor where it connects with a water level recorder table. A 1-inch water pipe extends over the 18-inch pipe where a gate valve is provided for flushing float well. (See drawings, file nos. 126/56, 126/57 and 126/78, exhibit F)

4.08. Access bridge. The access bridge is a reinforced concrete deck on steel girders and reinforced concrete bridge piers. It is about 187 feet long and 9 feet 4 inches wide with a 6-foot roadway, and serves as access from the top of the dam to the control room. The bridge is designed for a live load of 60 pounds per square foot of the 6-foot wide roadway surface which would limit the maximum concentrated live load to 8 tons. Electric light is provided by five curb light fixtures, equally spaced. (See drawings, file nos. 126/39 and 126/51 to 126/54 inclusive, exhibit F)

4.09. Standby generator house. The house for the diesel generator standby unit is situated on top of the embankment opposite the access bridge. It is a reinforced-concrete structure 15.5 feet wide, 16 feet long and 9.5 feet high (inside dimensions). It contains a 40-KW diesel generator unit, two 275 gallon diesel fuel tanks, a control panel for the switch-over from commercial power to generator power, and the necessary appurtenances. (See drawing, file no. 126/74, exhibit F, and paragraph 7.04c)

4.10. Inspections and maintenance. The dam tender or his assistants shall inspect each year, before the flood season starts, the interior of the outlet works structure and the full length of the outlet conduits and shall complete inspection check list, as shown in exhibit C. Inspection shall be accomplished by two persons, one to stand by for rescue, if required. In addition to inspection and maintenance work described in paragraph 3.06 and applicable to this section, the dam tender shall perform maintenance work pertaining mostly to the outlet structures, as described in the following subparagraphs.

a. Channel. The channel shall be kept free of driftwood, trash, silt and other debris. Driftwood, brush, weeds and any other combustible trash on the project shall be burned safely in areas removed from any structures. Incombustible accumulations shall be hauled away and dumped in approved disposal areas.

b. Concrete structures. All concrete in the outlet works shall be inspected and repaired as soon as any reinforcing steel is exposed. Repairs shall be made by thoroughly cleaning the surface by chipping or sandblasting and building the concrete up to its original section. The intake sump for the float well shall be inspected and cleaned annually.

c. Control room and standby generator house. These structures shall be clean, orderly and in a state of good repair at all times, both inside and outside. All light bulbs shall be operable at all times. The water, plumbing and sewage disposal systems shall be maintained tight and free from leaks. Any worn or defective washer in the water faucet shall be replaced at once. Water closet shall be kept clean and free from objectionable odors. The electrical system shall be maintained free from shorts and grounds. Panelboards shall be kept clean and free from dust. If inspection discloses that any painted surfaces are not adequately protected, they shall be thoroughly cleaned and repainted. Any leaks in the roofs shall be promptly repaired. Doors shall be kept in good shape and locked to protect the equipment from dust, rain, and vandalism.

d. Access bridge. Periodic inspection of the access bridge includes the condition of the concrete in deck and piers, the paint on metal surfaces, handrails, etc. Items requiring repair shall be reported in check list, exhibit C.

SECTION 5

SPILLWAY

5.01. General features. The spillway is a detached structure at the east abutment on the left side of the canyon. The spillway structure consists of an approach channel, a reinforced-concrete control section and a reinforced-concrete drop structure and bucket. (See drawings, file nos. 126/33 to 126/37 inclusive, exhibit F) A short description of the features is contained in the following paragraphs.

5.02. Spillway approach channel. The spillway approach channel is an unlined, trapezoidal channel about 535 feet long. It has a bottom width of 100 feet and side slopes of 1 on 1.5. Grouted stone gutters are installed at the top of side slopes to take care of side drainage. (See drawing, file no. 126/33, exhibit F)

5.03. Control section. The control section, which connects the approach channel and the drop structure and bucket, is a concrete-lined trapezoidal section 50 feet long. The bottom width varies from 100 feet at station 14+50 to 125 feet at station 15+00 (spillway crest, elevation 475.0). The side slopes vary from 1 vertical on 1.5 horizontal at station 14+50 to 1 on 2.25 at station 15+00. The upward slope of the invert from station 14+50 to station 15+00 is 0.135. A concrete cutoff wall, which extends to a depth of about 7 feet below the slabs of the invert and the side slopes, is provided at station 14+50. Grouted stone gutters at the top of side slopes take care of side drainage. (See drawing, file no. 126/35, exhibit F)

5.04. Drop structure and bucket. The drop structure is a concrete-lined trapezoidal channel with a base width of 125 feet, a length of 500 feet, and side slopes of 1 on 2.25. The downward slope of the invert from the spillway crest at station 15+00 to station 17+00 is 0.1150 and from there to the bucket 0.1400. A steel sheet piling cutoff wall and an apron of derrick stone about 10 feet thick at the end of the bucket protect the downstream end of the spillway against undermining. (See drawing, file no. 126/35, exhibit F)

5.05. Inspections and maintenance. The dam tender or his assistants shall perform periodic inspections and maintenance according to paragraph 2.09, titled Inspections and maintenance, and shall complete inspection check list as shown in exhibit C. The spillway shall be inspected at least once a year during the dry season.

SECTION 6

CARBON CANYON CHANNEL

6.01. Channel. The channel, including the upstream transition, is an open rectangular channel, 4,125.70 feet long, extending from station 389+05.70 to station 347+80. The channel is covered between stations 382+49 and 380+30 for Rose Drive crossing, and between stations 356+30 and 355+64, for Imperial Highway and Pacific Electric Railroad crossings. The transition section, which is 80 feet long, connects the outlet conduit of the dam with the upstream end of the channel. The width of the transition section ranges from 4.75 feet to 10 feet and the wall height from 9 feet to 5.5 feet. The channel width ranges from 10 feet to 14 feet with wall heights from 5.5 feet to 10 feet. At the downstream end, a cutoff wall of 32-pound steel sheet piling, 25.5 feet long, is driven into the ground across the channel and is backed by a derrick stone apron to prevent undermining. Near the downstream end, the Golden Avenue bridge crosses the channel. (See drawings, file nos. 126/79 to 126/90 inclusive, exhibit F)

6.02. Fences. Safety guard fences run continuously on top of the walls on both sides of the channel from the upstream end to the downstream end, except for gaps at the crossings of Rose Drive and Imperial Highway, where fences run across the channel. They consist of 2-inch diamond-mesh chain link galvanized wire fencing, 36-inches wide and are supported on 1¼-inch diameter galvanized steel pipe posts grouted into the top of the walls. Two strands of galvanized barbed wire are securely fastened to the pipe posts above the mesh fencing. (See drawing, file no. 126/82, exhibit F)

