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Beach Erosion Control

Cooperation study of Coast of Southern California. Point conception to Mexico boundry. (App. VII. Interim Report. 1960 ~~1959~~.)

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Beach Erosion Control
Coast of Southern California

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This interim report describes briefly the area of Southern California to be studied for a 3-year period of time on beach erosion. Hydrographic surveys were made along several miles of baselines from Ventura River to Mugu Lagoon and at 17 locations at San Luis Obispo County. Aerial photographs were taken of the coastline from Morro Bay to the International Boundary.

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REPORT OF THE DISTRICT ENGINEER

ON

BEACH EROSION CONTROL

COOPERATIVE STUDY OF COAST OF SOUTHERN CALIFORNIA,
POINT CONCEPTION TO MEXICAN BOUNDARY

(CONTRACT NO. W-04-193-ENG-5196, APPENDIX VII, INTERIM REPORT)

SYLLABUS

This interim report consists of a brief description of the area to be studied over a 3-year period of time, and a summary and description of the field work accomplished and data collected during the first year of the study. Field work accomplished in Santa Barbara County consisted of establishing and monumenting 12.4 miles of permanent baseline and making hydrographic surveys at 75 ranges between Santa Barbara Point and Carpinteria. In Ventura County, 6.4 miles of baseline was established and monumented and 12.3 miles of baseline was recovered, for a total length of about 19 miles of baseline from just upcoast of the Ventura River to Mugu Lagoon. Hydrographic surveys were made at 100 ranges along this stretch of coast. Ground photographs were taken at about 3-month intervals at 130 locations along the shore between Gaviota and Imperial Beach and an additional 20 ground photograph stations were recovered or established in San Luis Obispo County, for comparison with 1938 photographs. Hydrographic surveys made in 1958 at 17 locations along San Luis Obispo County were collected and are on file in the Los Angeles District. Aerial photographs were taken of the coastline from Morro Bay to the International Boundary in September 1959 and are on file in the Los Angeles District, along with earlier aerial photography dating back to 1938 in some areas. Contracts were awarded for wave studies which will consist of the preparation and analysis of statistical wave data at 10 theoretical deep-water stations and 6 specific shore locations. These wave studies will be completed in 1960 and available for distribution in 1961.

The work accomplished under the initial allocation of $30,000 ($15,000 Federal and $15,000 contributed funds) and the cost of each item are tabulated below:

(a)	Surveys (32 miles baseline and 175 profiles)...	$22,000
(b)	Contract for statistical wave data.....	3,000
(c)	Obtaining aerial and ground photographs.....	2,500
(d)	Preparation of report.....	2,500
	Total cost.....	30,000

The district engineer finds that erosion is occurring along the San Diego Bay shoreline of the city of Coronado and threatening damage to the municipal golf course.

The district engineer also finds that severe erosion is occurring in the city of San Diego at locations in La Jolla and along Sunset Cliffs in Ocean Beach. The value of the utilities, property, and improvements subject to destruction if the erosion is allowed to continue is presently estimated at $15,000,000.

The district engineer finally finds that since 1958 there has been serious erosion of the beach in the authorized project area near the Ventura pier and damage to Shore Drive.

The district engineer recommends the preparation of a second interim report to be submitted in June 1961, at an estimated cost of $41,000.

The district engineer also recommends the preparation of a special report on the erosion in the city of San Diego, at an estimated cost of $18,000.

The district engineer finally recommends that the State of California initiate construction of the authorized project at Ventura in the immediate future, because of the continued erosion of the beach and the resulting damage to streets near the Ventura pier. The plan of improvement was recommended in House Document 29, 83d Congress, 1st session, and provided for the construction of 3 groins for the protection of the shore at Ventura, the initial construction to consist of the most eastern groin and the remaining groins to be deferred pending demonstration of the need therefor.

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UNITED STATES ARMY CORPS OF ENGINEERS,
OFFICE OF THE DISTRICT ENGINEER,
LOS ANGELES DISTRICT,
APRIL 5, 1960.

Subject: Beach erosion control report on cooperative study of coast of southern California, Point Conception to Mexican Boundary (Contract No. W-04-193-Eng.-5196, appendix VII, interim report)

Through: Division Engineer, U. S. Army Division, South Pacific, San Francisco, Calif.

TO: Chief of Engineers, Department of the Army, Washington, D. C.

AUTHORITY

1. This interim report is submitted under authority of section 2 of the River and Harbor Act approved July 3, 1930 (46 stat. 945, P.L. 520, 71st Cong.), as amended and supplemented. Public Law 826, 84th Congress, approved July 28, 1956, authorized Federal assistance in the protection of publicly owned shores. Shores other than public may also be eligible for Federal assistance under certain conditions set forth in the Act.

2. Formal application, dated July 27, 1946, for a continuing cooperative study of the problems of beach erosion and shore protection along the entire Pacific Coast of California was made by the Division of Beaches and Parks, Department of Natural Resources, State of California, under authority of sections 506.6 and 5015, Public Resources Code of the State of California. On September 10, 1953, beach erosion control functions were transferred to the Division of Water Resources, Department of Public Works, in accordance with chapter 1859 of statutes 1953, State of California.

3. Provision was made in the general agreement for accomplishment of the study by specific areas to be defined in appendixes to the application, these appendixes to be implemented from time to time upon agreement between the parties. The Chief of Engineers, on September 12, 1946, approved the application by the State of California for the continuing study. Appendix VII to this agreement was executed June 17, 1958, and provided for the reexamination of the shores of California from Point Conception to the Mexican Boundary over a 3-year period. Funds for the first year of the cooperative study were provided by the United States and local interests on a matching basis, with the Federal Government contributing $15,000 and the State of California $15,000.

PURPOSE

4. This beach erosion study is of survey scope. The ultimate objective of this study is to reexamine the Pacific Ocean shore of California from Point Conception to the Mexican Boundary, with a view to determining areas of active or potential erosion and to obtain additional data on shore processes and problems to enable design of effective protective measures for problem areas. This study is intended to supplement previously completed and/or presently authorized studies.

5. The purpose of the present interim report is to set forth work accomplished during the first year of the 3-year study. Specific objectives for the first year of the study were:

(a) Obtain vertical and oblique aerial photographs.

(b) Establish ground-photograph stations along the shoreline and take photographs at 3-month intervals to show seasonal changes of the beaches.

(c) Reestablish baselines from prior studies or establish new baselines, as required, and obtain profiles to the 36-foot-depth from Santa Barbara Point to Carpinteria, and from the Ventura River to Point Mugu.

(d) Obtain statistical wave data and prepare statistical wave hindcasts for selected deep-water offshore stations between Point Conception and the Mexican Boundary, and determine the effects of offshore islands upon wave action at the mainland shore.

PRIOR REPORTS

6. Prior reports on beach erosion control and shore protection and reports containing pertinent data are listed in the following table.

Table 1

Prior Reports (Federal)

Title	Date	Document
SANTA BARBARA COUNTY		
Beach Erosion at Santa Barbara, Calif.	Jan 15, 1938	H. Doc. 552/75/3.
Reexamination of Santa Barbara Harbor, Calif.	Aug 6, 1941	H. Doc. 348/77/1.
Beach Erosion Study at Santa Barbara, Calif.	Feb 18, 1942	Not published*.
Santa Barbara, Calif., Beach Erosion Control Study.	Dec 5, 1947	H. Doc. 761/80/2.
VENTURA COUNTY		
Ventura Harbor, Calif.....	May 1940	H. Doc. 792/64/1.
Port Hueneme, Calif.....	Nov 10, 1950	H. Doc. 362/83/2.
Appendix I, Coast of California, Carpinteria to Point Mugu, Beach Erosion Control Study.	June 6, 1952	H. Doc. 29/83/1.
Design Memorandum No. 1, General Design for Harbor and Shore Protection Works Near Port Hueneme, California.	May 1957	Not published*.
Sand Bypassing at Port Hueneme, California.	March 1957	Tech. Memo. #92*.
LOS ANGELES COUNTY		
Los Angeles and Long Beach Harbors, Calif.	June 6, 1940	H. Doc. 843/76/3.
Cooperative Beach Erosion Study, Long Beach, Calif.	Aug 1941	Not published*.
Review of Report, Navigation, on Alamitos Bay, Calif.	Aug 1951	Not published*.
Appendix II, Coast of California, Point Mugu to San Pedro Breakwater, Beach Erosion Control Study.	June 5, 1952	H. Doc. 277/83/2.
Playa Del Rey Inlet and Basin, Venice Calif.	Aug 8, 1952	H. Doc. 389/83/2.
Design Memorandum No. 1, General Design for Redondo Beach Harbor, California.	June 1955	Not published*.
Design Memorandum No. 1, General Design for Playa Del Rey Inlet and Harbor, Venice, California.	Nov 1956	Not published*.

* See footnote at end of table.

Table 1--Continued

Prior Reports (Federal)--Continued

Title	Date	Document
ORANGE COUNTY		
Beach Erosion Study, Orange County, Calif.	Feb 13, 1940	H. Doc. 637/76/3.
Newport Bay Harbor, Calif.....	Apr 14, 1943	S. Doc. 138/78/1.
Longshore Current Observations in Southern California.	Jan 1950	Tech. Memo. #13*.
Anaheim Bay Harbor, Calif.....	Nov 30, 1953	H. Doc. 349/83/2.
Wave Action and Sand Movement Near Anaheim Bay, California.	Feb 1956	Tech. Memo. #68*.
Beach Erosion Control Report on Cooperative Study of Orange County, California, Appendix V, Phase 1.	June 15, 1959	Not published*.
SAN DIEGO COUNTY		
Beach Erosion Study, Coronado, Calif.	Sept 30, 1941	H. Doc. 636/77/2.
San Diego River and Mission Bay, San Diego County, Calif.	July 25, 1946	H. Doc. 760/79/2.
Beach Cycles in Southern California.	July 1950	Tech. Memo. #20*.
Sand Movement on the Shallow Inter-Canyon Shelf at La Jolla, California.	Nov 1951	Tech. Memo. #26*.
Oceanside, Ocean Beach, Imperial Beach and Coronado, San Diego, Calif. Beach Erosion Control Study.	Feb 28, 1956	H. Doc. 399/84/2.

* Available in the office of the district engineer, Los Angeles, Calif.; the division engineer, U. S. Army Engineer Division, South Pacific, San Francisco, Calif.; and the Chief of Engineers, Washington, D. C.

DESCRIPTION

General

7. The area under investigation comprises that portion of the coast lying between Point Conception and the Mexican Boundary, a length of about 325 miles, extending generally in a southeast direction through the counties of Santa Barbara, Ventura, Los Angeles, Orange, and San Diego, and is shown on plates 1, 2, and 3.

8. Santa Barbara County.--The shore of Santa Barbara County extends from the mouth of the Santa Maria River on the north to Rincon Point, a distance of about 110 miles. From the San Luis Obispo-Santa Barbara County line to Point Arguello, a distance of about 35 miles, the shore extends due south and from Point Arguello to Point Conception, a distance of 15 miles, the shore runs generally southeast. The 60-mile stretch of shore from Point Conception to the Santa Barbara-Ventura County line at Rincon Point extends nearly due east. There are 6 prominent headlands along the Santa Barbara County shoreline, consisting of the following in geographical order: Point Sal, Purisima Point, Point Arguello, Point Conception, Goleta Point, and Santa Barbara Point. South of the section of coast between Point Conception and Rincon Point is the Santa Barbara channel, a coastal waterway formed by the mainland and a chain of islands, San Miguel, Santa Rosa, Santa Cruz, and the Anacapa group. These islands lie approximately parallel with the coast and are from 25 to 40 miles offshore. The elevation of Santa Barbara County ranges from sea level to over 6,800 feet. Principal drainage areas are the Santa Maria and Santa Ynez Rivers, both of which drain into the ocean north of Point Arguello. Average annual rainfall varies from 14 inches at Santa Maria to 18 inches at Santa Barbara.

9. Santa Barbara County had an estimated population of 138,800 as of January 1960. Principal coastal cities and communities are Goleta, Santa Barbara, Montecito, Summerland, and Carpinteria, with estimated populations in January 1960 of 6,870, 66,140, 8,300, 1,000, and 3,800, respectively. The west coast of Santa Barbara County is federally owned from Point Sal to a point about 5 miles downcoast of Point Arguello. There are 6 state-owned beaches along the south shore of the county consisting of Gaviota, Refugio, El Capitan, Goleta, Arroyo Burro, and Carpinteria Beach State Parks. All of the shore within the city limits of Santa Barbara is publicly owned.

10. Ventura County.--The shore of Ventura County extends about 44 miles in a southeastern direction from the Santa Barbara County line at Rincon Point to the Los Angeles County line near Arroyo Sequit about 9 miles upcoast of Point Dume. The shoreline downcoast from Rincon Point extends generally southeast along the narrow coastal plain for a distance of about 13 miles to the mouth of the Ventura River. Downcoast from the river the shore extends east about one mile along the central part of the town of Ventura, and then extends south-southeast along the Oxnard Plain about 10 miles to Port Hueneme. Downcoast from Port Hueneme the shoreline extends generally in a southeast direction for 7 miles to Laguna Point. From Laguna Point, the shoreline extends in a general east-southeast direction about 11 miles to the south Ventura County boundary. The elevation of Ventura County ranges from sea level to over 8,800 feet. Principal drainage areas are the Ventura River which empties into the ocean just north of the city of Ventura, the Santa Clara River which

flows into the ocean about midway between Ventura and Oxnard, and Calleguas Creek which empties into Mugu Lagoon near Point Mugu. Average annual rainfall in the county varies from 12 inches at the shore to 35 inches in the mountains. Prominent headlands along the shoreline are Punta Gorda, Pitas Point, and Point Mugu.

11. The 1959 estimated population of Ventura County was 185,000 and the principal cities along the coast are Ventura, Oxnard, and Port Hueneme, with estimated populations of 31,000, 34,000, and 10,900, respectively. The Federal Government owns about 6 miles of shoreline between Arnold Road and Point Mugu, and also the shore immediately upcoast and downcoast of Port Hueneme Harbor. The State of California owns that part of the shore between Pitas Point and Ventura known as Emma Wood Beach State Park, and a 3-mile stretch of shore in the city of Ventura extending from about .4 mile above the Ventura pier to the south city limits. This beach is San Buenaventura State Beach. The county owns 3 small parcels along the shore between Rincon Point and Pitas Point, which are Rincon Beach County Parks Nos. 3, 4, and 5. The county of Ventura also owns about 2 miles of the shore upcoast from the Port Hueneme Harbor.

ALSO, PT. MUGU STATE PARK

12. Los Angeles County.--The shoreline of Los Angeles County extends about 78 miles from the Ventura County line near Arroyo Sequit to the Orange County line at the San Gabriel River between Long Beach and Seal Beach. From Arroyo Sequit the shore runs generally east-southeast for about 10 miles to Point Dume. From Point Dume to Pacific Palisades, a distance of 18 miles, the shore runs nearly due east and then extends toward the southeast and south in a curving arc for about 20 miles to the foot of the Palos Verdes Hills at Malaga Cove. The Palos Verdes Hills form the large coastal headland that separates Santa Monica and San Pedro Bays. The shoreline winds around this headland in a succession of small coves and salients for 18 miles in a general southeast direction to the root of the San Pedro breakwater. From here the shoreline continues another 12 miles along Los Angeles and Long Beach harbors to the San Gabriel River at Seal Beach. Santa Catalina Island lies some 22 miles offshore in a south-southwest direction from the Palos Verdes Hills. The elevation of Los Angeles County ranges from sea level to over 10,000 feet. Principal drainage areas are the Los Angeles and San Gabriel Rivers, both of which empty into San Pedro Bay on the west and east sides, respectively, of the city of Long Beach. Average annual rainfall for Los Angeles is 15 inches. Prominent headlands along the shore of Los Angeles County are Point Dume, Palos Verdes Point, Point Vicente, and Point Fermin.

13. Los Angeles County had an estimated population of 5,970,000 in 1959. Principal coastal cities and communities and

their latest estimated populations are: Santa Monica, 87,700; El Segundo, 14,800; Manhattan Beach 34,600; Hermosa Beach, 16,500; Redondo Beach, 47,500; San Pedro and Wilmington, 139,000; and Long Beach, 319,000.

14. There are about 65 miles of shoreline in Los Angeles County exclusive of commercial harbor frontage. Of this mileage 2.2 miles are federally owned, 2.4 miles are owned by the State of California, 4.7 miles by the county, 18.4 miles by 7 cities, and the remainder, or 37.7 miles, is privately owned. Length of shoreline owned by the cities are:

> Los Angeles, 6.1 miles; Santa Monica, 1.1 miles; Manhattan Beach, 0.2 mile; Hermosa Beach, 1.7 miles; Redondo Beach, 0.8 mile; Palos Verdes Estates, 4.7 miles; and Long Beach, 3.8 miles.

15. Orange County.--The coastline of Orange County extends in a general southeast direction for about 42 miles from the San Gabriel River at Seal Beach to the south limits of San Clemente near San Mateo Point. From the San Gabriel River at Seal Beach the shore runs southeast for 17 miles to the entrance to Newport Bay. The beach is broken by jettied entrances at the San Gabriel River outlet, Anaheim Bay, Santa Ana River outlet, and the Newport Bay entrance. Downcoast of Newport Bay, the shoreline extends southeast a distance of 16 miles to Dana Point. From Dana Point, the shore runs generally east about 2 miles to San Juan Creek. At San Juan Creek, the shore again turns southeast and continues about 7 miles to the San Diego County boundary at the south side of San Clemente. The only large headland in Orange County is Dana Point, about midway between Laguna Beach and San Clemente. Principal drainage areas are the Santa Ana River which empties into the Pacific Ocean between Newport Beach and Huntington Beach, and San Juan Creek which flows into the ocean just east of Dana Point. The elevation of Orange County ranges from sea level to 5,600 feet. Average annual rainfall is about 14 inches.

16. The population of Orange County was estimated at 605,200 in 1959. Coastal cities are Seal Beach, Huntington Beach, Newport Beach, Laguna Beach, and San Clemente. Estimated populations are: 4,800, 10,400, 24,400, 9,000, and 7,800, respectively. Of the 42 miles of shoreline along Orange County, 16 miles are publicly owned and 26 miles are privately owned. State Park beaches are located at Huntington Beach, Corona del Mar, Doheny Beach, and San Clemente.

17. San Diego County.--The shore of San Diego County extends about 75 miles in a general southward direction from the common Orange County-San Clemente boundary near San Mateo Point to the International Boundary with Mexico, about 1-1/2 miles south of the

mouth of the Tia Juana River. From San Mateo Point the shore extends about 44 miles to Point La Jolla, and in this length changes alinement from east-southeast at the county line to nearly due south at La Jolla. From Point La Jolla to False Point at Pacific Beach, a length of 4 miles, the shoreline is a series of coves and wave-cut caves. From False Point to the tip of Point Loma, the shore extends southward for about 11 miles. The 3 miles of shore from the Zuniga jetty, at the entrance to San Diego Bay, to Coronado runs generally east and then turns in a gentle arc for the next 11 miles until it runs south at the International Boundary. Principal streams in San Diego County are San Onofre and San Mateo Creeks at the northern county line, Santa Margarita and San Luis Rey Rivers near Oceanside, San Dieguito River near Del Mar, San Diego River at Mission Bay, and the Tia Juana River between Imperial Beach and the boundary. Annual average rainfall varies from 10 inches at San Diego to 40 inches at Cuyamaca in the Laguna Mountains. Prominent coastal headlands are Point La Jolla, False Point, and Point Loma. The elevation of San Diego County ranges from sea level to 6,500 feet.

18. In 1959, the estimated population of San Diego County was 890,000 and of the city of San Diego 500,000. Other coastal cities and their estimated 1959 populations are as follows: Oceanside, 21,000; Carlsbad, 10,000; Encinitas, 3,600; Solana Beach, 3,700; Del Mar, 1,500; Coronado, 18,800; and Imperial Beach, 16,600. Only 13 miles of the shoreline of San Diego County is privately owned. The Federal Government owns 29.8 miles of the shore; the State of California, 15.5 miles; the cities of Oceanside, San Diego, Coronado, and Imperial Beach, 15.1 miles; and the county, 1.4 miles. State Park beaches in San Diego County include Carlsbad, La Costa, Ponto, Cardiff, Torrey Pines, Mission Bay, and Silver Strand.