6.03. Drainage structures. A 36-inch reinforced concrete pipe, about 60 feet long, is provided for the discharge of side drainage through the west channel wall near station 358. A 36-inch corrugated metal pipe runs under Rose Drive and discharges into the channel about station 378 through the east channel wall. Provision for side drainage along the rest of the channel consists of sloping the backfill behind the channel in order to ensure the entrance of overland flows into the channel. (For concrete drain pipe, see drawing, file no. 126/88 and for corrugated metal drain pipe under Rose Drive, see drawing, file no. 126/102, exhibit F)

6.04. Inspection and maintenance. The dam tender or his assistants shall inspect each year, before the flood season starts, the full length of the channel and shall complete the inspection check list, as shown in exhibit C. Maintenance of the channel and the fences is described in paragraphs 3.06 and 4.10. Drain pipes shall be kept free from any obstruction that would affect a free flow through the pipes.

SECTION 7

GATES, HOISTS AND MACHINERY

7.01. Gates. Two slide gates, 5 feet wide by 6 feet 6 inches high, are set in the concrete intake structure. The total hydrostatic load on each gate for maximum water surface elevation 493.7 is approximately 217,500 pounds. The gate assembly includes the following parts: (a) gate leaves which are cast steel, (b) gate frames and bonnets are cast iron, (c) bonnet covers are cast steel, (d) gate leaf stems are K-monel metal, (e) bearing seal strips on gate leaves and gate bodies are bronze of dissimilar composition, and (f) bottom seals are cast steel frames with undercut side walls poured full of babbitt metal. (For gate assembly and details, see drawings, file nos. 126/58 to 126/70 inclusive, exhibit F)

7.02. Hoists. The two hydraulic hoist cylinders are 7 feet 7¼ inches long with 18 inches bore, fabricated of steel. The hoist cylinder heads are cast steel; the hoist pistons are cast iron, 18 inches in diameter, 10-1/8 inches high and are equipped with 4 piston rings and 4 Garlock packing rings. (See drawing, file no. 126/65, exhibit F)

7.03. Operating machinery. Operating machinery consists of (a) two pumps and motors, (b) a standby unit, and (c) a hydraulic system. A short description is contained in the following paragraphs:

a. Pumps and motors. Two vane-type constant delivery, high pressure oil pumps with capacities of about 12 gallons per minute, are driven by two 7½ hp, 1200 rpm, 60 cycle, 220/440 volts, 3 phase motors, located in the control room. Only one pump and motor is required for gate operations, while the other unit serves as standy. Circuit switches #3 and #5 in Power Panel "P" are key interlocked so that only one 7½ hp hydraulic pump motor can be in operation at one time. Electric power for the motors is supplied by the Southern California Edison Company at 240 volt, 3 phase, 60 cycle. (See drawing, file no. 126/68 and 126/71, exhibit F)

b. Standby unit. A diesel generator unit is installed in the standby generator house to provide electric power if the commercial Edison power fails. The unit includes a 40 kilowatt, 240 volt, 1200 rpm, 60 cycle, 3 phase generator; a 4 cycle, internal combustion diesel engine, equipped with a hydraulic starter and a Woodward governor; and two 275 gal. diesel oil storage tanks. A conduit carries the power wires to the control room. (See drawing, file no. 126/74, exhibit F)

c. Hydraulic system. The hydraulic oil pressure system is activated by electrically powered oil pumps and controlled by 4-way valves. The 1¼-inch, schedule 80, extra strong piping extends from the control room down to the gate hoists. The force exerted by the oil pressure forces the pistons in the hoist cylinders up or down, which in turn raises or lowers the gates. The hydraulic pressure oil is stored in a rectangular 90 gal. tank in the control room. (See drawing, file no. 126/68, exhibit F and sketch on page 7-5, Hydraulic Diagram)

7.04. Gate operations. The gates are raised and lowered by means of hydraulic hoist cylinders activated by oil pressure which is generated by electric powered high pressure oil pumps, located in the control room. The actual operation of the gates is accomplished through manipulation of 4-way valves, one for each gate. Selsyn transmitters are mechanically connected to gate position indicators and recorders located in the control room which automatically indicate and record gate opening heights. There is one overload relief valve at the pump unit, set at approximately 800 psi. Each hoist cylinder is equipped with a counterbalance valve, set at 50 psi, in the pipeline that connects with the bottom of the cylinder. During the gate closing stroke, this valve dampens to a great extent any vibrations caused by high velocity flow of water under the gate leaf and prevents excessive pressure drops in the pipeline that connects with the top of the cylinder. The gate opening and closing speed is approximately one foot per minute. (See drawing, file no. 126/68, exhibit F and Hydraulic Flow Diagram, page 7-5)

7.05. Inspections, tests and maintenance. The dam tender or his assistants shall perform periodic inspections, tests and maintenance, as described in paragraphs 2.10 and 2.11 and shall complete the inspection check list as shown in exhibit C. Maintenance work pertaining to service gates is outlined in the following paragraphs:

a. General. The gate assemblies shall be maintained in the best possible operating condition. They shall be tested once every month and the report (see exhibit D) shall be submitted to the Engineering Division by the Construction Division. Repairs, which shall be made by electricians and mechanics from the district base yard, shall conform to the standards specified in the contract specifications for the original work. Loose, damaged, unserviceable, or missing parts shall be promptly tightened, repaired or replaced.

b. Gates. Gates must come to a true closure against the bottom seal. The Chief, Engineering Division, shall be notified by the Chief, Construction Division, whenever the gates fail to close tightly or whenever the seals are damaged. Gate seal surfaces shall be kept clean and free from mud and sand, and the bottom sealing surface

shall be kept free from rocks or other obstructions. Each gate shall stop automatically at the fully open position and shall close tightly without shock. Gate position indicators in the control room and staff gages on the hoist cylinders shall be adjusted to show the actual gate opening height above the gate sill.

c. Electrical equipment. Electrical equipment shall be tested every 30 days or oftener if defects develop. Equipment removed for repair or alteration shall be replaced without delay and tested after reinstallation. If wiring becomes damp, megger tests shall be made of insulation. Any evidence of trouble developing in the electrical supply lines or transformers shall be immediately reported to the local representative of the Southern California Edison Company and to the Chief, Maintenance Section. The motors and pumps shall be lubricated and maintained by qualified electricians from the District base yard. The switches, lights, convenience outlets, and wiring circuits shall be kept in first class operating condition. Defective parts shall be replaced with new parts equal in quality to those in the original installation.

d. Diesel standby unit. The diesel engine must always be properly lubricated. Before engine is started, any assistant to the dam tender, if not familiar with the standby unit, should consult instruction manual, exhibit G-2. The fuel tanks for the engine shall NEVER be less than half full.

e. Operation of electrical facilities. The operation of the electrical facilities is described in attached booklet, exhibit G-2, titled "Carbon Canyon Dam, Instructions for Operation of Service Gates." The locations of the instruments and circuit breakers on the generator control panel are shown in the booklet, exhibit G-2.

f. Transferring plant to standby service. In transferring the plant to standby generator service from the Edison Company service, use instructions shown in exhibit G-2. Check voltmeter on generator side to make certain that the generator is up to full voltage.

g. Transferring plant to Edison service. To transfer the power supply from the standby unit to Edison Company service, use the instructions given in exhibit G-2.

NOTE--The voltage regulator and the field rheostat are not to be touched at any time except by authorized personnel from the base yard.

h. Painting. Painting of exposed metal surfaces shall be done as required. Surfaces shall be thoroughly cleaned before painting; oil and grease shall be removed with suitable solvents and clean cotton rags and rust spots and loose paint with stiff wire brushes. Paint

shall be applied in a workmanlike manner and in accordance with applicable paragraphs of the original construction and supply specifications. Gates, gate frames, trash racks and other metal surfaces exposed to water shall be painted with rust preventives.

COMPUTATION SHEET

SHEET 24-A OF _____ SHEETS

PROJECT Carbon Canyon Gates

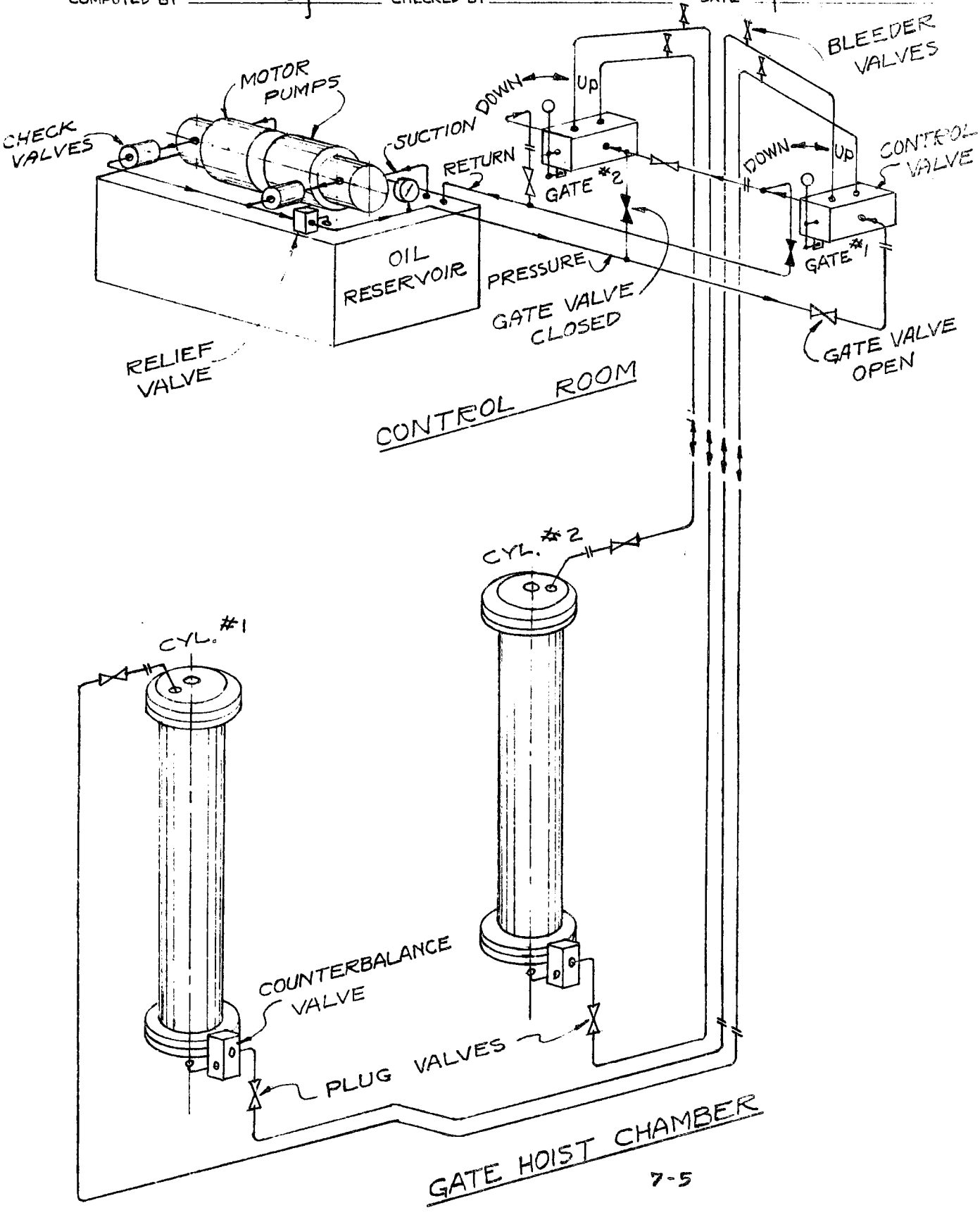
DWG. NO.

ITEM Hydraulic Flow Diagram

FILE

COMPUTED BY R.E. Roy CHECKED BY

DATE April 1958



SECTION 8

HYDROLOGIC INSTALLATIONS

8.01. General. Hydrologic installations include the following: A reservoir water stage recorder; a telemark installation; reservoir staff gages; gate position indicators and recorders; precipitation gages; an outflow gaging station; and sedimentation monuments. Short descriptions of these items are contained in the following paragraphs.

8.02. Reservoir water stage recorder. A Stevens A-35 water stage recorder is located in the control room on top of a table, recording water stage elevation from gate sill elevation 403 to maximum water surface. It is equipped with a tape gage and is operated at either slow time (2.4 inches of paper travel per day) or fast time (9.6 inches of paper travel per day).