STUDY ITEMS AND EXISTING PROJECTS

General

19. The items of work accomplished since July 1958 and existing projects are described in detail in the following paragraphs for each of the 5 counties between Point Conception and the Mexican Boundary. (pls. 1 through 3).

Santa Barbara County

20. General.--Aerial photographs were taken of the shoreline in September 1959, and ground photographs were taken at 27 stations between Gaviota Beach State Park and Rincon Point. Hydrographic surveys and beach cross sections were made between Santa Barbara Point and Carpinteria. In June 1959, a contract was awarded to National Marine Consultants, Inc., for a statistical wave analysis at 7 deep-water locations and 4 specific shore locations.

21. Aerial photographs.--Vertical aerial photographs at a scale of 1:10,000 were taken in September 1959 between the county line at Rincon Point and Point Conception. Vertical aerial photographs have also been taken from Rincon Point to Refugio, and at Gaviota, Point Conception, and Point Arguello in May 1958 at a scale of 1:10,000. Oblique aerials were also taken in May 1958 of Gaviota, Point Conception, and Point Arguello. These photographs, as well as earlier photographs, are on file in the Los Angeles District.

22. Ground photographs.--Eleven ground-photograph stations, established in 1937-38, were recovered in August 1958, and 14 new stations were established. Three of the old stations at Point Sal, Lions Head, and Surf were not repeated after August 1958. The remaining old stations at Arroyo Hondo, Refugio Beach State Park, Goleta pier, Santa Barbara Point, Santa Barbara Cemetery, Biltmore Hotel, and the Carpinteria pier were repeated in November 1958 and in February, May, and August 1959. New stations were established in August 1958 at Gaviota, El Capitan State Beach, Signal Oil Lease-Elwood, Goleta Point, Arroyo Burro Beach, San Ysidro Road, Santa Claus, Sandyland Cove, and Carpinteria, and photographs taken every 3 months. Beach profiles were compiled at the piers at Gaviota, Goleta, and Carpinteria each time a photograph was taken, by measuring the height of the deck of the pier above the beach at a known point appearing in the picture, and then establishing a scale for the photograph.

23. Surveys.--In June 1959, about 4,100 feet of baseline was established and monumented, and 5 ranges were surveyed between Santa Barbara Point and the breakwater at Santa Barbara Harbor. A comparison of these profiles with those surveyed in 1937 is shown on plate 7. Six ranges were also sounded seaward of the breakwater in June 1959 and are shown on plate 8. During March, April, and May 1959, about 8,000 feet of baseline was recovered and 16 ranges were sounded along East Beach between Stearns Wharf and the east Santa Barbara city limits. Also, 53,200 feet of baseline was established and monumented, and 48 ranges were surveyed between the east city limits of Santa Barbara and Carpinteria. Comparative profiles of the 1959 and 1937 profiles are shown on plates 9 through 18. An index to the profiles is shown as plate 4.

24. Wave data.--Statistical wave data is to be supplied for 2 deep-water stations off Santa Barbara County by National Marine Consultants, Inc., of Santa Barbara under terms of a contract with the Los Angeles District. One deep-water station is located about 20 miles off Point Arguello and the other station about midway between Point Conception and Santa Barbara, in the Santa Barbara channel. The deep-water wave data is to be shown in a frequency distribution and arranged to show wave height versus wave period and direction. The distribution will show wave heights by 1-foot intervals from 0 to 18 feet, wave periods in 2-second intervals from 6 to 18 seconds, and wave directions by 22-1/2-degree intervals from south-southeast clockwise

to north. In addition to the preceding, design-wave data shall be computed from records of the past 50 years for the harbor site at Santa Barbara showing cumulative curves for heights exceeding 12 feet. This report will be completed early in 1961.

25. Existing project.--There is an existing navigation project at Santa Barbara Harbor, authorized by the River and Harbor Acts of August 30, 1935, and March 2, 1945, which provides for maintenance of present depths in the harbor by the dredging by, and at the expense of, local interests. The United States is to reimburse local interests an amount not to exceed $30,000 annually. About 530 small craft are presently based in the harbor. Previous maintenance dredging was done in 1938, 1940, 1942, 1945, 1949, and 1952 by the Corps of Engineers.

Ventura County

26. General.--Aerial photographs were taken of the entire county shoreline in September 1959, and ground photographs were taken at 35 stations between Rincon Point and Arroyo Sequit. Hydrographic surveys and beach cross sections were taken between the Ventura River and Mugu Lagoon. A statistical wave analysis is also being prepared for deep-water stations and for the site of the Ventura County Harbor near Port Hueneme under a contract with National Marine Consultants, Inc. Construction is underway at the Ventura County Harbor near Port Hueneme, and there are plans for a small-craft harbor between Ventura and the Santa Clara River.

27. Aerial photographs.--Vertical aerial photographs at a scale of 1:10,000 were taken of the entire county shoreline in September 1959, and from Mugu Lagoon to the Ventura River in May 1958. Oblique aerial photographs of Mugu Lagoon, Port Hueneme, Santa Clara, and Ventura Rivers were also taken in May 1958. Vertical aerial photographs at a 1:5,000 scale were made from Port Hueneme to the Santa Clara River in April 1956, and from Arroyo Sequit to the Ventura River in 1955. Prints of these photographs are on file in the Los Angeles District.

28. Ground photographs.--Five ground photograph stations established in 1937-38 were recovered in August 1958, and 12 old stations were recovered in October 1958. Old photograph stations recovered are located at Ventura County Parks (Rincon #5 and #4), Conoco Refinery near Dulah (2 miles upcoast of the Ventura River), Ventura pier, San Miguel Beach, Point Mugu, "Sand Drift," Big Sycamore Creek, Bass Rock, and Little Sycamore Creek. Photographs at these stations were repeated in November 1958, and in February, May, and August 1959. Eighteen new photograph stations were established at Rincon Point, Richfield pier at Punta Gorda, Seacliff, Emma Wood Beach State Park, Sycamore pier, Bass Rock, between Bass Rock and Deer Canyon, Deer Canyon, and Little Sycamore Beach. These stations were repeated in February, May, and August 1959.

29. Surveys.--During June-July 1959, 33,800 feet of baseline was established and monumented between the Ventura River and Mandalay Beach, and 65,000 feet of baseline was recovered between Mandalay Beach and Mugu Lagoon. Hydrography and beach cross sections were surveyed on 100 ranges between the Ventura River and Mugu Lagoon. Comparative profiles showing the 1959, 1948, and 1937 surveys have been prepared and are shown on plates 19 through 31. Annual surveys from 1954 through 1959 have been made in the Hueneme-Mugu area between Oxnard Road and Laguna Point and are on file at the Los Angeles District and the Beach Erosion Board. Beach cross sections have been taken at 4- to 6-week intervals since June 1959 at the site of the Ventura County Harbor, as part of a research study, and are on file at the Los Angeles District. Sand samples were taken at MLLW, mid-tide, plus 8, and at top of berm on 4 ranges near the entrance to the Ventura County Harbor, but no analysis has been made to date.

30. Wave data.--National Marine Consultants, Inc., has been awarded a contract to furnish statistical wave data for a deep-water station about 20 miles southwest of Port Hueneme and shoreward of San Nicolas Island. The data will be organized in a frequency distribution and arranged to show wave height versus wave period and direction. The distribution will show wave heights by 1-foot intervals from 0 to 18 feet, and one interval of greater than 18 feet; wave periods in 2-second intervals from 6 to 18 seconds, with two additional intervals showing periods less than 6 and more than 18 seconds; and wave direction by 22-1/2-degree increments from south-southeast clockwise to north. Wave-refraction diagrams are to be prepared for a 20-mile length of shore centered on Port Hueneme. This report will be completed early in 1961.

31. In April 1954, a WH-1 pressure-type wave gage was installed in 35 feet of water about one mile upcoast of Port Hueneme Harbor. The gage was programmed to furnish a record every 4 hours and remained in service until January 1960. The gage records are available at the Beach Erosion Board in Washington, D. C. Three pressure-type wave gages are to be installed during the construction of the Ventura County small-craft harbor as part of a research study, and two of the gages were installed early in 1960 but are not yet operative.

32. Existing projects.--There is an existing beach erosion control project at Ventura, as approved in House Document 29, 83d Congress, 1st session, and authorized by Act of Congress of September 3, 1954. The authorized plan of improvement provides for the construction of 3 groins for the protection of the shore at Ventura, the initial construction to consist of the most eastern groin and the remaining groins to be deferred pending demonstration of need therefor. This plan of improvement is shown on plate 32. Since 1958 there has been serious erosion near the Ventura pier, and a storm in February 1959 caused extensive damage to Shore Drive between California and Chestnut Streets. The profiles on plate 21 show the retreat of the shoreline in this area. In view of the above, it is recommended that the State of California initiate construction on the authorized project as soon as possible. The proposed construction of a small-craft harbor about 2 miles downcoast of the Ventura pier is a possible source of material for artificial fill to widen the beach upcoast of, or between, the proposed groins.

33. The Ventura County Harbor was approved in House Document 362, 83d Congress, 2d session, and authorized by Act of Congress of September 3, 1954. The project is located about one mile north of the existing harbor at Port Hueneme and consists of the construction of a small-craft harbor and shore-protection works, as shown on plate 33. The harbor will provide facilities for berthing 500 small craft and commercial fishing boats. Material dredged from the harbor will be deposited on the shore downcoast of the Port Hueneme Harbor. A contract was awarded December 30, 1958, for the construction of 2 entrance jetties and a 2,300-foot-long offshore breakwater. The jetties were completed in September 1959, and the breakwater is about 50 percent completed. A contract for the dredging was awarded February 1960, and work is scheduled to commence about July 1960.

Los Angeles County

34. General.--Aerial photographs of the coastline of Los Angeles County at a scale of 1:10,000 were taken in September 1959. Ground photographs were taken at 22 locations between the Ventura-Los Angeles County line and the Hermosa Beach pier. No surveys have been made in Los Angeles County. Construction along the shores of Santa Monica Bay was accomplished by the State of California, Division of Highways, at Pacific Palisades and by the Corps of Engineers at Playa del Rey Harbor. Local interests have also been dredging at Alamitos Bay in Long Beach and depositing material along Belmont Shores.

35. Aerial photographs.--Vertical aerial photographs at a scale of 1:10,000 were taken in September 1959 of the shore between Point Dume and Palos Verdes. The entire county shoreline was also photographed in May 1958 at a 1:10,000 scale and in September 1955 at a scale of 1:5,000. These photographs are on file in the Los Angeles District.

36. Ground photographs.--Eleven ground photograph stations established in 1937-38 were recovered in 1958 and 13 new stations were established. Old stations recovered were at Arroyo Sequit, Flores Beach, Las Tunas Beach, Castle Rock, Manhattan pier, Hermosa pier, and Belmont pier. Most of these locations have been photographed at 3-month intervals. New stations were established at Sequit Point, Nicolas Canyon, Paradise Cove, Escondido Canyon, Corral Canyon, Malibu pier, Las Tunas Beach, Tunas Canyon, Will Rogers Beach, Sunset Boulevard, and Pacific Palisades. Beach profiles were compiled from the photographs at Paradise Cove and Malibu pier.

37. Storm damage on January 6-7, 1959.--High tides (over 6 ft.), combined with storm waves, caused extensive damage to structures at Escondido Canyon, Malibu Beach, and Los Flores (about 2.5 miles downcoast of Malibu pier) and damaged boats at Santa Monica. The shoreline was inspected from Zuma Beach County Park, about 3 miles north of Point Dume, to the San Monica pier on January 7.

38. At Zuma Beach County Park, the year-round lifeguards reported the beach retreated over 50 feet in one day, leaving the beach very narrow, but no damage to structures was reported. Breakers were estimated to be 10 feet high from 6 a.m. to 4 p.m. on January 6 with some series estimated at 13 feet or higher. A large amount of seaweed and debris was scattered over parking areas, shoreward of a low cinder-block wall along the beach, but no damage to the wall was reported.

39. At Paradise Cove, a vertical loss of sand of 3 to 4 feet was reported along the beach, and a vertical berm ranging from 2 to 5 feet in height was noted on the morning of January 7. The short pier at Paradise Cove has a deck elevation of 20 feet above mean lower low water, and it was reported that wave crests nearly reached the pier deck on the night of January 6. Assuming a tide stage of +3 feet, the waves were estimated to be 12 to 15 feet in height. No structural damage was reported except for the destruction of a float at the seaward end of the pier.

40. Malibu Cove Colony is a new residential development at Escondido Beach immediately downcoast of Escondido Canyon and about 4.5 miles upcoast of Malibu Beach. This development consists of houses selling for an average cost of $60,000. Five of the homes suffered total damage estimated by the owners and real estate developers at $20,000 to $30,000. The damage in this area resulted when the storm waves eroded the beach in front of a timber bulkhead and allowed the overtopping waves and the water surging under the lower timbers to remove the material back of the bulkhead and carry it under the wall and into the surf zone. The removal of the material back of the bulkhead caused the collapse of patio floors, septic tanks, and fireplaces.

41. At Malibu Colony (Malibu Beach), wooden bulkheads in front of 3 homes were damaged and one beach cabana destroyed, resulting in damage estimated at $7,000.

42. At Los Flores Beach, about 2.5 miles downcoast from Malibu pier (20,700 to 20,900 blocks along Pacific Coast Highway), 20 homes were damaged, and wooden bulkheads were destroyed or damaged at an additional 10 houses. Two homes were so severely damaged they were condemned by building inspectors.

43. Six boats anchored behind the Santa Monica breakwater were washed ashore and 3 of them completely destroyed, 2 badly damaged, and one slightly damaged. The Santa Monica pier was slightly damaged by debris being battered against piling and stringers.

44. Wave data obtained from the Surf and Weather Station at Camp Pendleton for January 5 through 7 is tabulated in tables 2 and 2-A. These are the only analyzed data for this storm available in vicinity of Los Angeles County.

Table 2

Wave data - Surf and Weather Station, Camp Del Mar, Oceanside, Calif.

Wave gage records

Date	Wave period	Significant ht.		Maximum		Extreme		Time and tide of extreme	
		Wave	Breaker	Wave	Breaker	Wave	Breaker		
	Seconds	Feet	Feet	Feet	Feet	Feet	Feet	Time	Feet
Jan. 6, 1959									
0415	7.6	4.2	5.4	6.4	7.5	-	-	-	-
1015	10.5	5.2	7.5	7.4	9.6	8.5	10.5	0924	+4.1
1615	10.6	3.8	4.9	6.7	8.9	8.0	10.3	1430	-0.9
2215	10.8	4.2	6.3	6.5	8.8	8.0	10.3	1721	+2.5
Jan. 7, 1959									
0415	11.5	3.9	6.3	6.8	8.9	8.2	10.7	0224	+2.2
1015	11.3	3.0	5.1	4.1	6.5	6.2	8.8	0709	-
1615	-	-	-	3.9	-	-	7.8	1036	-

Table 2-A

Wave data - Surf and Weather Station, Camp Del Mar, Oceanside, Calif.

Visual observations

Date	Wave approach		Littoral drift		Wind		
	From	Angle	To	Ft./min.	Direction	Time	Velocity
		Degrees					Knots
Jan. 5, 1959							
0530	S	5	N	40	E	1000	-
1015	S	5	N	80	ESE	1100	-
1615	S	5	N	100	SSE	1200	-
Jan. 6, 1959							
0545	S	10	N	200	SSE	0100	13
1015	S	5	N	150	SSE	0545	25
1615	S	5	N	150	-	-	-
Jan. 7, 1959							
0530	Direct	-	S	130	WSW	0530	4
1005	N	10	S	150	-	-	-

45. Surveys.--No survey was made by the Los Angeles District and the latest surveys along Santa Monica Bay were made by the city of Los Angeles in April-May 1958 between El Segundo and the Ocean Park pier. Periodic beach surveys have also been made by the State of California of the Pacific Palisades area where the Department of Highways constructed a series of 5 stone groins and filled them artificially to provide an area to move the highway seaward.

46. Wave data.--In July 1948, the Beach Erosion Board installed a step-resistance-type wave gage on the seaward end of the Standard Oil Company pier at El Segundo. The gage was mounted in about 30 feet of water and operated until January 1953, when it was lost during a severe storm. Tabulated analysis of gage records are available at the Beach Erosion Board or the Los Angeles District.

47. Existing projects.--There is an existing navigation project at Playa del Rey inlet and basin authorized by Act of Congress of September 3, 1954. The project consists of the construction of 2 entrance jetties and the dredging of an entrance channel, a main channel, and 8 side basins to provide facilities for about 7,000 small craft, as shown on plate 34. The dredged material (12,500,000 cu. yds.) is to be used to construct moles and for deposition on adjacent lowlands and beaches. Federal participation is limited to 50 percent of the cost of the entrance jetties and the entrance and main channels. Jetty construction was started in February 1958. The north jetty was completed in August 1958 and the south jetty in November 1958. Dredging of the project is scheduled to start early in 1960.

48. There is an existing navigation project at Redondo Beach presented in House Document 303, 81st Congress, and authorized by Act of Congress of May 17, 1950. The improvement consisted of the reconstruction of 1,455 feet of the existing breakwater, construction of a 2,830-foot extension to the existing breakwater, and the construction of a 600-foot-long south breakwater, to provide facilities for about 1,000 small craft and to provide shore protection for the beach fronting Redondo Beach. Construction was started in May 1956 and completed in May 1958. Dredging and installation of floats, etc., is to be accomplished by the city of Redondo Beach, starting in 1960.

49. There is an existing project to provide shore protection to the Santa Monica Bay shoreline of Los Angeles County. This project was approved in House Document 277, 83d Congress, and authorized by Act of Congress of September 3, 1954. The authorizing act provides for the contribution of Federal funds toward the cost of 5 protective features under the modified master plan for the development of the shoreline of Los Angeles County (pl. 35). Work on the project has not been started.

50. The city of Long Beach is constructing a small-craft harbor at Alamitos Bay at its expense under a modification of a plan developed by the Los Angeles District. Excess dredged material from the harbor was deposited along the ocean shore of Alamitos Peninsula.

Orange County

51. General.--Aerial photographs of the coastline of Orange County at a scale of 1:10,000 were taken in September 1959. Ground photographs were taken at 22 stations between Seal Beach and San Clemente. No surveys were made for this study, but a hydrographic survey was made of the area between the San Gabriel River and the entrance to Newport Bay for phase 2 of the Orange County beach erosion control study. Surveys were also made at Seal Beach and in the vicinity of Dana Point. Construction was completed on the authorized project at Seal Beach. A contract was awarded to Marine Advisers to prepare a statistical wave analysis for a proposed harbor site at Dana Point.

52. Aerial photographs.--Vertical aerial photographs at a scale of 1:10,000 were taken in September 1959 of the entire shoreline of the county. In May 1958, vertical photographs were taken from the San Gabriel River to Newport Bay entrance and from Dana Point to San Mateo Point at 1:10,000 scale. During the same period, oblique photographs were taken of Seal Beach, Santa Ana River, Laguna Beach, and South Laguna. The entire county shoreline was photographed at a 1:5,000 scale in September 1955. All of these photographs are on file at the Los Angeles District.

53. Ground photographs.--Sixteen ground-photograph stations established in 1937-38 were recovered in October 1958, and 6 new stations were established during the year. Old stations were recovered at Seal Beach, Huntington Beach, Newport, and Balboa piers; at Corona del Mar, Crystal Cove, El Moro Beach, Laguna Beach, Salt Creek, Dana Point, San Juan Creek, and at San Juan Capistrano and San Clemente piers. New stations were established at Seal Beach, Huntington Beach, Aliso Creek, Dana Cove pier, and San Clemente Beach State Park. These photographs were repeated at approximately 3-month intervals. Comparative beach profiles were prepared from the photographs at the Seal Beach, Huntington Beach, Newport, Balboa, San Juan Capistrano, and San Clemente piers.