8.03. Telemark. A Stevens reservoir water stage telemark, installed in connection with the water surface recorder, provides means of ascertaining the water surface elevation in the reservoir at any time by commercial telephone.

8.04. Reservoir staff gages. Eighteen 5-foot adjustable staff gages are set in a row on the upstream slope of the dam near the control room to indicate water surface elevations from 405 to 495. The staff gages are graduated in feet and tenths of feet and are readable from the control room and bridge. (Location and details of staff gages are shown on drawing, file no. 126/32, exhibit F).

8.05. Gate position indicators and recorders. Two Selsyn operated Stevens-type PJ gate position dial indicators and two Stevens-type PK gate position recorders, one for each gate, are located in the control room. (See drawing, file no. 126/69 and 126/70, exhibit F)

8.06. Gate position staff gages. Each of the two gate hoist cylinders is equipped with a gate position staff gage graduated in feet and tenths of feet, showing the distance of the bottom of the gate above the gate sill. (See drawing, file no. 126/66, exhibit F)

8.07. Standard rain gages. A shielded collector ring, mounted on the roof of the control room, is connected by tubing to a plastic graduate inside the control room.

8.08. Recording rain gage. An "Instrument Corporation" dual traverse recording rain gage with a capacity of 12 inches is located near the gaging station.

8.09. Outflow gaging station. The outflow gaging station, located at station 386+86 in the Carbon Canyon outflow channel, consists of a 48-inch diameter concrete pipe stilling well and a concrete block recorder house, 8 feet square and 8 feet high. The stilling well is provided with two $2\frac{1}{2}$-inch intake pipes. A Stevens-type A-35 water stage recorder, equipped with a tape gage, records water surface elevations. A float operated selsyn transmitter conveys the gage height of the water surface at the outflow gaging station to the control room. A foot bridge at channel station 387+26 facilitates the taking of discharge measurements at the gaging station. The gaging station is operated by the U. S. Geological Survey under a cooperative agreement. (See drawing, file no. 126/89, exhibit F).

8.10. Sedimentation monuments. Sedimentation monuments are 2-inch diameter iron pipes with caps which are used as reference points for sedimentation surveys. For identification and protection the monuments are provided with 3-inch square white painted wooden posts.

8.11. Inspection, servicing, maintenance and reporting. Inspection, servicing, maintenance and reporting are done by the dam tender, the U. S. Geological Survey and the Hydrology & Reservoir Regulation Section of the Engineering Division. This work is described in the following paragraphs.

a. By the dam tender. The dam tender or his assistants shall perform periodic inspections and maintenance of the hydrologic installations and shall complete inspection check list as shown in exhibit C. In addition, he shall keep the backboards for the staff gages firm; gage faces clean; silt accumulations removed from float wells and intakes to float wells; outflow gaging station and appurtenances clean and repaired; and weeds cleared near gaging stations. In accordance with written instructions from the Hydrology & Reservoir Regulation Section, the dam tender shall perform routine servicing of the gages (except the water level recorder at the outflow gaging station) and shall make radio and written reports to the Hydrology & Reservoir Regulation Section.

b. By the U. S. Geological Survey. The U. S. Geological Survey is responsible for servicing the outflow gaging station and for publishing outflow records of this station in the U. S. Geological Water Supply papers.

c. By the Engineering Division. Designated personnel of the Engineering Division shall inspect, service and adjust all recorders at 30-day intervals or more often if necessary during the flood season, 15 October through 15 April. Also, they shall complete inspection check list as shown in exhibit C.

SECTION 9

COMMUNICATION FACILITIES

9.01. Radio station. A radio transmitting and receiving station, which permits communication between the dam tender, the Hydrology & Reservoir Regulation Section and other fixed and mobile stations, is located in the control room. The radio station operates on a frequency of 40,060 kilocycles and is part of the Corps of Engineers' radio reporting network. The call letters of Carbon Canyon Dam are WUK-426.

9.02. Telephone. Outside telephone communication is provided by the Pacific Telephone and Telegraph Company.

9.03. Maintenance of radio installation. The maintenance of the radio facilities, including periodic inspections, testing and servicing, is the responsibility of the Hydrology & Reservoir Regulation Section, Engineering Division, which should be notified immediately when trouble develops in the radio system.

9.04. Telephone maintenance. The maintenance of the telephone service is the responsibility of the Pacific Telephone Company. When trouble develops in the telephone service, the dam tender shall immediately notify the company's service department. Also, priority for repair of damage shall be requested of the company.

SECTION 10

WATER SUPPLY AND SEWAGE

10.01. Water supply system. Water is supplied to the control room by the Chanslor-Western Oil and Development Company in a 1½-inch diameter wrought-iron water pipe which runs near the standby generator house under the crest of the dam and under the access bridge into the control room. A 3/4-inch water pipe extends from the control room down through the intake tower to the gate hoist chamber. A 1-inch water pipe to the floatwell is provided for flushing purposes. (See drawings, file nos. 126/28, 126/39, 126/49 and 126/78, exhibit F for water distribution).

10.02. Sewage system. The sewage system includes a 4-inch cast iron soil pipe from the toilet in the control room under the centerline of the access bridge to a 750-gallon Nottingham Hygi-Sept septic tank, located near the standby generator house. From the tank, a 6-inch diameter vitrified clay pipe, 20 feet long, and a 4-inch open joint clay drain pipe, 70 feet long, distribute the effluent into gravel-filled trenches. (See drawings, file nos. 126/39 and 126/78, exhibit F).

10.03. Inspections and maintenance. The dam tender or his assistants shall perform periodic inspections and maintenance of the water supply system and the sewage system in accordance with paragraph 2.09, titled "Inspections and maintenance," and shall complete inspection check list as shown in exhibit C. Leaking pipes and valves shall be promptly repaired. Maintenance work shall include keeping (1) pipe hangers and supports firmly in place, (2) drains, sewers, and traps clean and properly repaired, (3) the sewage system free from harmful materials and chemicals, and (4) excess sludge accumulations removed from the septic tank. Keep system free of materials apt to clog the pipes. These materials include grease, rags, and pieces of wood, also chemicals harmful to pipes and to digesting bacteria, such as lye, acid, salt, oil, and gasoline. Sludge accumulations in the septic tank shall be inspected each year before the flood season begins, preferably during September or October. If sludge accumulations in the tank are half-way up to the inlet or outlet pipes, or about 10 inches deep, the accumulations shall be either bailed or pumped out, and either buried in trenches or placed in locations approved for this purpose. If annual inspections indicate that accumulations in the septic tank are not sufficient to warrant annual removal, the inspection may be extended to 2-year periods.