54. Surveys.--No surveys were made in Orange County for Appendix VII, but beach and hydrographic surveys were made for phase 2 of the Orange County beach erosion control report. The area from the San Gabriel River to the Newport Bay entrance was surveyed between October and December 1958. Seventy-four ranges were sounded and 91,800 feet of baseline was reestablished. Profiles of this survey

are available in the Los Angeles District. Surveys were also made at Seal Beach in January 1958 and August 1959 under the existing project. The shoreline from Newport Harbor entrance to the county boundary at San Clemente was surveyed by the Los Angeles District in 1955, and the results are contained in the Beach Erosion Control Report on Cooperative Study of Orange County, Appendix V, Phase 1, dated June 15, 1959. A survey was made by the Los Angeles District in May 1959 at the site of a proposed small-craft harbor near Dana Point.

55. Wave data.--Marine Advisers of La Jolla have been awarded a contract to furnish statistical wave data for 3 deep-water stations off the Orange-San Diego County coastline. One station is located about 55 miles off Point Vicente and about midway between San Nicolas and San Clemente Islands. One station is about 120 miles west of San Diego and southwest of Cortes Bank, and the third station is about 60 miles southwest of San Diego. Shallow water wave statistics are also to be furnished for a proposed harbor site at Dana Point and refraction diagrams are to be prepared for a 20-mile length of shoreline centered at the harbor site. The report will be completed in 1960.

56. The Beach Erosion Board, in conjunction with the Los Angeles District, has operated a step-resistance-type wave gage at Huntington Beach almost continuously since June 1948. The gage is mounted on the seaward end of the municipal pier where the depth of the water is about 25 feet. This gage gives a detailed record for about 7 minutes every 4 hours. Tabulated analysis of gage records are available at the Beach Erosion Board or at the Los Angeles District.

57. Existing projects.--There is an existing shore-protection project at Seal Beach and at Surfside-Sunset Beach. Both were approved in House Document 349, 83d Congress, and authorized by Act of Congress of September 3, 1954. The plans of improvement provide for the artificial placement of 225,000 cubic yards of material on the shore and the construction of a groin at Seal Beach, and the placement of 1,000,000 cubic yards for a feeder beach at Surfside (pl. 36). The project at Seal Beach was completed in October 1959 at a cost of about $285,000. No work has been accomplished at Surfside-Sunset Beach.

58. There is an existing navigation project at Newport Bay Harbor as authorized by the Public Works Program of the National Industrial Recovery Act of June 15, 1934 and River and Harbor Acts of August 26, 1937 and March 2, 1945. The project provides for 2 entrance jetties, an entrance channel, main channel, and inner harbor channels, and has facilities for about 4,000 small craft. The project is 76 percent complete.

59. The district engineer has recommended a plan of improvement for shore protection at Doheny Beach State Park to consist of a protective beach 100 feet wide and about 6,000 feet long, by the

artificial placement of about 329,000 cubic yards of material on the beach between the upper and lower limits of the State Park; the upper portion of the beach fill to be retained by a 250-foot-long groin to be constructed at the seaward end of the upcoast levee of San Juan Creek.

San Diego County

60. General.--Aerial photographs were taken of the shoreline between San Clemente and Del Mar at a scale of 1:10,000 in September 1959, and the entire county shoreline was photographed in May 1958. Ground photographs were taken at 20 stations between Oceanside and Imperial Beach. Limited hydrographic surveys were made at Oceanside and Imperial Beach in connection with the authorized projects. A contract was awarded to Marine Advisers to prepare a statistical wave analysis for the Camp Pendleton Harbor area.

61. Aerial photographs.--Vertical aerial photographs at a scale of 1:10,000 were taken of the shoreline from San Clemente to Del Mar in September 1959. In May 1958, the entire shoreline of San Diego was photographed at a scale of 1:10,000 and oblique photographs were taken at San Mateo and San Onofre Creeks, at Santa Margarita, San Luis Rey, San Dieguito and Tia Juana Rivers, at Buena Vista, Agua Hedionda, Batiquitos, and San Elijo Lagoons, and at Del Mar and Imperial Beach. Vertical aerial photographs at a scale of 1:5,000 were taken in September 1955. Prints of the above photographs are on file in the Los Angeles District.

62. Ground photographs.--Ten ground-photograph stations established in 1937-38 were recovered in October 1958, and 9 new locations were established during the year. Old stations were recovered at Oceanside, Agua Hedionda, San Elijo Lagoon, San Dieguito River, Del Mar, Soledad Valley, Crystal pier, and Coronado. New stations were established at Agua Hedionda, Moonlight Beach, Cardiff, Pacific Beach, Ocean Beach, and Imperial Beach. Photographs at most of these stations were repeated in February, May, and August 1959. Comparative beach profiles were compiled from the photographs at Oceanside and Crystal piers.

63. Surveys.--No surveys were made in San Diego County for appendix VII. Limited hydrographic surveys were made at Camp Pendleton Harbor near Oceanside in July and October 1959 for the project at Oceanside, and surveys were also made at Imperial Beach in September 1958 and October 1959 in connection with the construction of the authorized project.

64. Wave data.--A contract was awarded to Marine Advisers in August 1959 to compile deep-water wave statistics at 3 stations off the coast of Orange and San Diego Counties. Wave height, wave period, and wave direction will be compiled as monthly, seasonal, and

annual summaries. The wave data will be organized in a simple frequency distribution and arranged to show wave height versus wave period and direction. Severe storm-wave characteristics are also to be developed of the 10 worst storms from 1900 to 1958. Shallow-water wave statistics will be developed for the proposed small-craft harbor site near Oceanside and refraction diagrams drawn for a 20-mile-length of shoreline centered on the proposed harbor site.

65. A surf and weather station has been operated continuously near Camp Pendleton Harbor since 1951. A recording pressure-type wave gage is located offshore in about 32 feet of water. The gage gives a detailed record for about 20 minutes every 6 hours and records maximum wave heights between the detailed 20-minute runs. Visual observations are also made 3 times daily by personnel of the Surf and Weather Station, Camp Del Mar, U. S. Marine Corps. These observations are made from the beach south of the Santa Margarita River and breaker height, wave period and direction, and direction and velocity of the littoral currents are recorded.

66. The U. S. Navy has recently constructed an oceanographic tower off Mission Beach, San Diego, in about 55 feet of water. The tower is approximately 4,500 feet seaward of the Mission Beach Amusement Park and about 5,000 feet northwest of the entrance to Mission Bay. Gages of various types will be installed on the tower and will be under the direction of the U. S. Navy Electronics Laboratory.

67. Existing projects.--There are existing shore-protection projects at Oceanside, Ocean Beach, and Imperial Beach. These projects were approved in House Document 399, 84th Congress, and authorized by Act of Congress of July 3, 1958. The authorized plan of improvement provides for the following shore-protection features:

(a) At Oceanside, create a protective beach 200 feet wide and 10,000 feet long between 9th and Witherby Streets by the artificial deposit of 900,000 cubic yards of material on the shore.

(b) At Ocean Beach, create a protective beach 200 feet wide and 1,700 feet long between Cape May and Narragansett Avenues by the artificial deposit of 250,000 cubic yards of material on the beach, and the construction of a stone groin about 530 feet long in the vicinity of Cape May Avenue to retain the artificial fill.

(c) At Imperial Beach, construct a series of 5 stone groins extending from the north end of the existing naval radio station seawall southward to a point about 400 feet south of Coronado Avenue, the groins to be spaced at about 1,000-foot intervals; the No. 1, or most northern groin, to be 600 feet long and the others about 400 feet long each.

68. At Oceanside, an estimated 700,000 cubic yards of material was deposited on the beach in the spring of 1958, without cost to the project, by the U. S. Navy from the maintenance dredging of Camp Pendleton Harbor.

69. At Ocean Beach, the city of San Diego constructed a 530-foot-long stone groin at Cape May Avenue in 1955 at a cost of $23,900. Also, 275,000 cubic yards of material was deposited on the beach from the Mission Bay dredging without cost to the Ocean Beach project.

70. At Imperial Beach, construction of the No. 1, or most northern groin, was started in July 1959 and completed in September 1959 at a cost of about $66,000. Construction of groin No. 2 is planned for some time in 1960.

EXPENDITURES - 1959 FISCAL FUNDS

71. The approved work items of phase 1 of the 3-year study were not all accomplished during the first year. The work that was accomplished and the cost of each item is summarized below:

(a) Surveys (32 miles baseline and 175 profiles)....		$22,000
(1) Profiles to 36-foot depth from Santa Barbara Point to Carpinteria.....	$11,000	
(2) Profiles to 36-foot depth from Ventura River to Point Mugu.....	11,000	
(b) Contract for statistical wave studies.....		3,000
(c) Photographs..... Obtained aerial photographs and established or recovered ground photo stations along the shore. Prepared comparative photographs dating back to 1938.		2,500
(d) Preparation of report on progress of work, including drafting and reproduction.....		2,500
Total cost.....		30,000

FISCAL FUNDS - 1960

72. Total funds available for appendix VII were reduced to $14,750 in 1960. A tabulation of the 1960 Federal and contributed funds is shown below:

Federal	Non-Federal	Total
$7,375	*$7,375	$14,750

* Includes 2,375 from Santa Barbara County.

PROPOSED WORK ITEMS

73. In view of the delay in submitting the first interim report, the partial funding in fiscal year 1960, and a request by the city of San Diego for a special study of erosion within the city limits, it is proposed to submit the second interim report in June 1961.

74. The city of Coronado is experiencing erosion of the embankment at locations along San Diego and Glorietta Bays, which is threatening serious damage to the municipal golf course. The city requested that a study be made of this erosion problem, and their request was approved by the Department of Water Resources, State of California, and can be included in the second interim report. At present, it is believed that there will be no Federal contribution required toward the cost of a plan of protection because of the pollution in San Diego Bay and along the shore.

75. Severe erosion is occurring in the city of San Diego at several locations in La Jolla and along the Sunset Cliffs area in Ocean Beach. The shore along Sunset Cliffs has receded rapidly in the past few years and the main access road to this area, Sunset Cliffs Boulevard, is in serious danger. Short stretches of this street near Hill Street have been badly damaged by collapse of the cliffs. The streets, utilities, property, and improvements subject to destruction if the erosion continues are presently valued at about $15,000,000. The city of San Diego and the State of California have requested that a study of the erosion problem be made under Appendix VII, and it is proposed to make a special study and report on the problem at an estimated cost of $18,000.

Work Items for General Study

76. Detailed work items required to accomplish the remaining work in phase 1 and all of the work in phase 2, with the estimated cost of each item, are tabulated below:

(a) Surveys..... $24,000

(1) Obtain profiles to 36-foot depth at intermittent beaches not otherwise covered between Point Conception and Point Mugu; and immediately above and below, and at each prominent headland between Point Conception and Point Mugu..... $4,500.

(2) Establish monumented baseline along the shore from Point Mugu to San Pedro breakwater. Obtain profiles to 50-foot depth in the Trancas-Zuma Beach area; from Malibu to Redondo Beach; at Cabrillo Beach; and immediately above and below, and at each prominent headland between Point Mugu and San Pedro breakwater.. 19,000

(3) Obtain profiles in San Diego Bay along the Coronado Municipal Golf Course..... 500

(b) Sand samples..... $4,000

(1) Obtain and analyze beach and offshore sand samples at selected profiles at each intermittent beach and at profiles on either side of headlands between Point Conception and Point Mugu..... $2,000

(2) Obtain and analyze beach and offshore sand samples at selected ranges at the following locations: Four profiles at each beach segment listed; at intermittent beaches; and on either side of headlands, all between Point Mugu and San Pedro breakwater..... $2,000

(c) Obtain vertical and oblique aerial photographs of study area and continue ground photographs at established photo stations..... 4,500

(d) Prepare statistical wave data for selected offshore stations..... 3,000

(e) Preparation of second interim report, including drafting and reproduction..... 5,500

Total estimated cost..... 41,000

Work Items for Special Study
(City of San Diego)

77. Detailed work items required for the erosion study in the city of San Diego and the estimated cost of each item are tabulated below:

(a) Preliminary planning, including careful inspection of the bluffs and wave-cut caves at locations in La Jolla and the area along Sunset Cliffs in Ocean Beach, and conferences with local interests..... $1,000

(b) Soils investigations..... 3,000

(1) Obtain and analyze borings at locations in La Jolla near La Jolla Cove; between Rocky Point and Whale View Point; and near Bird Rock..... $1,000

(2) Obtain and analyze borings at selected points along Sunset Cliffs in Ocean Beach from Niagara Street to the Naval Reservation on Point Loma..... $2,000

(c) Surveys.....		$6,000
(1) 5,000 feet of detailed topographic surveys of top and bottom of bluffs along La Jolla.....	$1,800	
(2) 12,000 feet of detailed topographic surveys along the Sunset Cliffs area of Ocean Beach.....	$4,200	
(d) Economic studies to determine value of streets, utilities, property, and improvements subject to damage or loss by continued erosion.....		2,000
(e) Design and cost estimates for comparison of various designs to determine most satisfactory method of protection.....		2,000
(f) Preparation of report, including drafting and reproduction.....		4,000
Total estimated cost.....		18,000

RECOMMENDATIONS

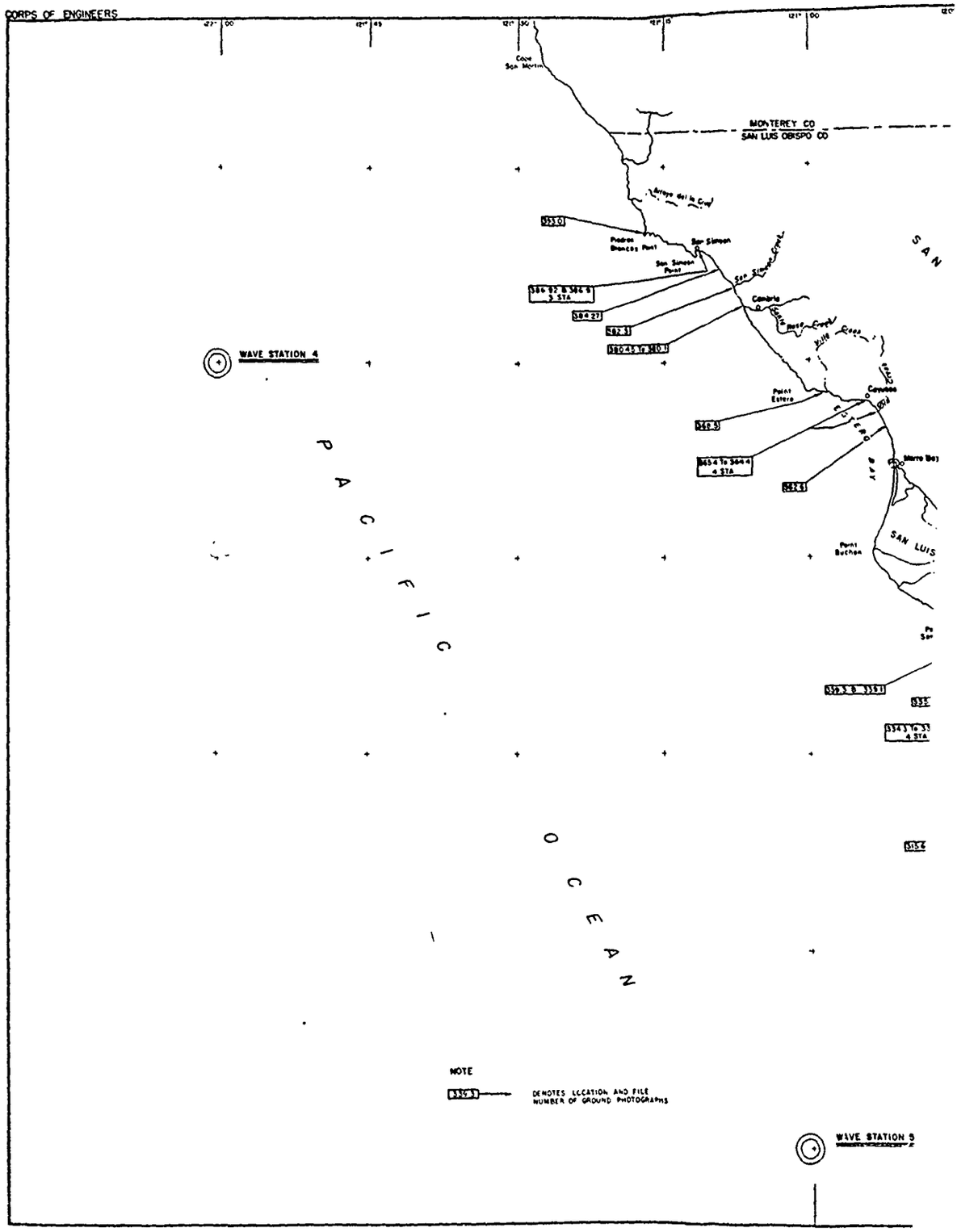
78. The district engineer recommends the preparation of a second interim report to be submitted in June 1961, at an estimated cost of $41,000.

79. The district engineer also recommends the preparation of a special report on the erosion in the city of San Diego, at an estimated cost of $18,000.

80. The district engineer finally recommends that the State of California initiate construction of the authorized project at Ventura in the immediate future, because of the continued erosion of the beach and the resulting damage to streets near the Ventura pier. The plan of improvement was recommended in House Document 29, 83d Congress, 1st session, and provided for the construction of 3 groins for the protection of the shore at Ventura, the initial construction to consist of the most eastern groin and the remaining groins to be deferred pending demonstration of the need therefor.

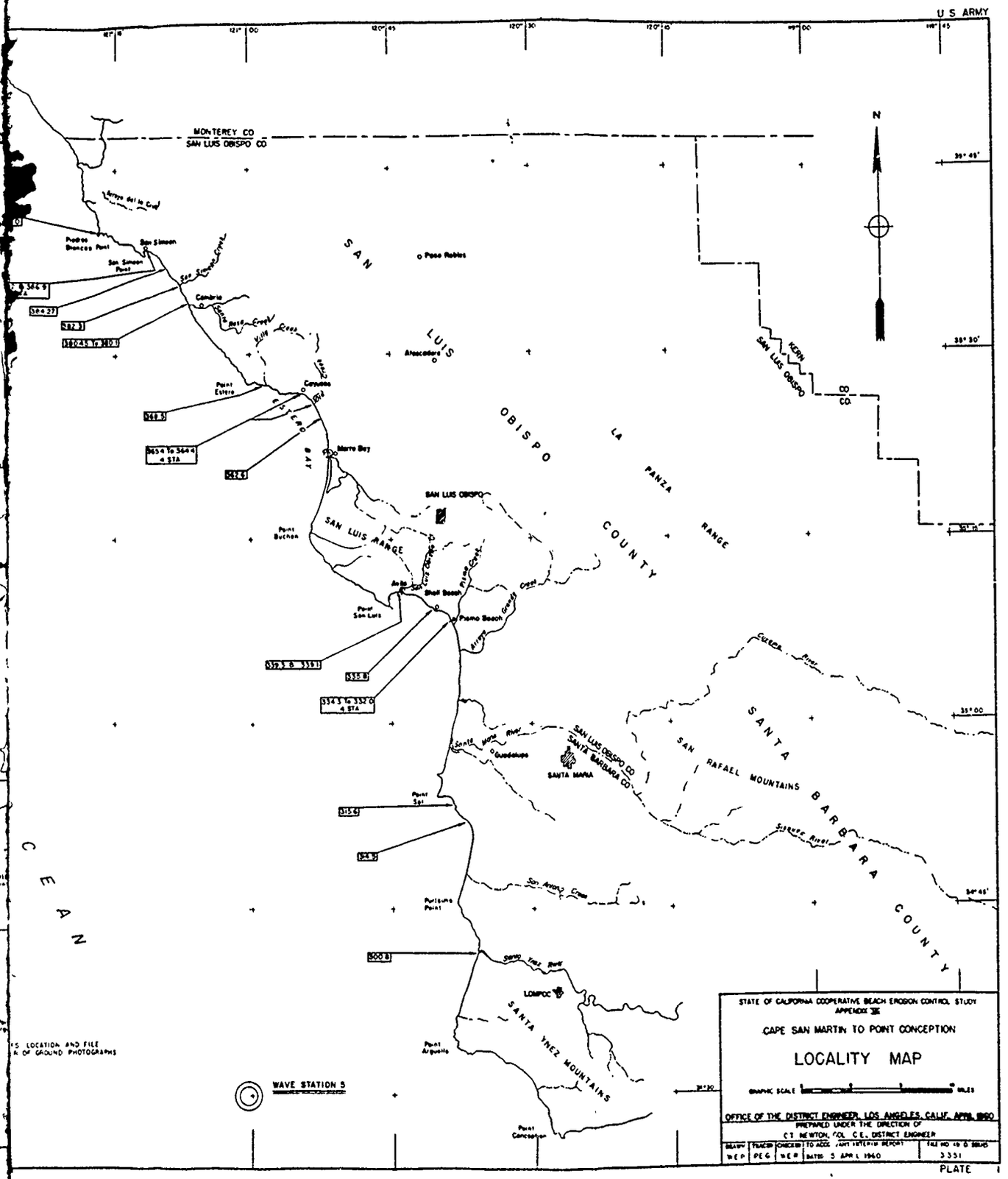
36 Incls
36 plates

W. T. BRADLEY
Colonel, Corps of Engineers
District Engineer


CORPS OF ENGINEERS
MONTEREY CO
SAN LUIS OBISPO CO
Cove San Martin
Arroyo del la Cruz
Pedras Blancas Point
San Simeon
San Simeon Point
San Simeon Creek
Cambria
Point Estero
Cayucos
Morro Bay
Point Buchon
SAN LUIS
WAVE STATION 4
PACIFIC OCEAN
NOTE
DENOTES LOCATION AND FILE NUMBER OF GROUND PHOTOGRAPHS
WAVE STATION 5