SECTION 11

FIRE FIGHTING EQUIPMENT, FIRE PREVENTION AND ACCIDENT PREVENTION

11.01. Control room. Fire fighting equipment in the control room includes one 5-pound carbon dioxide extinguisher and one $2\frac{1}{2}$-gallon soda acid extinguisher; in the generator room is one 20-pound carbon dioxide fire extinguisher.

11.02. Inspections, tests, and maintenance. The dam tender or his assistants shall perform periodic inspections and maintenance of the fire fighting equipment and shall complete inspection check list as shown in exhibit C. Fire fighting equipment shall be kept in first-class condition at all times. Maintenance is described in the following paragraphs:

a. Fire extinguishers. Fire extinguishers inside the building shall be placed near doorways that are easily accessible from the outside. All extinguishers shall be inspected once each month by the dam tender and annually by the Safety Branch and the inspection dates and initials of inspector recorded on attached card. Monthly inspection will determine if they show evidence of being used, if they are in good condition and located properly with no obstruction which would make them inaccessible. They shall be recharged immediately after use and shall be replaced promptly if defective. Maintenance of the soda acid extinguisher shall include (a) removing the cap and inspecting the contents every six months and (b) emptying, cleaning and recharging the extinguisher once a year, in accordance with the manufacturer's instructions. Carbon dioxide extinguishers shall be weighed annually. If the weight is 10 percent below that stamped on the side of the extinguisher, it must be recharged.

b. Fire prevention. Every precaution shall be taken to prevent the destruction of property by fire. All personnel must be constantly alert to the dangers inherent in fire hazards and the necessity for their prompt removal. Precautionary measures include (1) removing dry grass and weeds from the vicinity of buildings and combustible structures, (2) removing inflammable trash promptly and storing inflammable materials safely, and (3) preventing short circuits in electrical wiring and equipment. Inflammable trash, including wastepaper and oily rags, shall be placed in covered fireproof containers and burned daily in the designed places. Inflammable materials, including gasoline and paint, shall be stored ONLY in tightly sealed safety containers placed, if necessary, in locked compartments out of the reach of children. Short circuits shall be prevented by keeping electrical wiring and equipment in first-class condition, by not overloading any circuit, and by protecting circuits

with proper fuses or circuit breakers. The fire department telephone number shall be posted near the dam tender's telephone.

11.03. Accident prevention. Operating personnel will assure continuous accident prevention techniques in the operation of the dam and will apply every practical means for the promotion of safety.

a. The application of safety will be in conformance with the Corps of Engineers' and Los Angeles District Safety Program and Policies;

b. EM-385-1-1, General Safety Requirements, the Corps of Engineers, U. S. Army Safety Manual and LADM 385-1-1, Administrative Instructions for Los Angeles District, Safety Program, establish the general safety requirements for all activities and operations of the Painted Rock Dam;

c. Requirements outlined below do not detract from the above directives, but are emphasized as they pertain to predominate hazards which require foremost consideration:

(1) Personal protective equipment, such as hard hats, goggles, safety belts and lines, etc., shall be furnished employees as required and their use enforced;

(2) reciprocating, rotating or moving parts of equipment shall be guarded if such parts are exposed to contact by persons or create a hazard;

(3) portable electric tools and equipment shall be grounded;

(4) rubber mats will, at all times, be positioned in front of electrical control panels;

(5) when an individual is required to work alone in a remote section of the dam structure or the reservation, he shall inform his assistant or supervisor where he is going to work and the approximate time he will return. The informed person will check on his whereabouts if he does not report back at the specified time;

(6) paint and other inflammable materials shall be stored in locations approved by the Safety Branch;

(7) Wire rope used in connection with operations at the dam shall be inspected in accordance with Section XVII of EM-385-1-1, General Safety Requirements;

(8) signs, fencing, and barricades will be

adequately maintained. Protection of the visiting public will be given foremost consideration;

(9) motor vehicles will not be used on steep roads or ramps if they are not properly tuned and the braking system is not in good condition;

(10) emergency equipment for first-aid and rescue will be adequately maintained;

(11) doctors', ambulance and hospital names, addresses and telephone numbers will be posted prominently at telephones;

(12) accidents will be reported in accordance with district instructions. Publications relative to such reporting procedures will be kept on file.

SECTION 12

RESERVOIR REGULATION AND
FLOOD EMERGENCY REQUIREMENTS

12.01. Reservoir regulation. The regulation of Carbon Canyon Dam to affect optimum hydraulic operation of the project is a responsibility of the Chief, Engineering Division. He has delegated this responsibility through the Chief, Planning and Reports Branch to the Chief, Hydrology & Reservoir Regulation Section. Information pertaining to the regulation of Carbon Canyon Dam is given in the Reservoir Regulation Manual for that project. This manual contains: (a) details on the district's organization and methods for effecting the regulation of the project; (b) an explanation of the plan of operation and (c) pertinent data required for the operation of the dam. These operating data include a gate operation schedule, area and capacity curves, an outlet discharge curve, a spillway discharge curve, the reservoir design flood routing, the spillway design flood routing and other information. The dam tender shall transmit hydraulic data necessary for the operation of the dam to the Hydrology & Reservoir Regulation Section, including water surface elevations, gate settings and rainfall amounts. During severe floods, trained engineers are dispatched to the Carbon Canyon Dam to assist in the flood fight and to supervise operation of the project if communications with the District office are interrupted. In addition to the Reservoir Regulation Manual, the dam tender has been supplied with a book of operating data for the reservoir, which has been compiled primarily for use if communications should be disrupted during a flood. It is important that the dam tender and the district personnel assigned to assist him during high water periods shall be thoroughly familiar with the contents of this Operation and Maintenance Manual, the LADM 500-1-1, Emergency Flood Control Activities Manual and the Reservoir Regulation Manual for Carbon Canyon Dam.

12.02. Flood emergency preparations. Flood emergency preparations include storing adequate quantities of flood-fighting materials and equipment on the project BEFORE the flood season. If needed, additional materials and equipment shall be obtained from nearby dealers. Construction of flood damage preventing structures is also described in the flood emergency manual.

12.03. Inspections. During flood emergencies, the dam tender and his assistants shall keep the dam, the outlet works, and the spillway under constant surveillance to quickly detect and remedy

(1) sand boils or unusual wetness on the downstream slope of the dam; (2) incipient slides or sloughs; (3) stream or wave erosion; and (4) any other conditions that could endanger the embankment.

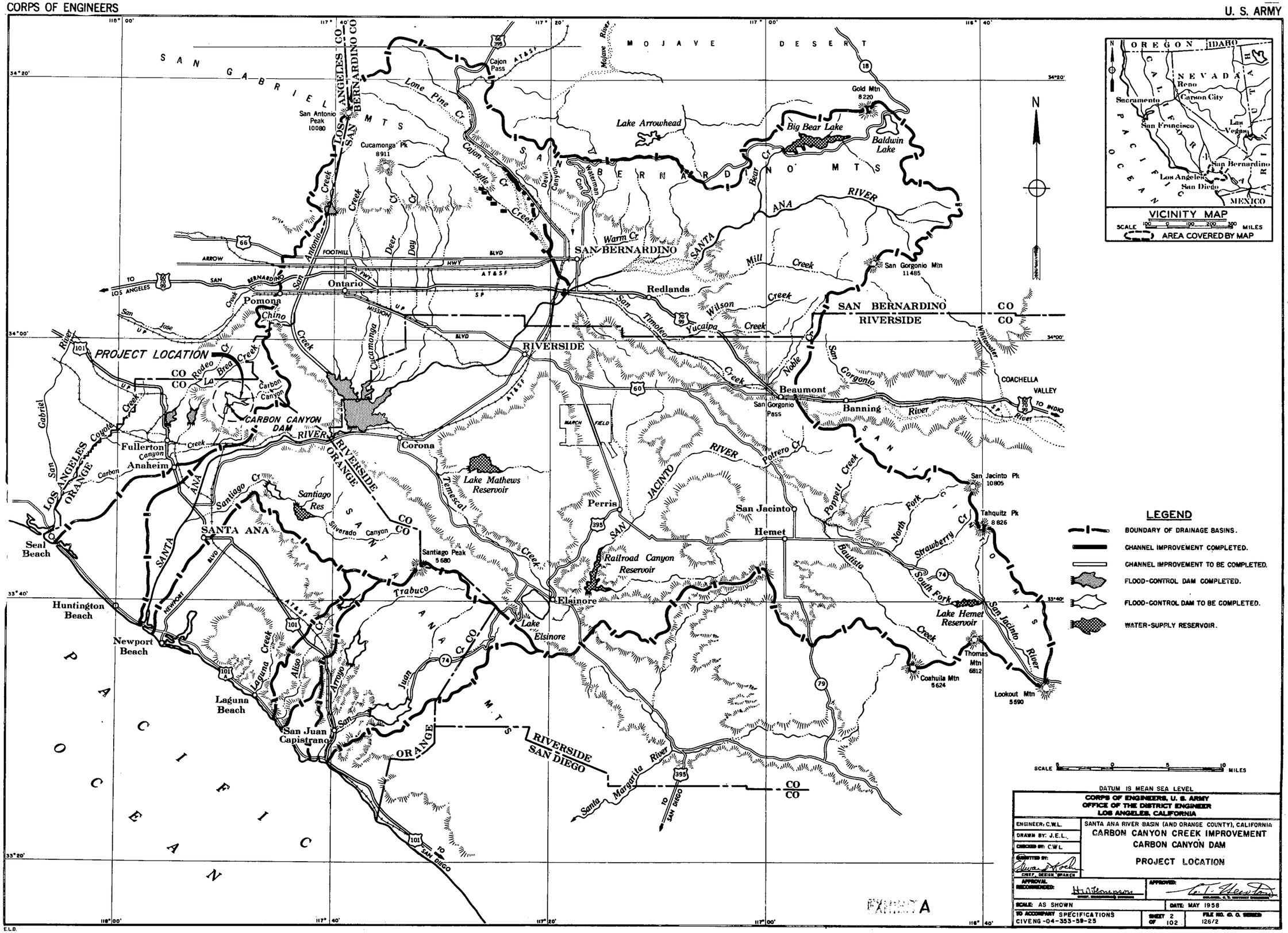
12.04. Flood warnings. The U. S. Weather Bureau is the Government agency officially responsible for issuing flood warnings and weather forecasts to the public.

12.05. Mobilization. Detailed instructions on mobilization of district forces for emergency duty during floods are given in the LADM 500-1-1, Emergency Flood Control Activities.

12.06. Notification of reservoir releases. The dam tender shall notify governmental and private organizations of anticipated water releases from the reservoir. Organizations interested in such notifications include (1) Federal agencies; (2) water conservation districts; (3) law enforcement agencies; (4) highway departments; and (5) recreational licensee. (See LADM 500-1-1, Emergency Flood Control Activities, issued by Corps of Engineers, U. S. Army, Los Angeles District).

CORPS OF ENGINEERS

U. S. ARMY



LEGEND

- BOUNDARY OF DRAINAGE BASINS.
- CHANNEL IMPROVEMENT COMPLETED.
- CHANNEL IMPROVEMENT TO BE COMPLETED.
- FLOOD-CONTROL DAM COMPLETED.
- FLOOD-CONTROL DAM TO BE COMPLETED.
- WATER-SUPPLY RESERVOIR.