2

U S ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX

CAPE SAN MARTIN TO POINT CONCEPTION

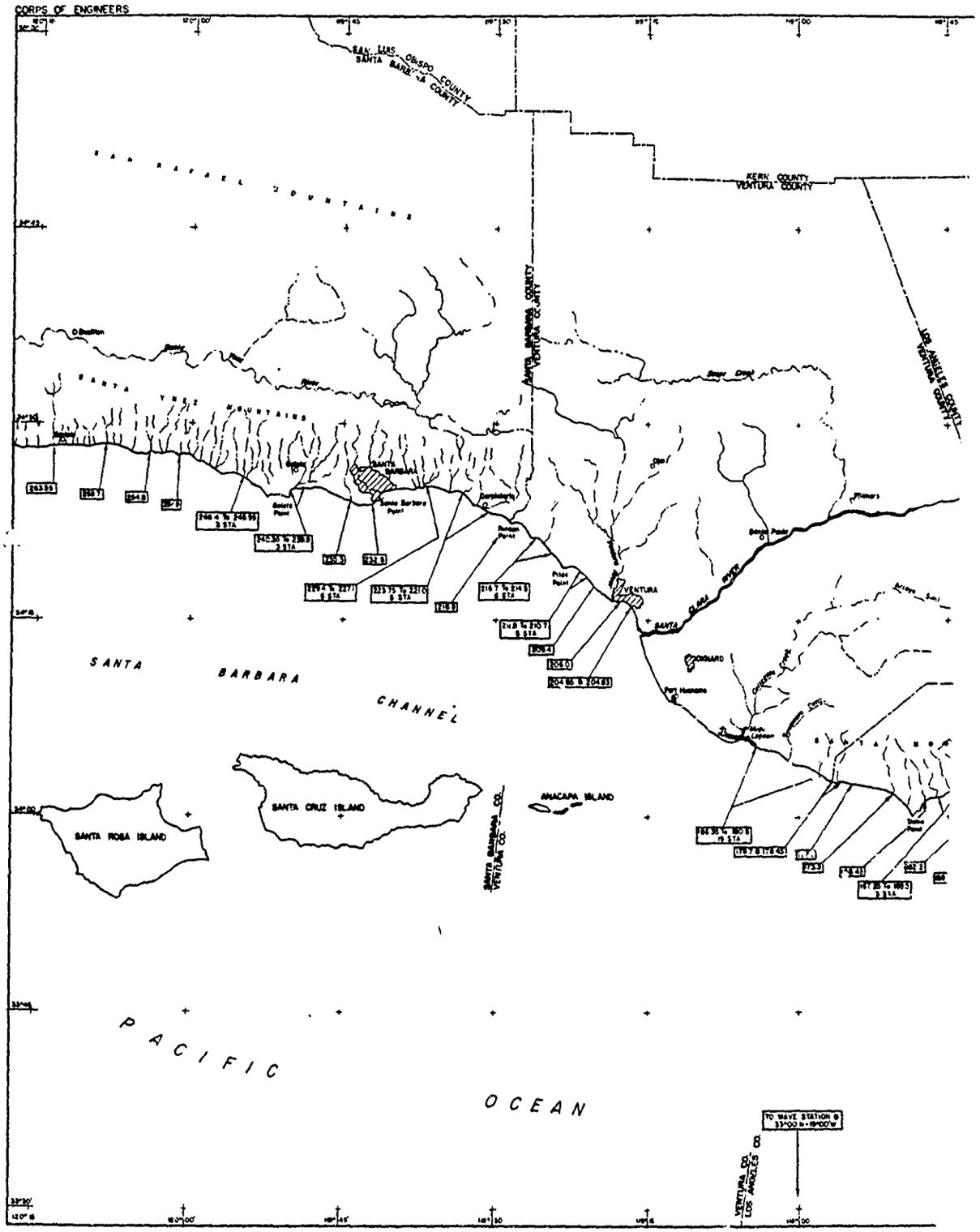
LOCALITY MAP

GRAPHIC SCALE MILES

OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. APRIL 1960
PREPARED UNDER THE DIRECTION OF
C T NEWTON, COL C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCM. / ANY INTERIM REPORT	FILE NO. 10 D. DRWG
W E P	P E G	W E P	DATED 5 APRIL 1960	3351

PLATE


CORPS OF ENGINEERS
SAN LUIS OBISPO COUNTY
SANTA BARBARA COUNTY
KERN COUNTY
VENTURA COUNTY
SANTA BARBARA COUNTY
VENTURA COUNTY
LOS ANGELES COUNTY
VENTURA COUNTY
SANTA BARBARA
VENTURA
SANTA CRUZ ISLAND
SANTA ROSA ISLAND
ANACAPA ISLAND
SANTA BARBARA CHANNEL
PACIFIC OCEAN
TO WAVE STATION 8
33°00'N-119°00'W
VENTURA CO.
LOS ANGELES

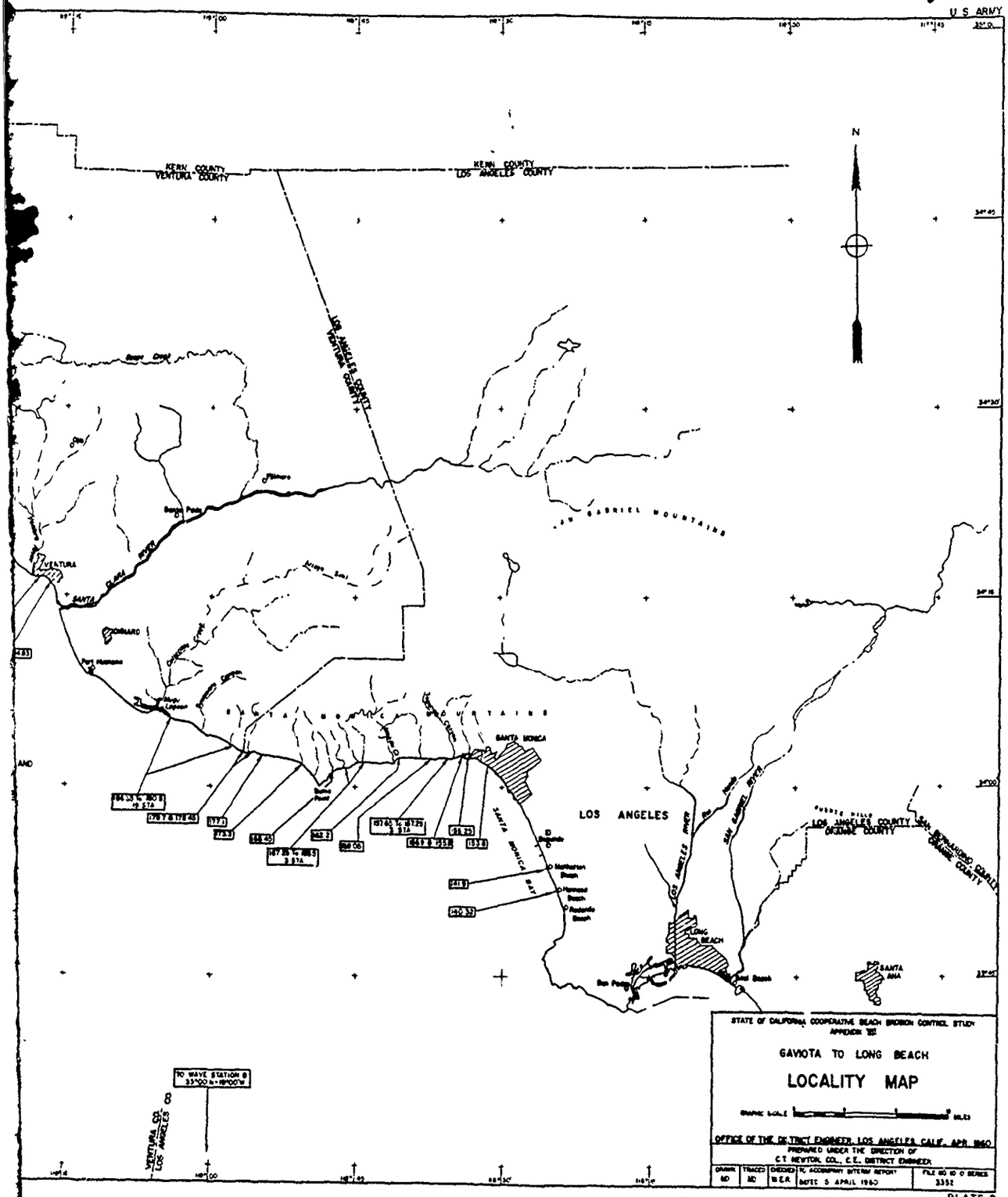
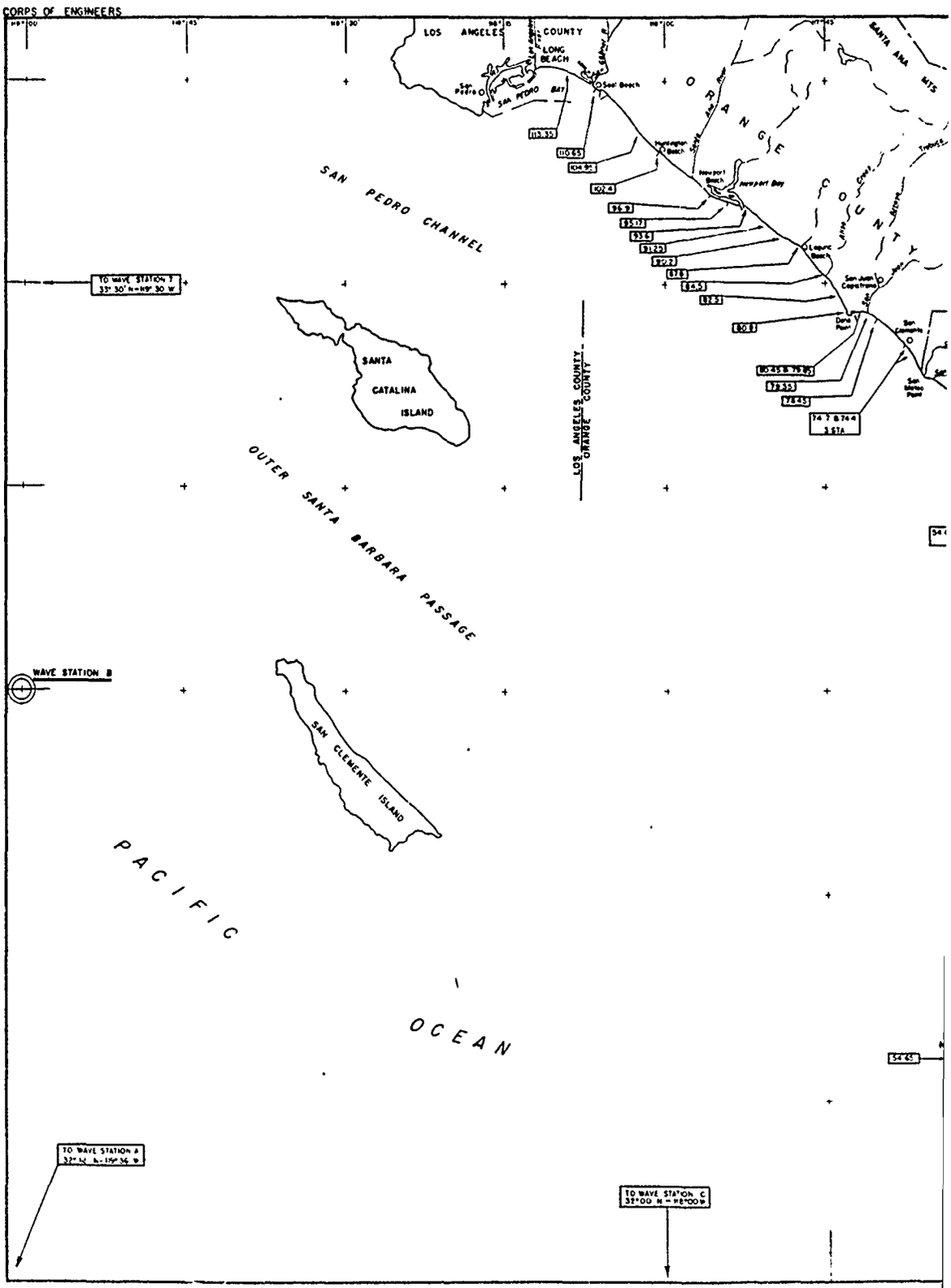
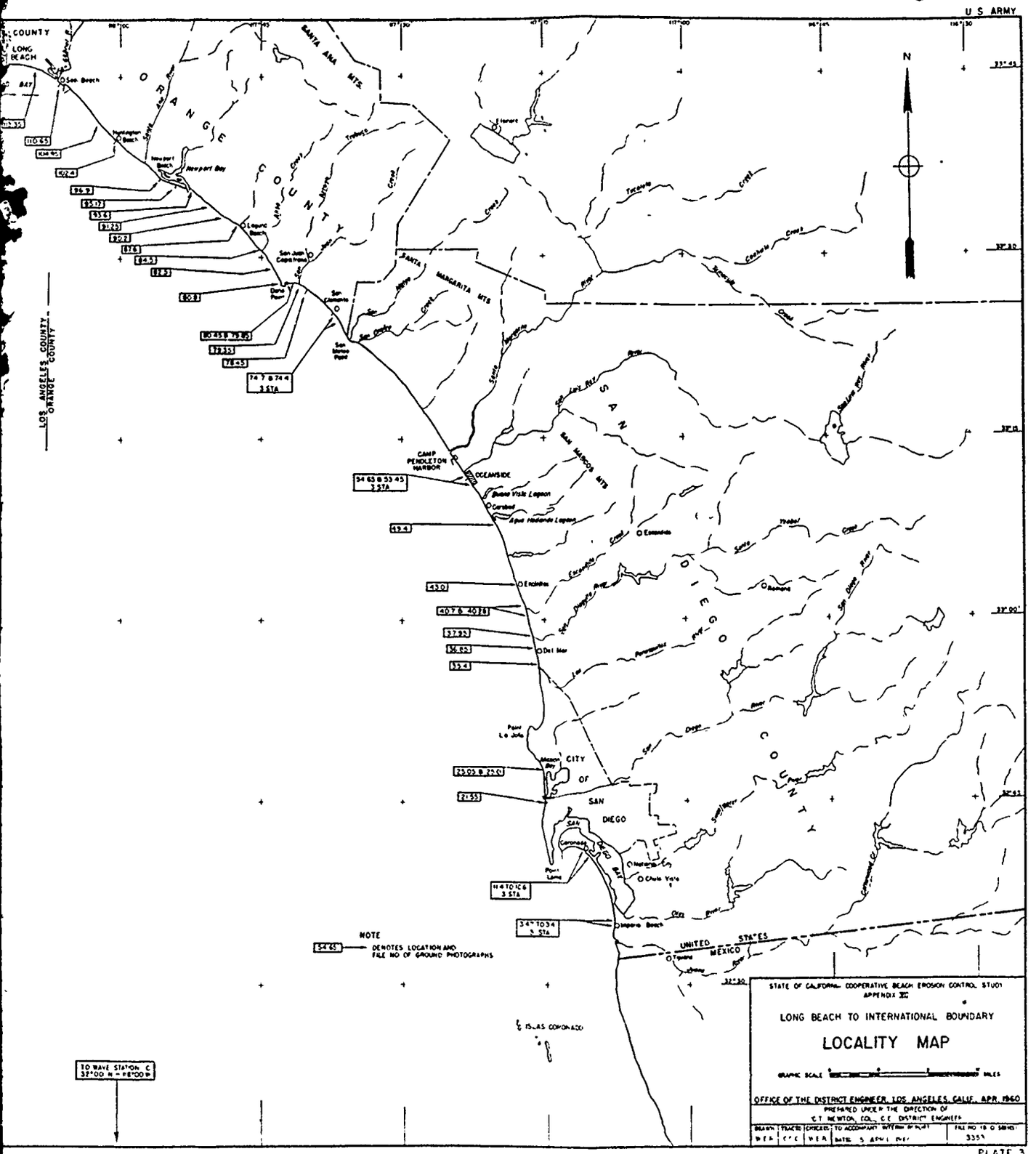

U S ARMY
KERN COUNTY
VENTURA COUNTY
KERN COUNTY
LOS ANGELES COUNTY
LOS ANGELES COUNTY
VENTURA COUNTY
N
SANTA BARBARA
VENTURA
SANTA CLARA RIVER
OXNARD
Port Hueneme
SANTA MONICA MOUNTAINS
SANTA MONICA
SANTA MONICA BAY
LOS ANGELES
LOS ANGELES RIVER
SAN GABRIEL RIVER
SAN GABRIEL MOUNTAINS
PUENTE HILLS
LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
ORANGE COUNTY
LONG BEACH
SANTA ANA
TO WAVE STATION 8
33°00' N-118°00' W
VENTURA CO.
LOS ANGELES
8
STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III
GAVIOTA TO LONG BEACH
LOCALITY MAP
GRAPHIC SCALE
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. APR 1960
PREPARED UNDER THE DIRECTION OF
C.T. NEWTON, COL., C.E., DISTRICT ENGINEER
DRAWN MD
TRACED MD
CHECKED W.E.R.
PL ACCOMPANY INTERIM REPORT
DATE 5 APRIL 1960
FILE NO 10 0 SERIES
3352

PLATE 2


CORPS OF ENGINEERS
LOS ANGELES COUNTY
LONG BEACH
SAN PEDRO BAY
ORANGE COUNTY
SANTA ANA MTS
SAN PEDRO CHANNEL
TO WAVE STATION 7
33° 30' N-119° 30' W
SANTA CATALINA ISLAND
LOS ANGELES COUNTY
ORANGE COUNTY
OUTER SANTA BARBARA PASSAGE
WAVE STATION B
SAN CLEMENTE ISLAND
PACIFIC
OCEAN
TO WAVE STATION A
32° N-119° 36' W
TO WAVE STATION C
32° 00' N-118° 00' W