SCALE 0 5 10 MILES

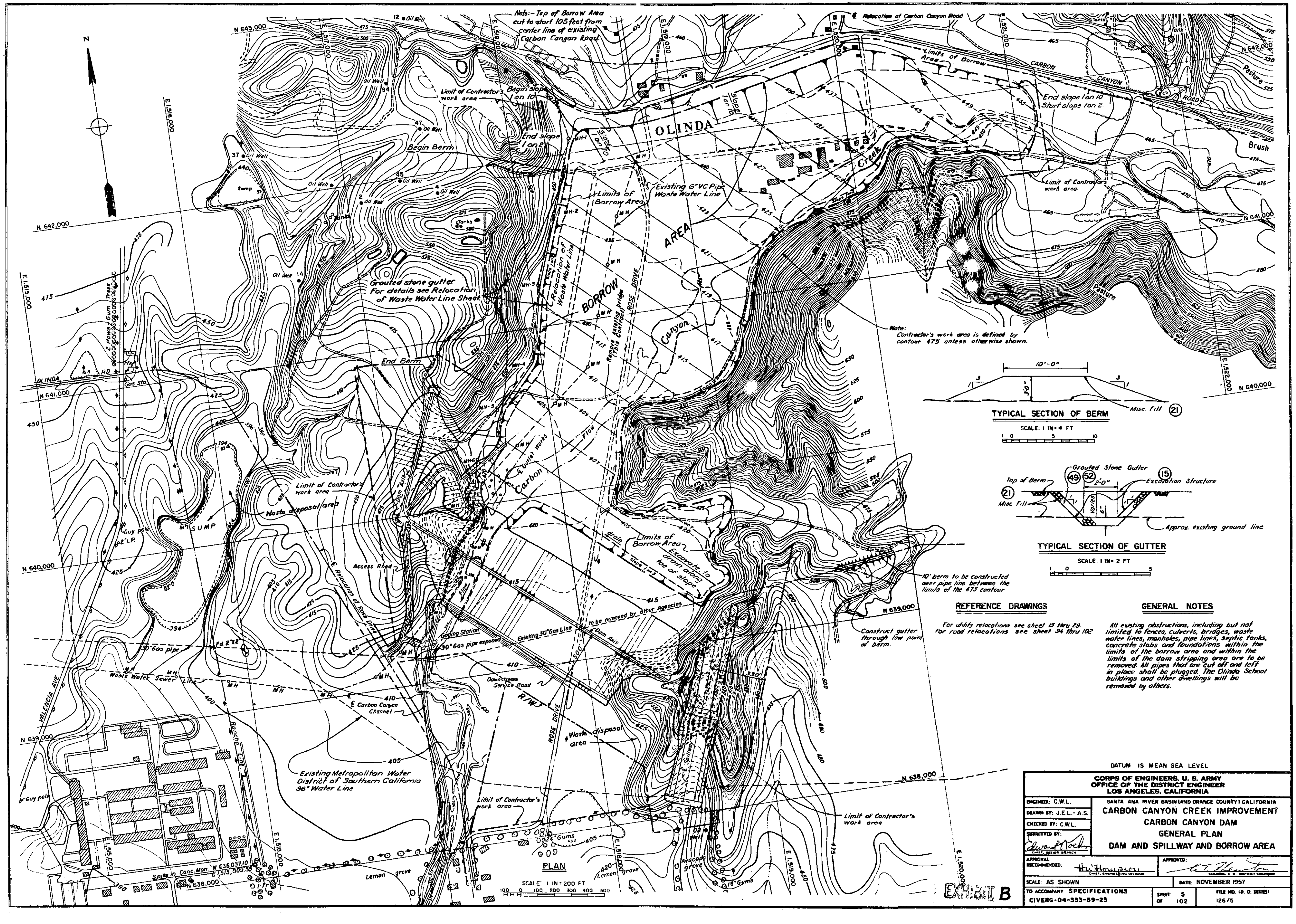
DATUM IS MEAN SEA LEVEL

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
LOS ANGELES, CALIFORNIA

ENGINEER: C.W.L.	SANTA ANA RIVER BASIN (AND ORANGE COUNTY), CALIFORNIA
DRAWN BY: J.E.L.	CARBON CANYON CREEK IMPROVEMENT
CHECKED BY: C.W.L.	CARBON CANYON DAM
SUBMITTED BY: CHIEF, DESIGN BRANCH	PROJECT LOCATION
APPROVAL RECOMMENDED: CHIEF, ENGINEERING DIVISION	APPROVED: COLONEL, C.E., DISTRICT ENGINEER
SCALE: AS SHOWN	DATE: MAY 1958
TO ACCOMPANY SPECIFICATIONS CIVENG-04-353-58-25	SHEET 2 OF 102 — FILE NO. O. O. SERIES 126/2

EXHIBIT A

E.L.D.



REFERENCE DRAWINGS

For utility relocations see sheet 15 thru 29.
For road relocations see sheet 94 thru 102

GENERAL NOTES

All existing obstructions, including but not limited to fences, culverts, bridges, waste water lines, manholes, pipe lines, septic tanks, concrete slabs and foundations within the limits of the borrow area and within the limits of the dam stripping area are to be removed. All pipes that are cut off and left in place shall be plugged. The Olinda School buildings and other dwellings will be removed by others.

DATUM IS MEAN SEA LEVEL

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
LOS ANGELES, CALIFORNIA

ENGINEER: C.W.L.
DRAWN BY: J.E.L.-A.S.
CHECKED BY: C.W.L.
SUBMITTED BY: [signature] CHIEF, DESIGN BRANCH

SANTA ANA RIVER BASIN (AND ORANGE COUNTY) CALIFORNIA
CARBON CANYON CREEK IMPROVEMENT
CARBON CANYON DAM
GENERAL PLAN
DAM AND SPILLWAY AND BORROW AREA

APPROVAL RECOMMENDED: [signature] CHIEF, ENGINEERING DIVISION
APPROVED: [signature] COLONEL, C. E. DISTRICT ENGINEER

SCALE: AS SHOWN
DATE: NOVEMBER 1957
TO ACCOMPANY SPECIFICATIONS CIVENG-04-353-59-25
SHEET 5 OF 102
FILE NO. (D. O. SERIES) 126/5

CONDITION SURVEY OF DAMS *(Complete in duplicate)*	INSPECTED BY	PROJECT DATE

After each item indicate one of the following:
(NA) Not Applicable; (S) Satisfactory; (U) Unsatisfactory (If Unsatisfactory, circle deficiency and explain on reverse side giving Item Number)

	ITEMS TO BE INSPECTED AND DEFICIENCIES TO LOOK FOR	NA, S, OR U
RESERVOIR	1. BASIN - dumping, floatable debris, dead brush, trees or logs, trespassing	
	2. ACCESS ROADS - rough, need blading, weed clearing, surfacing, slides, settlement, ruts, washouts, obstructions, damaged guard posts, barricades, lights, signs, eroded or plugged culverts	
	3. CHANNEL IN BASIN - concrete, grouted stone side slopes, stabilizers, rock toe, levee erosion, toe drains, subdrainage, manholes, side drains, gaging station	
EMBANKMENT	4. CREST - erosion, bituminous surfacing, slope to drain toward upstream facing, weeds, brush	
	5. SLOPES - erosion, loss of filter, cracks in grouted stone, wet areas or seepage in downstream slope, burrowing animals, weeds or brush	
	6. TOE DRAIN - seepage, drainage, relief wells, drainage ditches, plugging, silting of toe extension	
	7. GALLERY - concrete, seepage through joints, settlement, steelwork, rust, paint, padlocks	
SPILLWAY	8. APPROACH CHANNEL - sloughed or eroded banks, drainage ditches, deposit of sediment, weeds, brush	
	9. CONCRETE - width and extent of cracks, popouts, expansion joints, alinement of joints, subdrains	
	10. GATE OPERATING CHAMBER - lights, waterlines and valves, electric conduits, oil pressure lines, gate position indicators, gate pit joint or manhole leakage, float chamber leakage, float mechanism	
	11. DRAINAGE GALLERY (Hansen Dam) - malfunctioning of foundation drain holes, floor drains, drain outlet, drain manhole	
	12. BUCKET OR STILLING BASIN - accumulation of trash and debris, degradation of downstream channel, subdrains, weepholes, pools of stagnant water	
OUTLET WORKS	13. APPROACH CHANNEL - potential slides, sloughed areas, accumulation of trash and debris, rubbish, weeds, stone blanket, disintegration of rock, weepholes	
	14. INTAKE - cracks in concrete, spalled joints, seepage thru joints, displacement due to settlement, float recorder intake, missing wire screens, clogging of inlet, rusty ladder rungs, mud, sand or silt in float well, trash racks, vent pipes, diversion structure	
	15. CONCRETE - width, extent of cracks, popouts, alinement of joints, expansion joints, subdrainage	
	16. CONDUIT - trash and debris, concrete popouts, seepage thru joints, concrete abrasion areas	
	17. BUCKET OR STILLING BASIN - accumulation of trash and sediment, concrete, stagnant water, subdrainage	
	18. OUTLET CHANNEL - change in grade or alinement, obstructions, subdrainage, erosion, grouted stone	
	19. SERVICE BRIDGE - alinement, pier settlement, expansion joints, handrails, curbs, concrete, lights, paint	
GATES & HOISTS	20. GATES - corrosion, distortion of leaves, plates or frames, gate creep, missing bolts or nuts, oil leakage, tightness of seals, clean sealing surfaces, lubrication, paint	
	21. HOISTING EQUIPMENT - hoist cables, function of chains and sprockets, vibration of gear boxes, drive shafts, lubrication, gate stem, excessive wear, corrosion, rust, paint	
	22. HYDRAULIC SYSTEM - piping leaks, control system, pumps & motors, lubrication, sparking, excessive heat	
	23. ELECTRICAL EQUIPMENT - motors, heaters, gate position indicators, panels, loose wires, insulation, switchboard, defective parts, burnt fuses, broken switches, sparking, overheating, cleanliness	
CONTROL	24. HYDROMETRIC EQUIPMENT - correlate settings, automatic recordings, clocks, tape, ink in pens, charts	
	25. TELEPHONE-RADIO - defects in radio or telephone communication system, volume, audible howlers	
	26. FLOOD LIGHTS - condition, check lamps, conductor cable and terminal plug	
	27. ELEVATOR - malfunctioning, start, run and stop, brakes, paint, lubrication, cleanliness	
MISC	28. FENCING - damaged fabric, wires, posts, cables, chains, gates, missing fencing accessories, alinement, paint	
	29. STAFF GAGES - damage, displacement, legibility, concrete footing, paint	
	30. VANDALISM - report evidence	

ITEM NO.	DESCRIPTION OF DEFICIENCY AND RECOMMENDED REPAIRS	DATE REPAIR COMPLETED

One checklist to be submitted to the Chief, Maintenance Section, who will route it to the Design Branch, Engineering Div., and one checklist to be submitted to the Chief, Operations Branch, Construction Div.

U. S. ARMY ENGINEER DISTRICT, LOS ANGELES, CORPS OF ENGINEERS

REPORT OF STANDBY UNITS ON FLOOD CONTROL PROJECTS

DAM _____ DATE _____

	TIME	ENGINE			DATE	LOG	GENERATOR VOLTAGE (Under Full Load)			LIGHTING VOLTAGE (Under Full Load)	
		R.P.M.	Temp.	Oil Pressure			Phase 1	Phase 2	Phase 3	Circuit No. 1	Circuit No. 2
No. 1 STARTED											
STOPPED											
No. 2 STARTED											
STOPPED											
No. 3 STARTED											
STOPPED											

Engine Fuel on hand _____ gallons. REMARKS _____

Operate at least 30 minutes on the 1st and 16th of each month. Prepare in triplicate; 2 copies to Operations Branch.

NORMAL OPERATING VALUES							
DAM	Engine			GENERATOR VOLTAGE	LIGHTING VOLTAGE	TANK CAP. (Gals)	COMSUMPT (gal./h)
	R.P.M.	Temp.	Oil Press.				
Brea	990-1000	200	30-70	470-490	115-121	280	3
Fullerton	990-1000	200	30-70	470-490	115-121	280	3
Hansen	1800	Operating Range		238-244	115-121	500	4
Prado	1800	Operating Range		470-490	115-121	275	4
Sepulveda	1800	Operating Range		470-490	115-121	275	4
Santa Fe	890-900	170	Oper. Range	470-490	115-121	1000	6
Whittier Narrows	1800	180	30-60	470-490	115-121	1000	6
San Antonio	1200	180	30-60	470-490	115-121	550	5
Painted Rock	1200	180	65-75	470-490	115-121	550	5
Carbon Canyon	1200	180	40-50	238-244	115-121	550	4

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Damtender

SPL Form 341
18 Apr 63 Previous editions are obsolete

EXHIBIT D-1

CORPS OF ENGINEERS U.S. ARMY
LOS ANGELES DISTRICT

GATE OPERATIONS REPORT
FOR ALL TYPES GATE HOISTS

_____ DAM DATE _____

Gate No.	Water Surface Elevation	Gate Opening (in feet) Positions No. 1.	2.	3.	Power Used Outside	Standby	Hydraulic Hoists, Oil Pressure(lbs/sq. inch) Raising At Start	Raising After Start	Lowering At Start	Lowering After Start	Geared Hoists At Start Volts	At Start Amps	After Start Volts	After Start Amps	Remarks
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															

Is gate opening indicator operating correctly? _____

NOTE:
All gates will be test-operated at least once a month. Reports shall be made of operations during storms as well as during routine tests. Of particular importance is the force required to start or "crack" the gate from the closed position when there is water pressure against the gate. Under remarks, report all malfunctions or unusual operating characteristics. Prepare reports in triplicate; 2 to Operations Branch, 1 retained by Damtender.

_____
Damtender

_____

EXHIBIT D-2