2

U S ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX XI

LONG BEACH TO INTERNATIONAL BOUNDARY

LOCALITY MAP

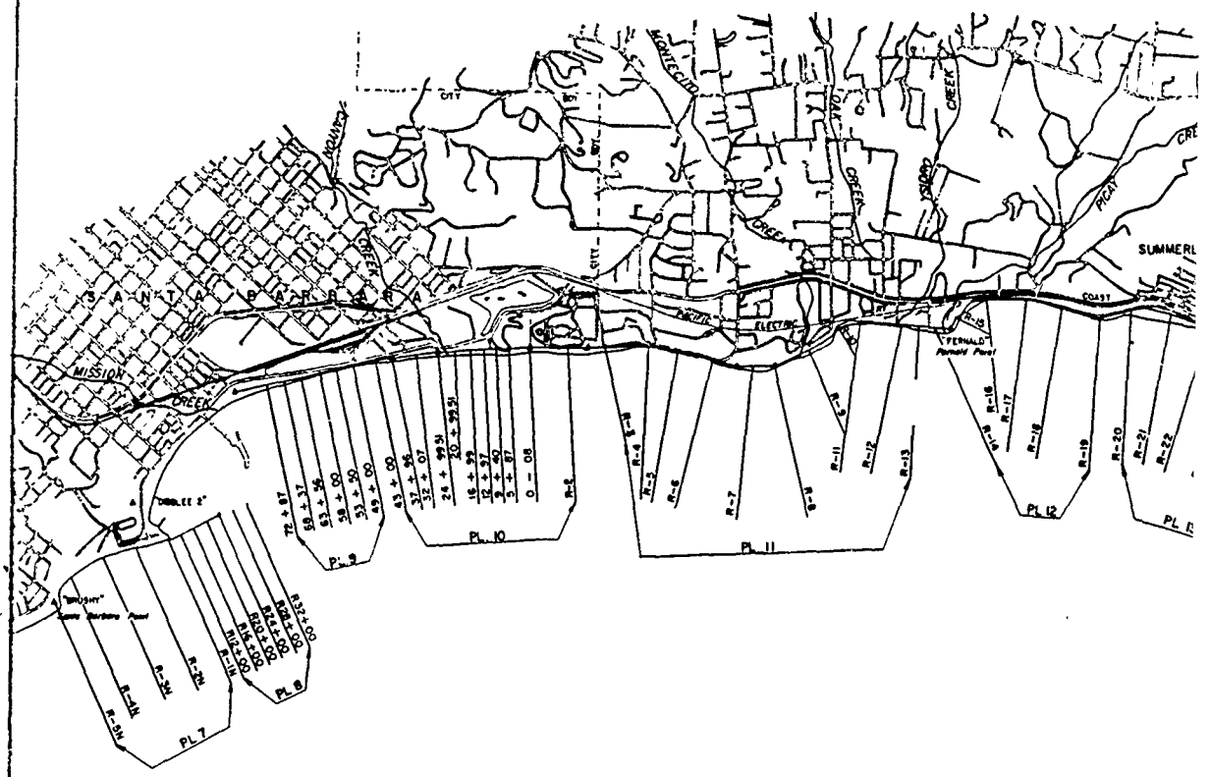
GRAPHIC SCALE 0 1 2 MILES

OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. APR. 1960
PREPARED UNDER THE DIRECTION OF
E.T. NEWTON, COL., C.E. DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY REPORT OF PLATE	FILE NO. 18 0 SERIES
WEA	CFC	WEA	DATE 5 APRIL 1960	3357

PLATE 3

ORPS OF ENGINEERS



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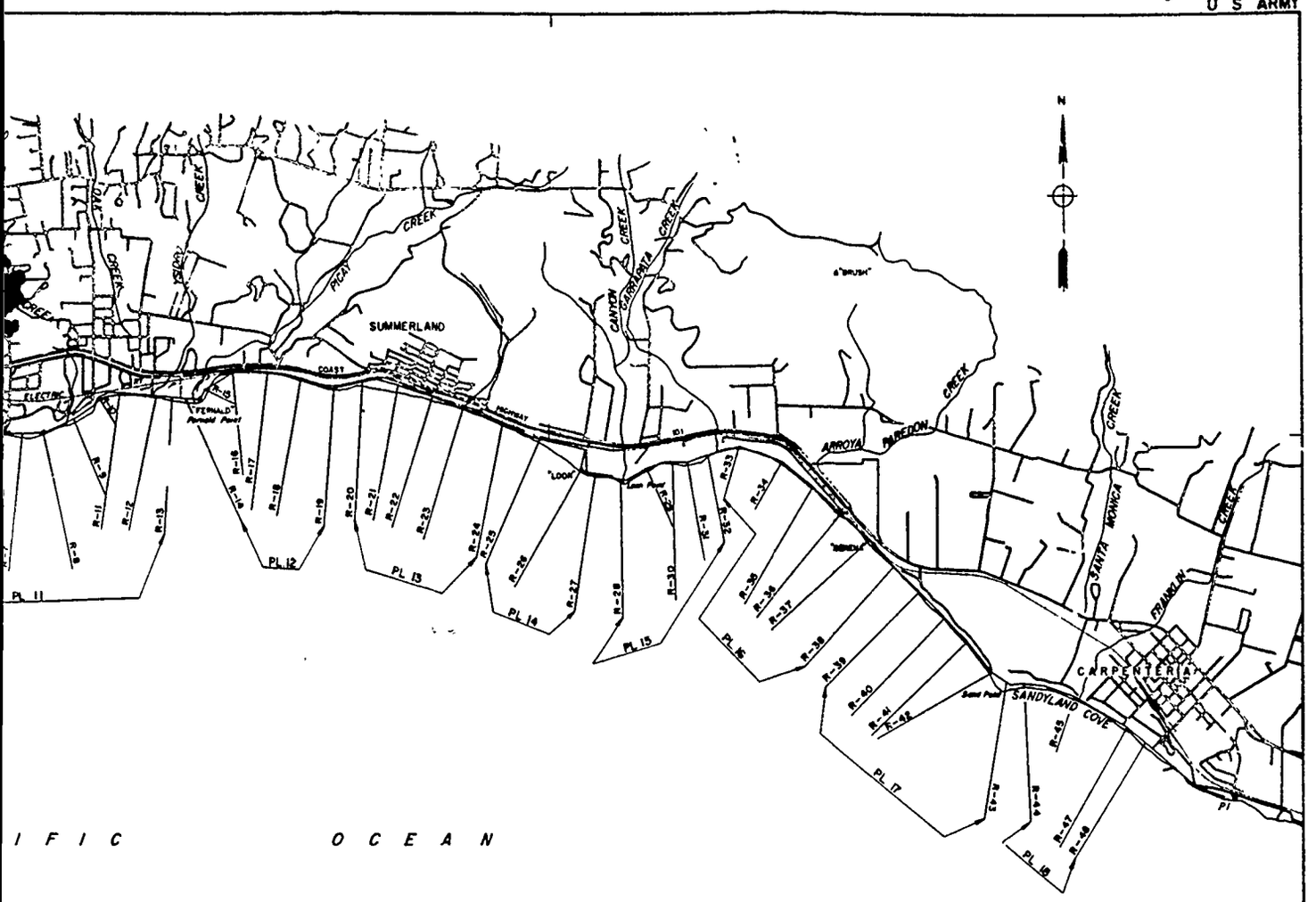
U S ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX XXII

SANTA BARBARA AREA

LOCATION OF PROFILES

IN ONE SHEET

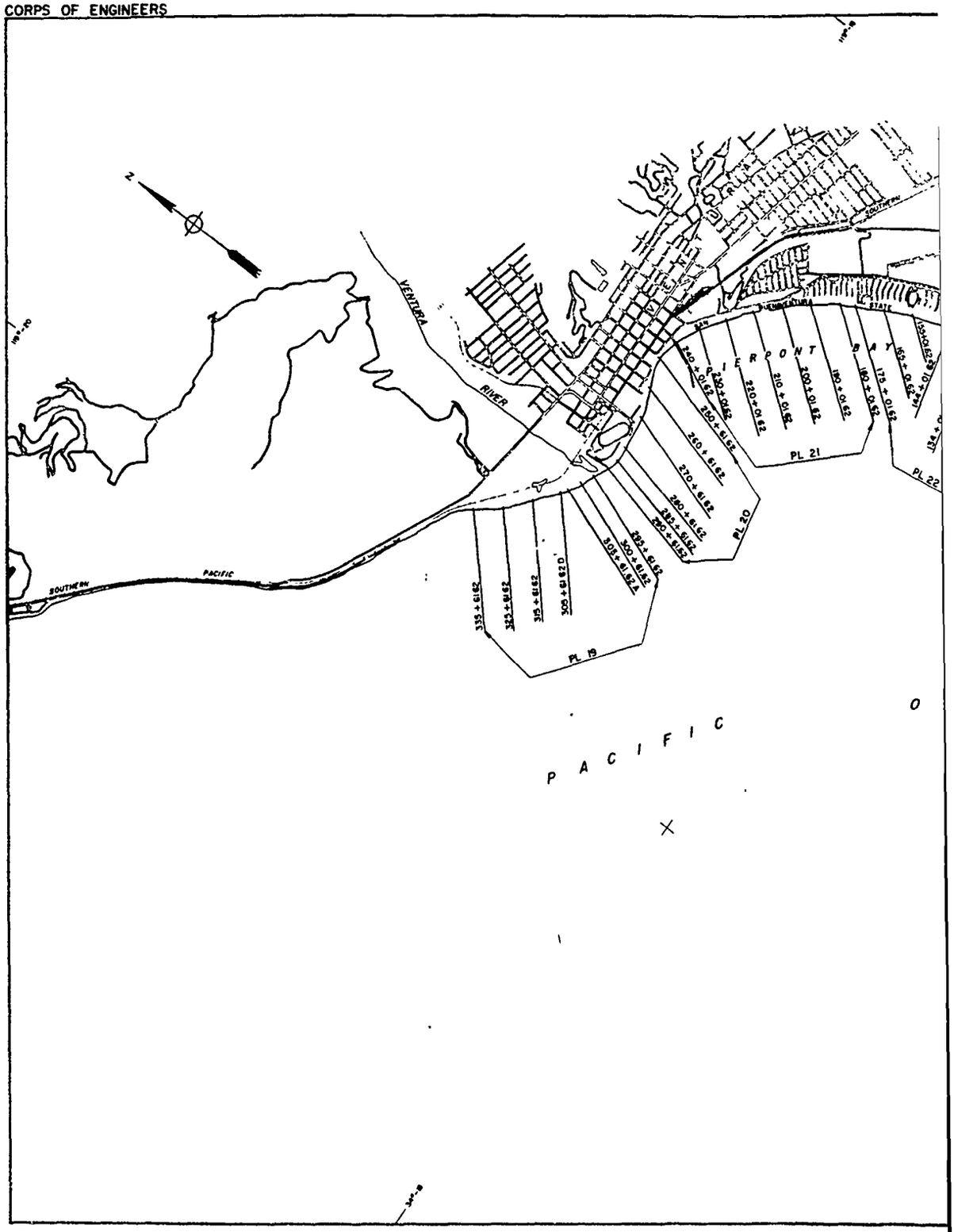
GRAPHIC SCALE 1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

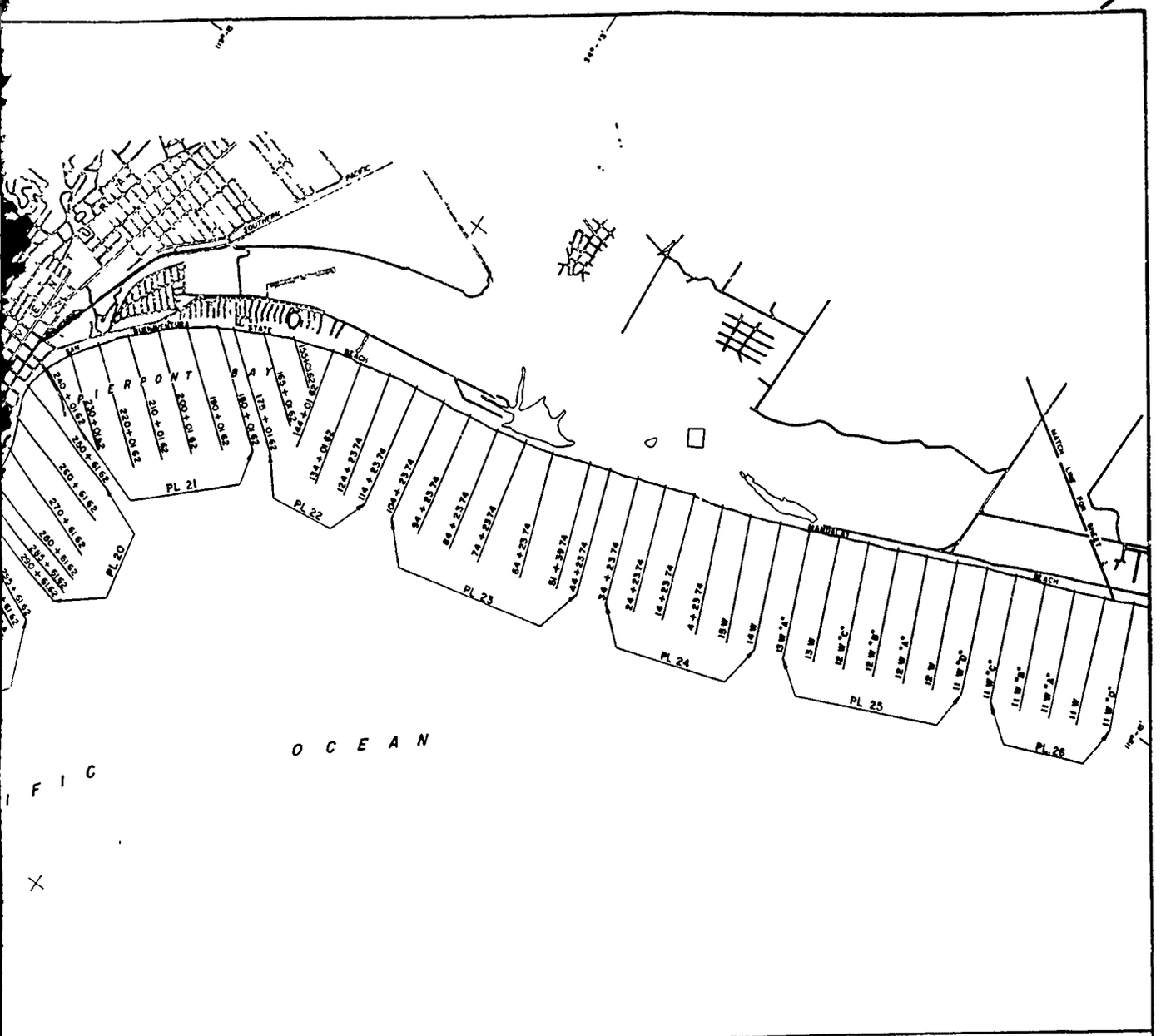
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF, JAN 1960
PREPARED UNDER THE DIRECTION OF
C T NEWTON, COL, CE, DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO (DO SERIES)
MD	MD	W E R	DATED 5 APRIL 1960	3323

PLATE 4

CORPS OF ENGINEERS





STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX XII

VENTURA AREA

LOCATION OF PROFILES

SHEET 1 OF 2

GRAPHIC SCALE 1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

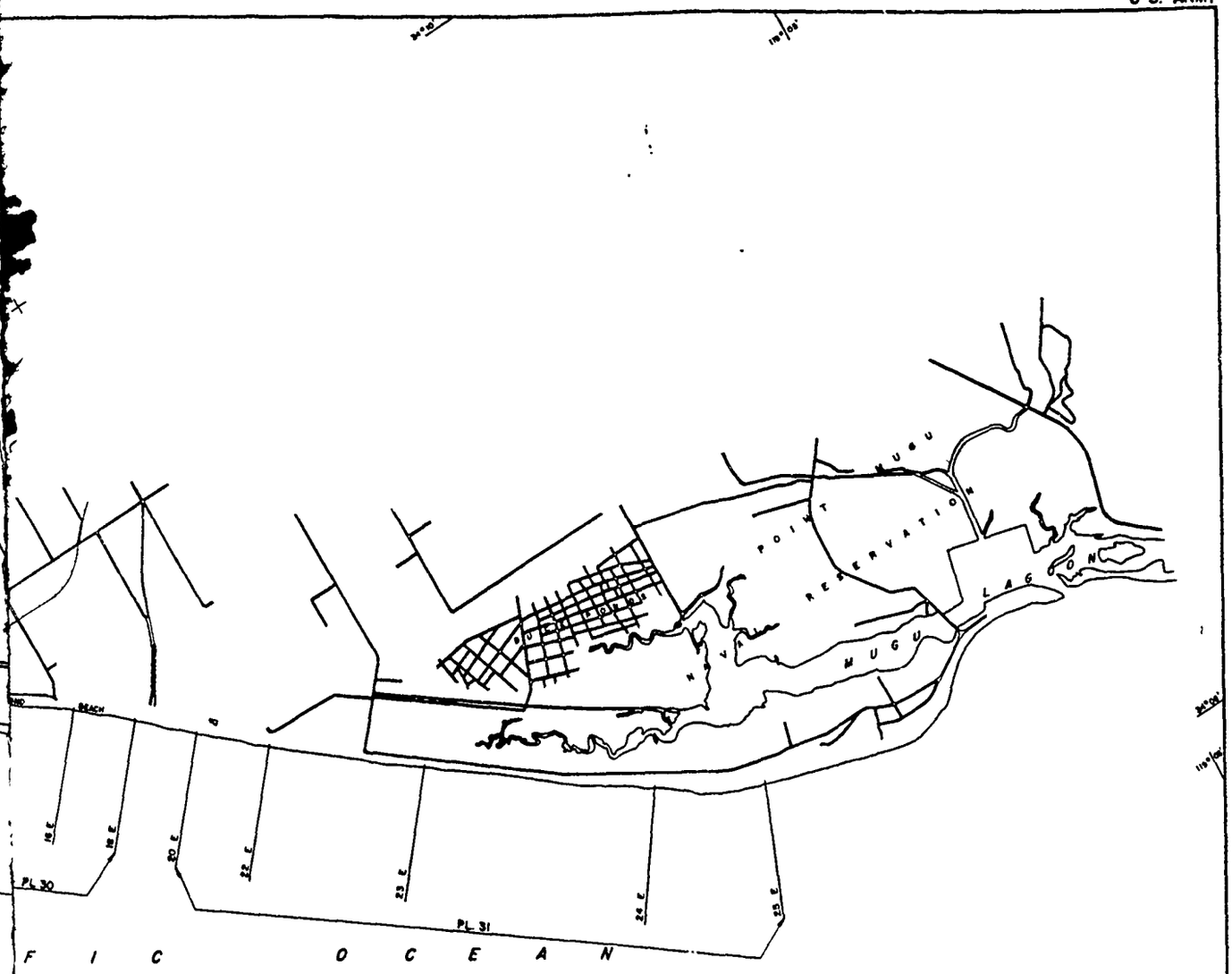
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. JAN 1960
PREPARED UNDER THE DIRECTION OF
C.T. NEWTON, COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED		
MD	MD	WEJR	TO ACCOMPANY INTERIM REPORT DATED 5 APRIL 1960	FILE 310 (DO SERIES) 3324

PLATE 5

CORPS OF ENGINEERS

U S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX VII

PORT HUENEME AREA

LOCATION OF PROFILES

SHEET 2 OF 2

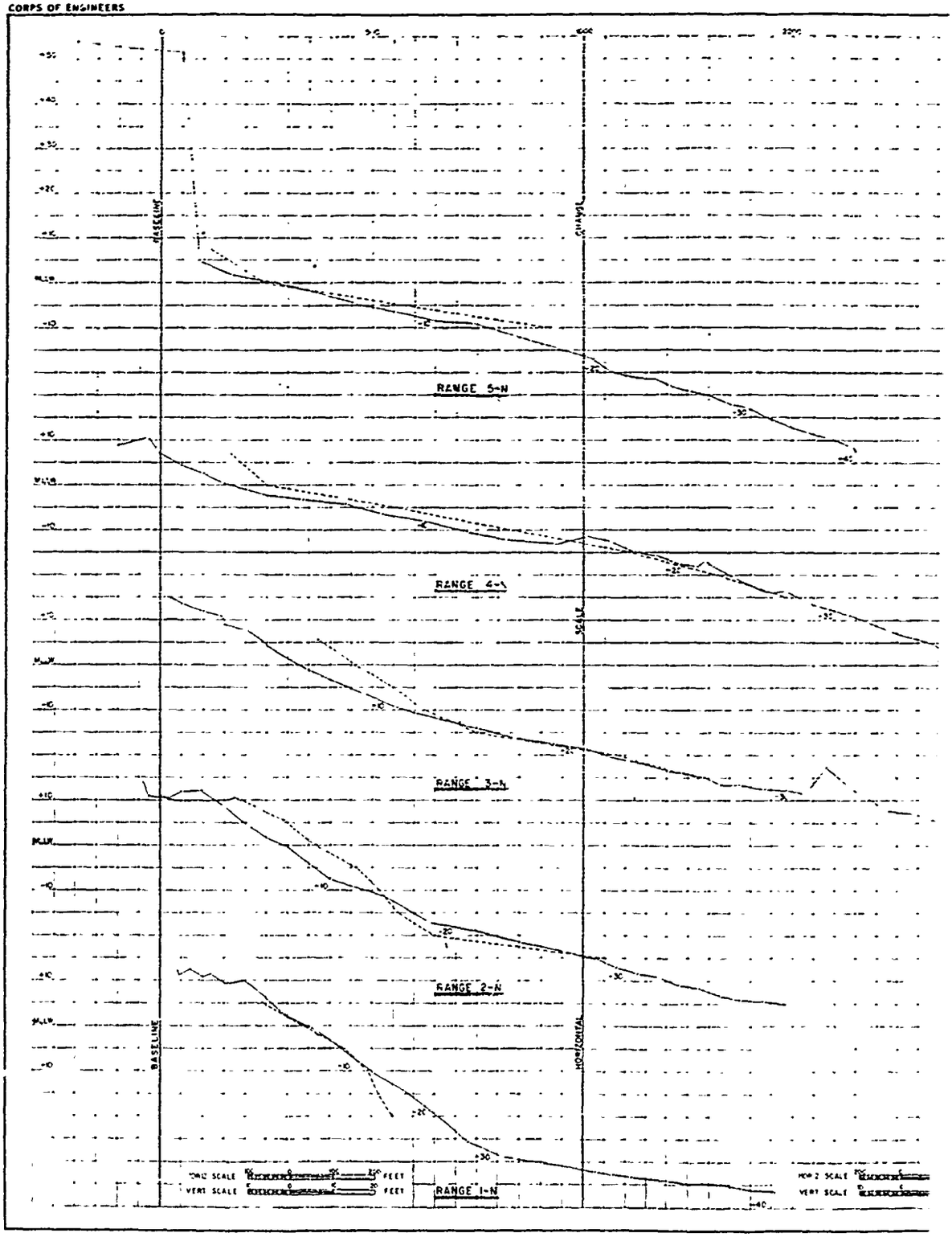
GRAPHIC SCALE 2000 0 1000 2000 3000 4000 5000 6000 7000 FEET

OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., JAN. 1960
PREPARED UNDER THE DIRECTION OF
C.T. NEWTON, COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO (DO SERIES)
MD	MD	W E R	DATED 5 APRIL 1960	3325

PLATE 6

CORPS OF ENGINEERS



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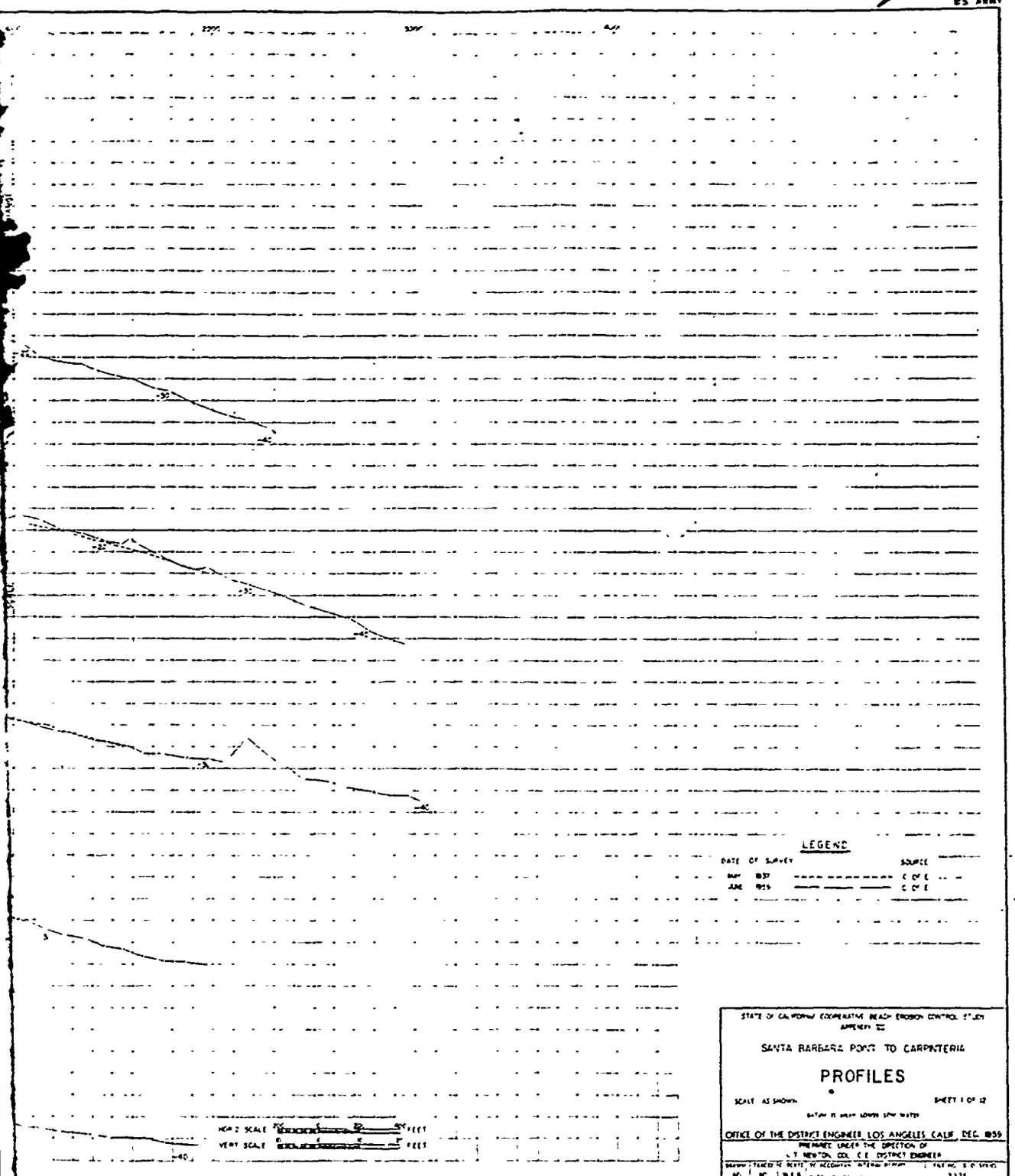
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 1 OF 12

DATUM IS MEAN LOWER LOW WATER

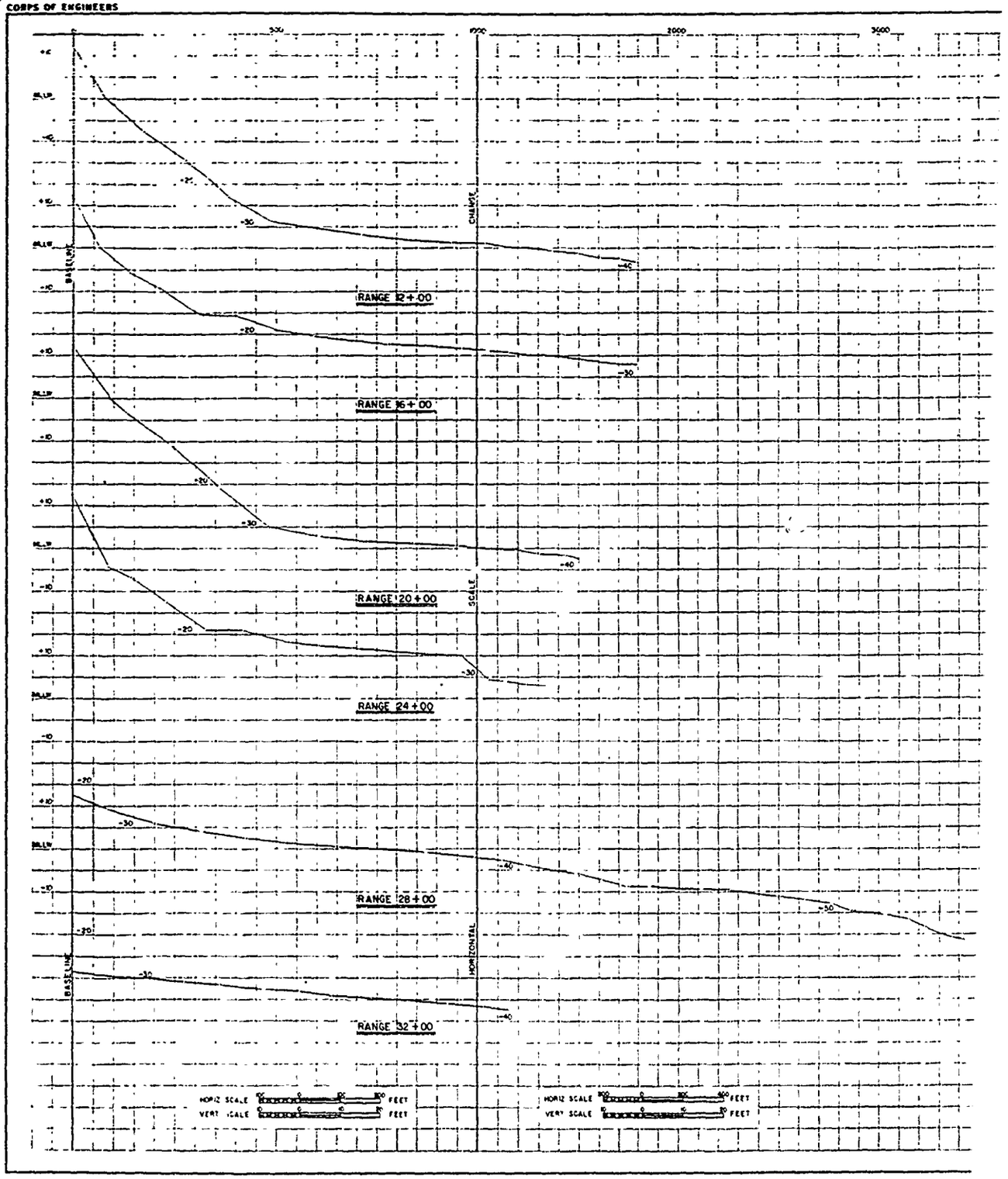
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC. 1959

PREPARED UNDER THE DIRECTION OF
L.T. NEWTON, COL. C.E. DISTRICT ENGINEER

3329

PLATE 7

CORPS OF ENGINEERS



US ARMY

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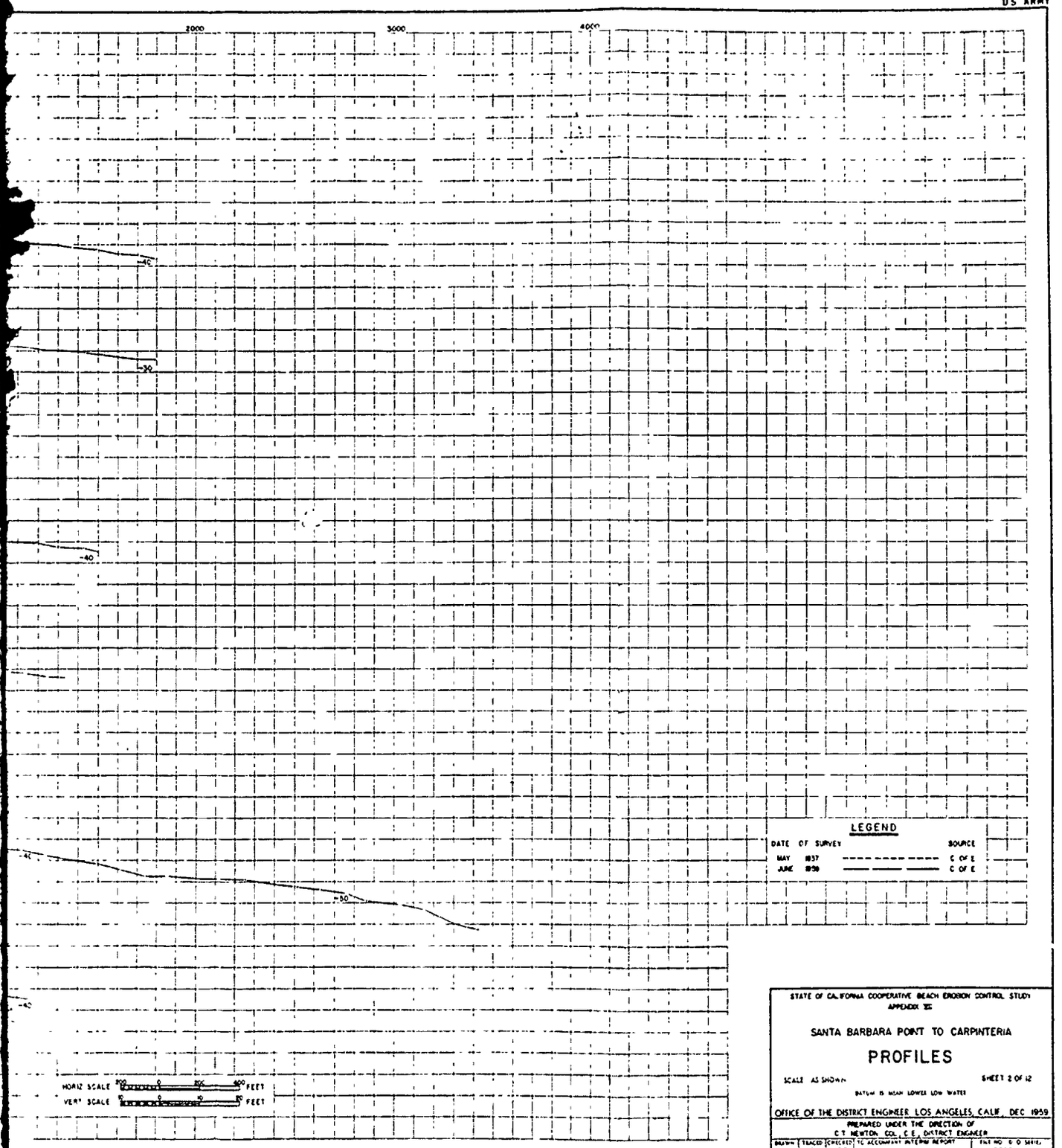


STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 2 OF 12

DATUM IS MEAN LOWER LOW WATER

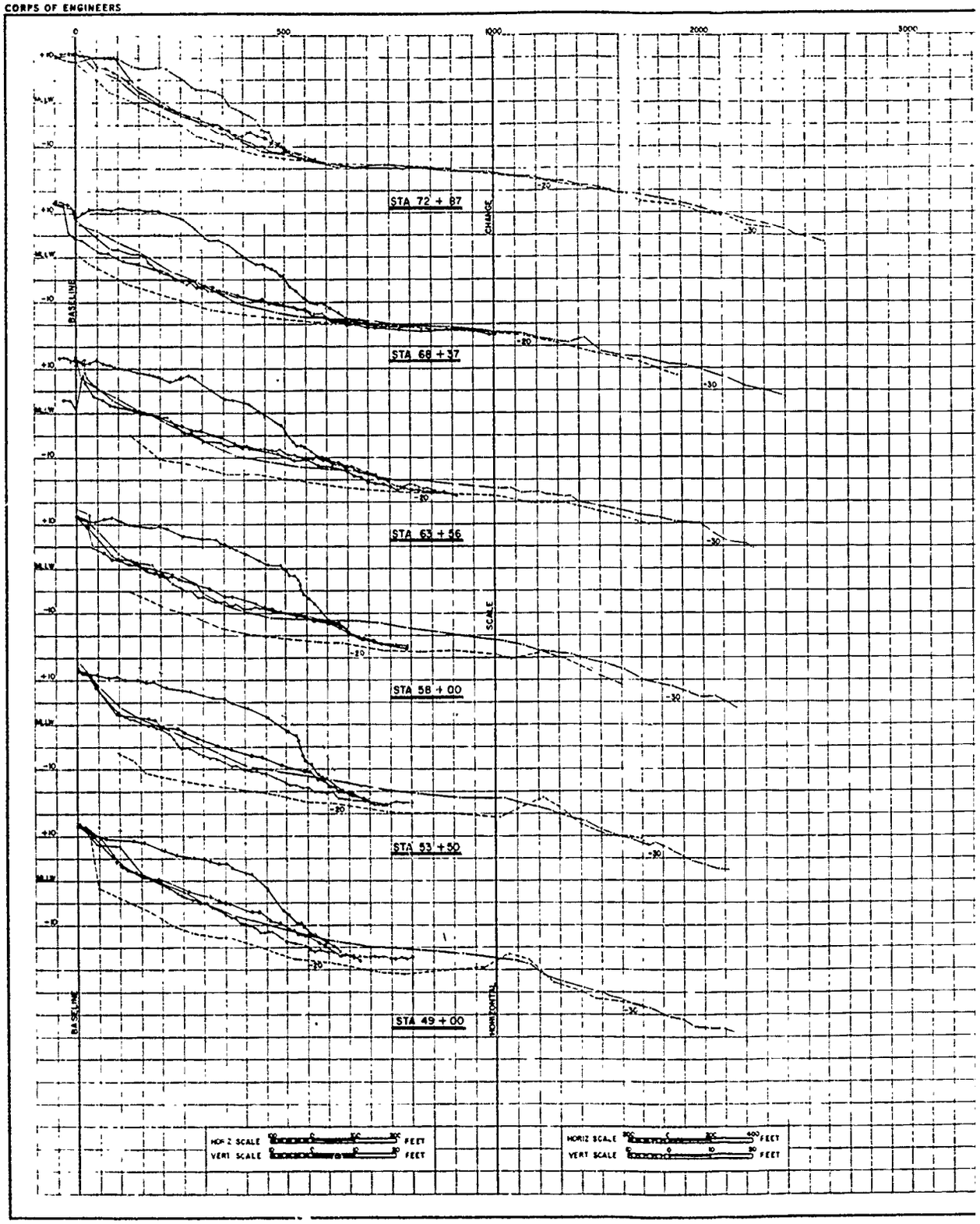
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., DEC 1959

PREPARED UNDER THE DIRECTION OF
C T NEWTON, COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. S.O. SERIES
M.	MD	WER	WATER & APRIL 1960	3327

PLATE 8

CORPS OF ENGINEERS



U.S. ARMY

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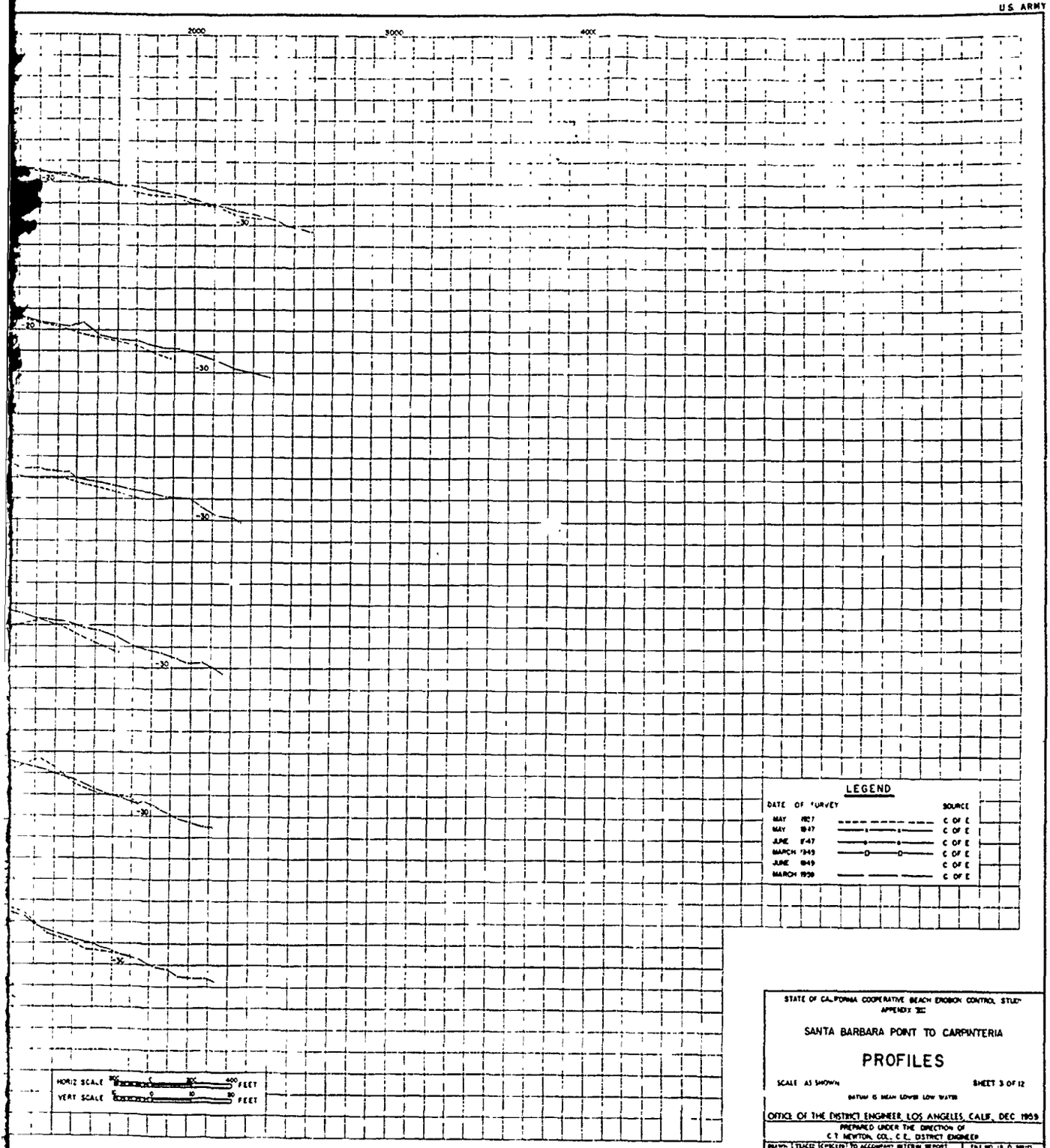


STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 3 OF 12

DATUM IS MEAN LOWER LOW WATER

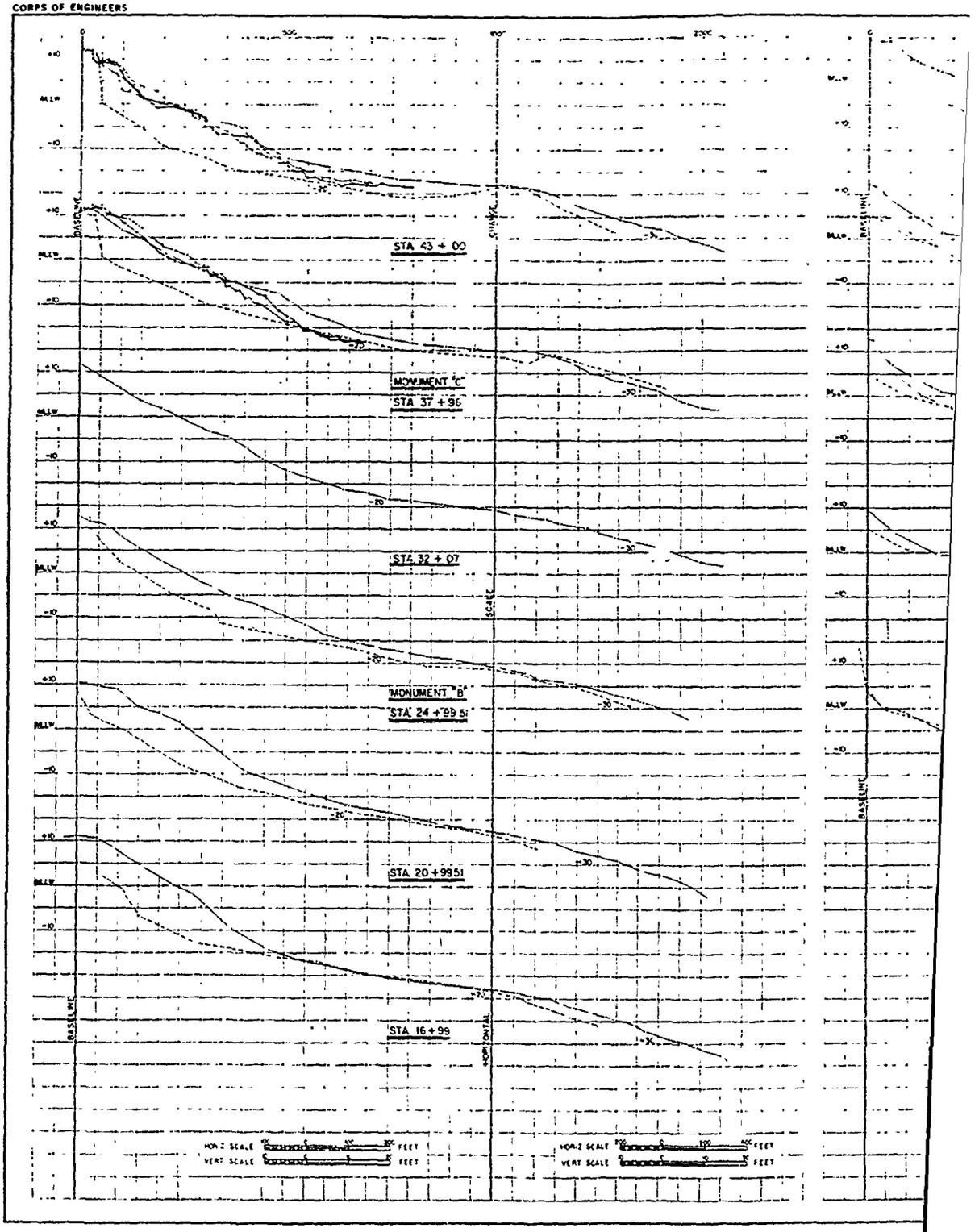
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., DEC 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO.
MD	MD	WEB	DATED 8 APRIL 1960	3328

PLATE 9

CORPS OF ENGINEERS



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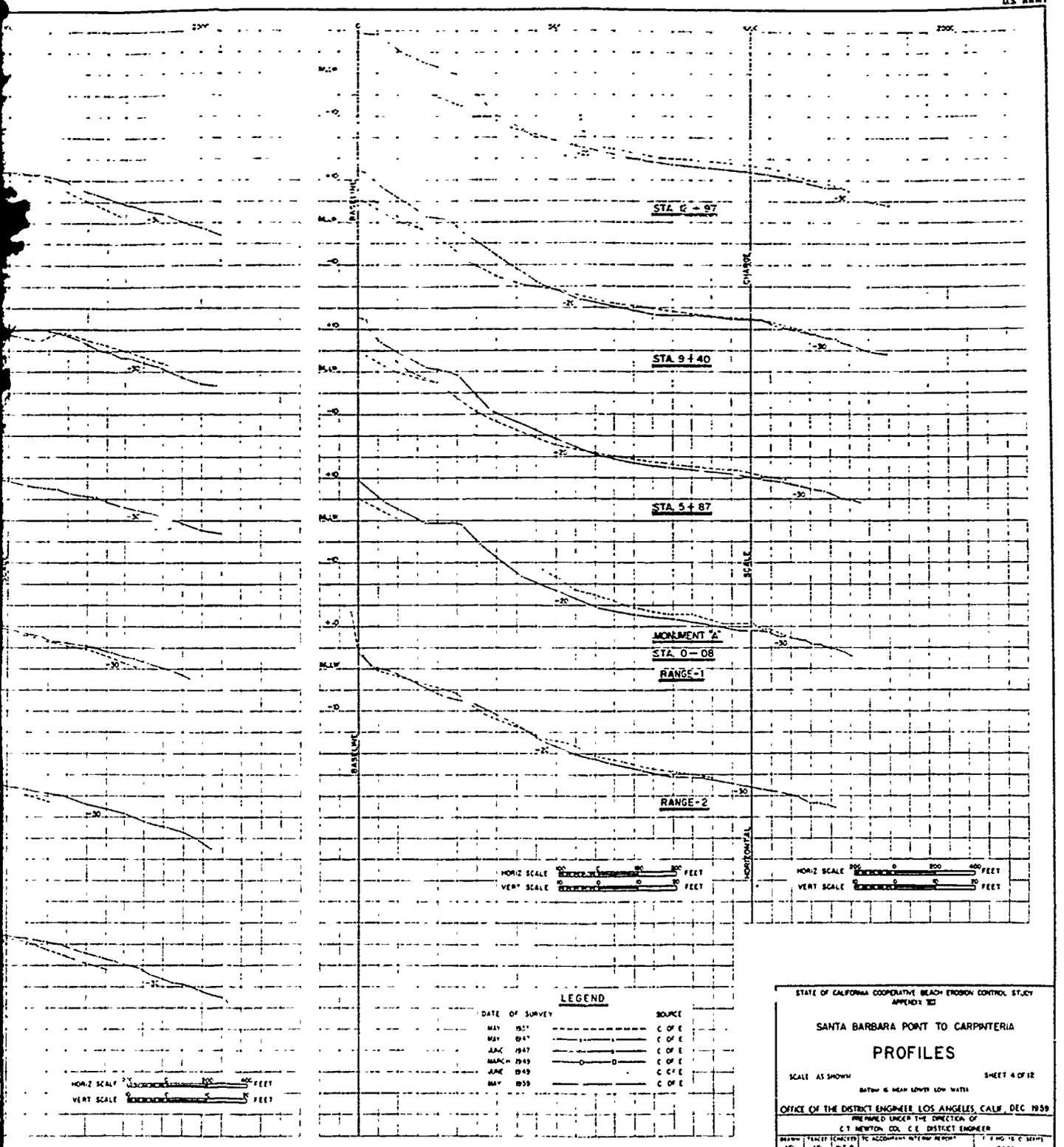
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 4 OF 12

DATUM IS MEAN LOWER LOW WATER

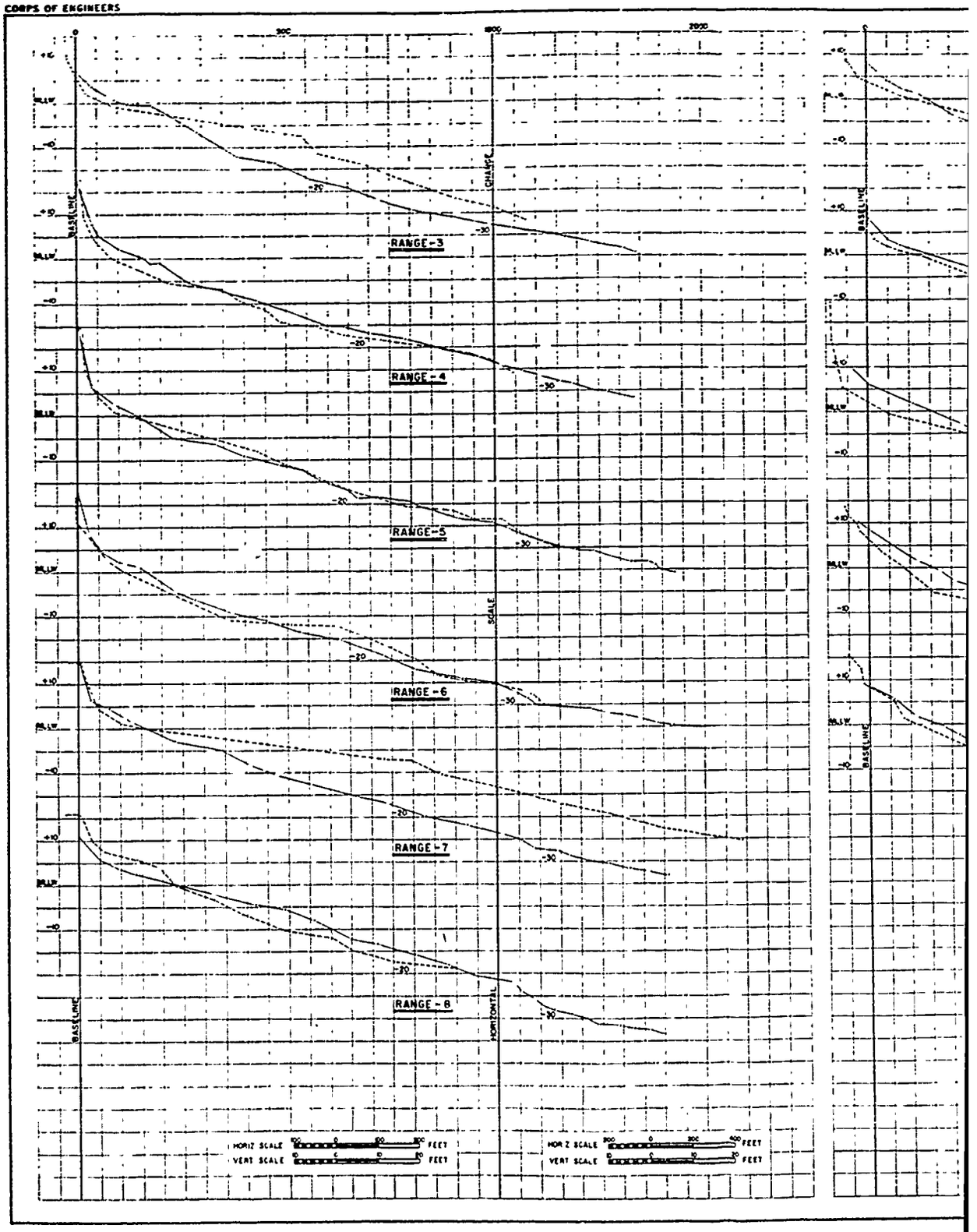
OFFICE OF THE DISTRICT ENGINEER LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON COL. C.E. DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. IN C. SERIES
MD	MD	WEA	DATED 4 APR. 1960	3324

PLATE 10

CORPS OF ENGINEERS



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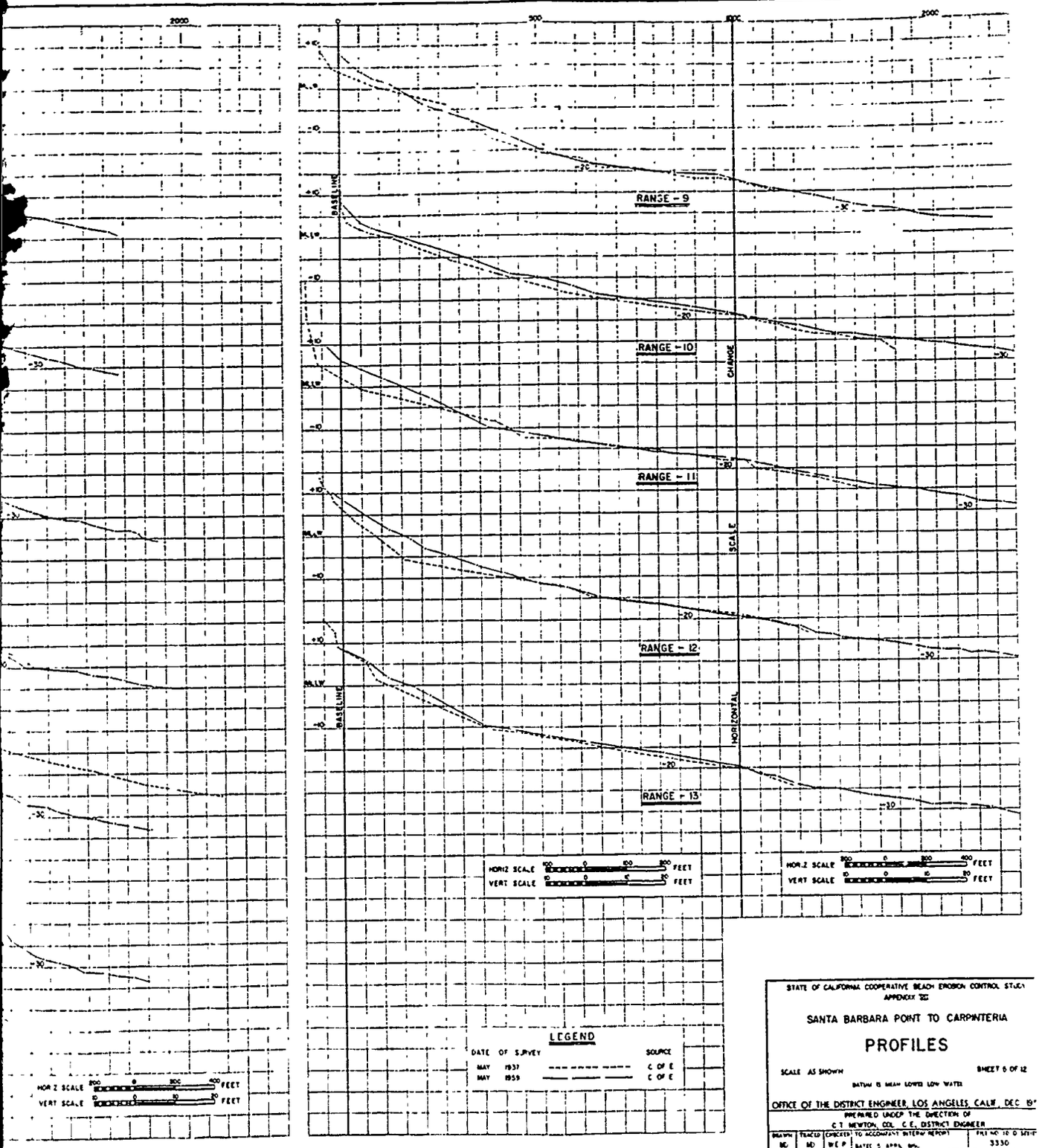
US A



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 6 OF 12

DATUM IS MEAN LOWER LOW WATER

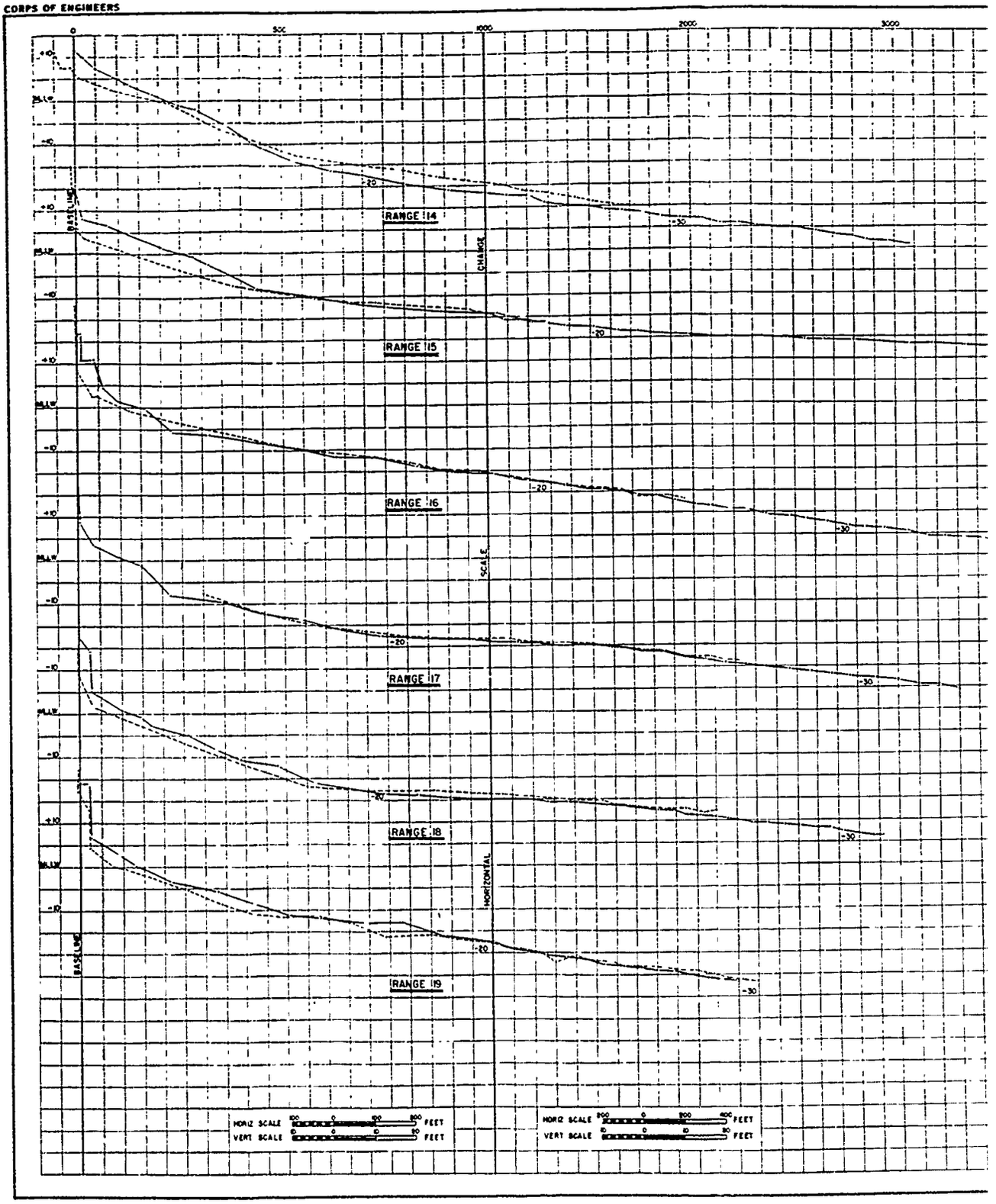
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC 19

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL. C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. 10 0 SERIES
BC	MD	WEP	DATED 5 APRIL 1961	3330

PLATE

CORPS OF ENGINEERS



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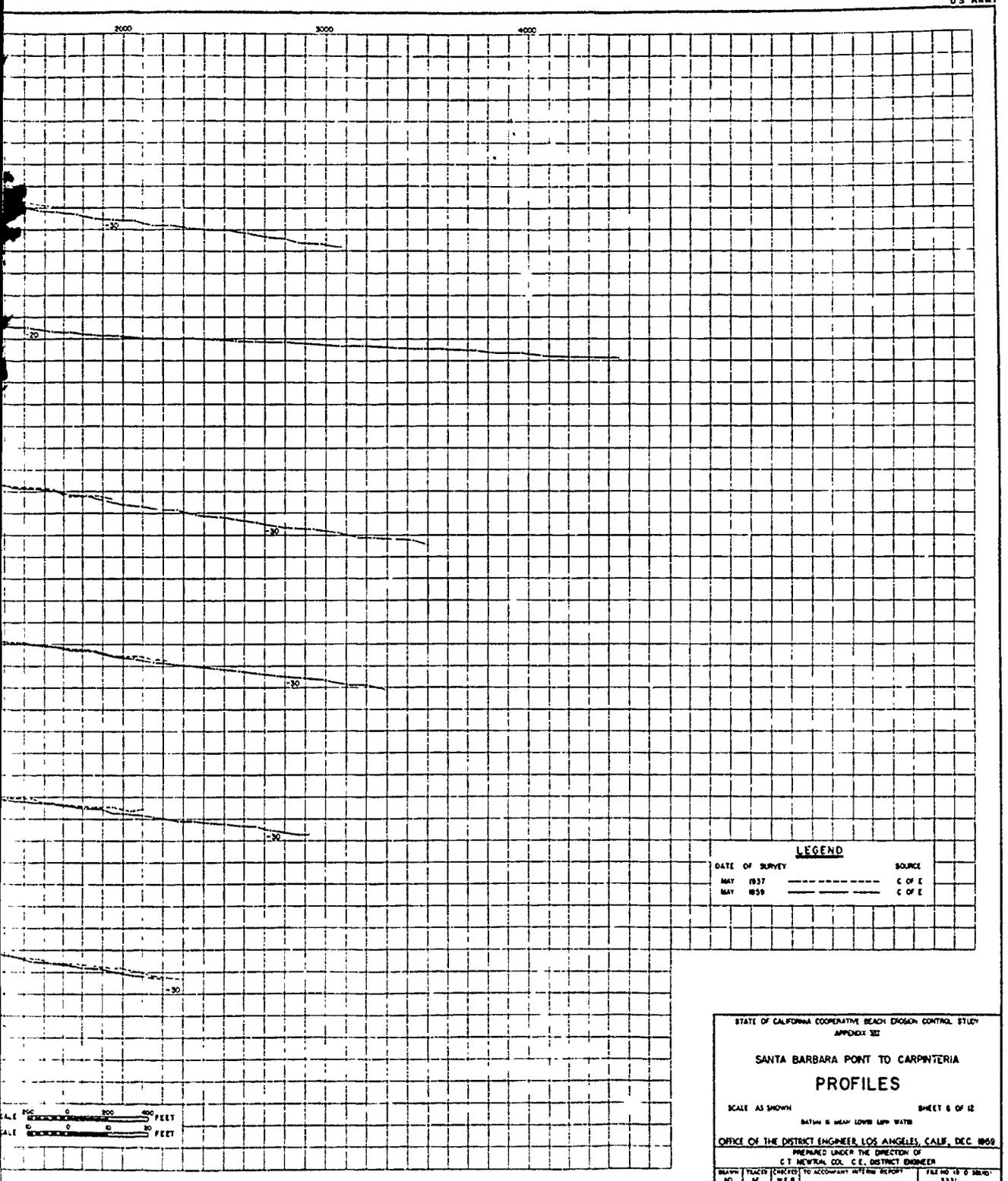
US ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX XII

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 6 OF 12

DATUM IS MEAN LOWER LOW WATER

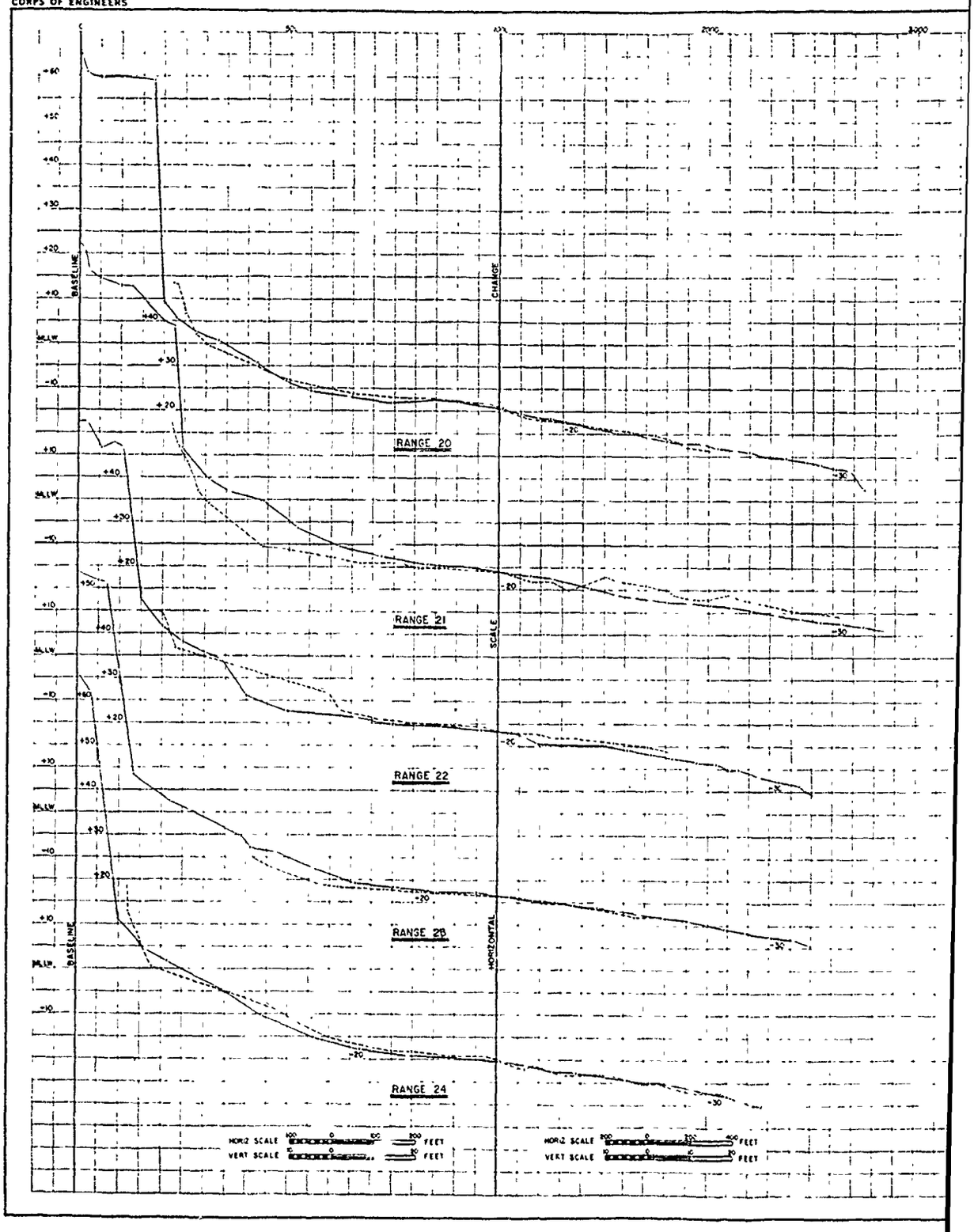
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., DEC. 1969

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL. C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. (D. O. DRAWING)
MO	BC	WER	DATED 5 APRIL 1966	3331

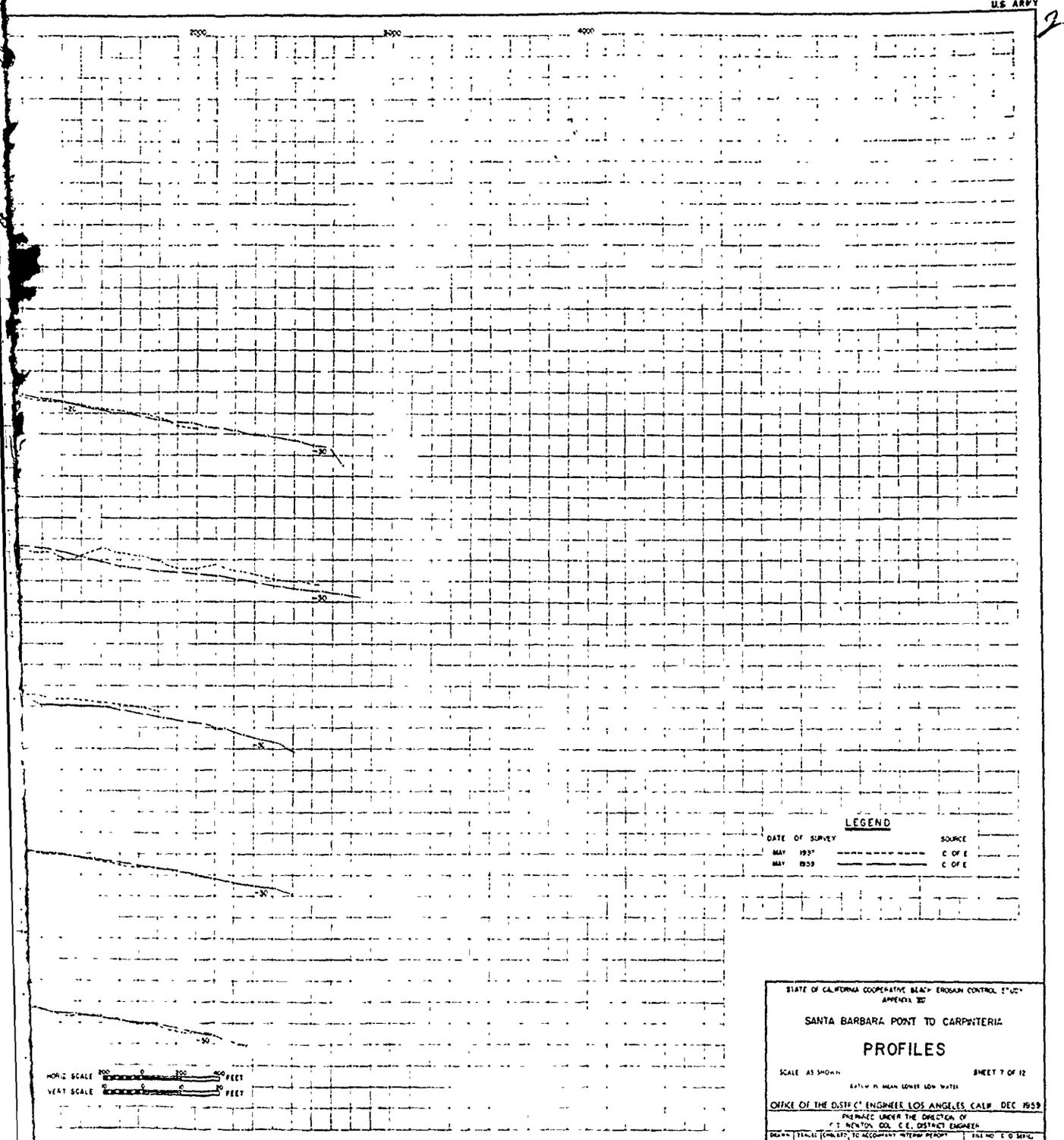
PLATE 12

CORPS OF ENGINEERS



U.S. ARMY

2



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 7 OF 12

DATUM IS MEAN LOWER LOW WATER

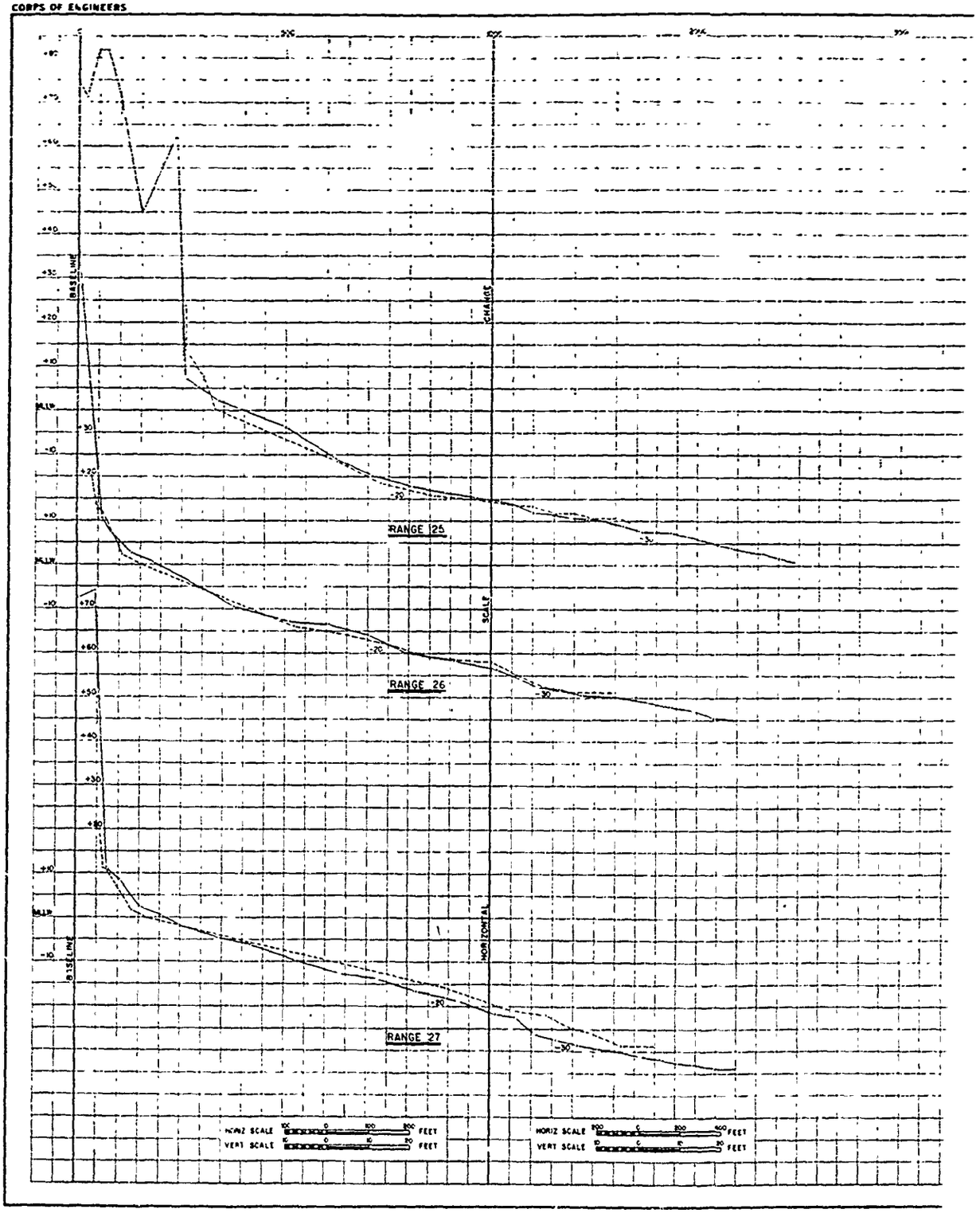
OFFICE OF THE DISTRICT ENGINEER LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
F. T. NEWTON COL. C.E. DISTRICT ENGINEER

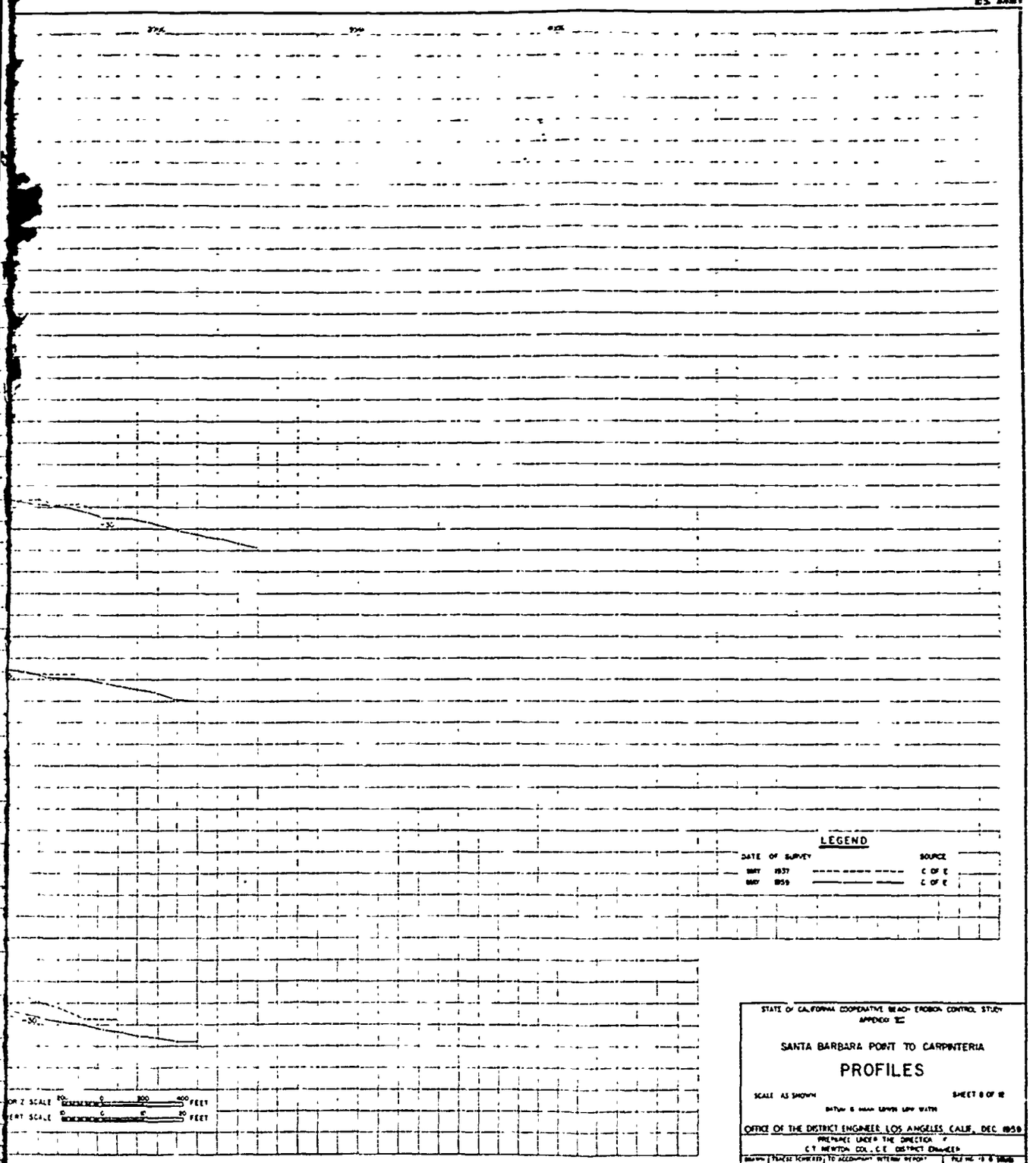
DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. C.O. SERIES
MC	MC	WER	DATED 5 APRIL 1960	3332

PLATE 13

CORPS OF ENGINEERS



U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX "C"

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 8 OF 12

DATUM IS MEAN LOWER LOW WATER

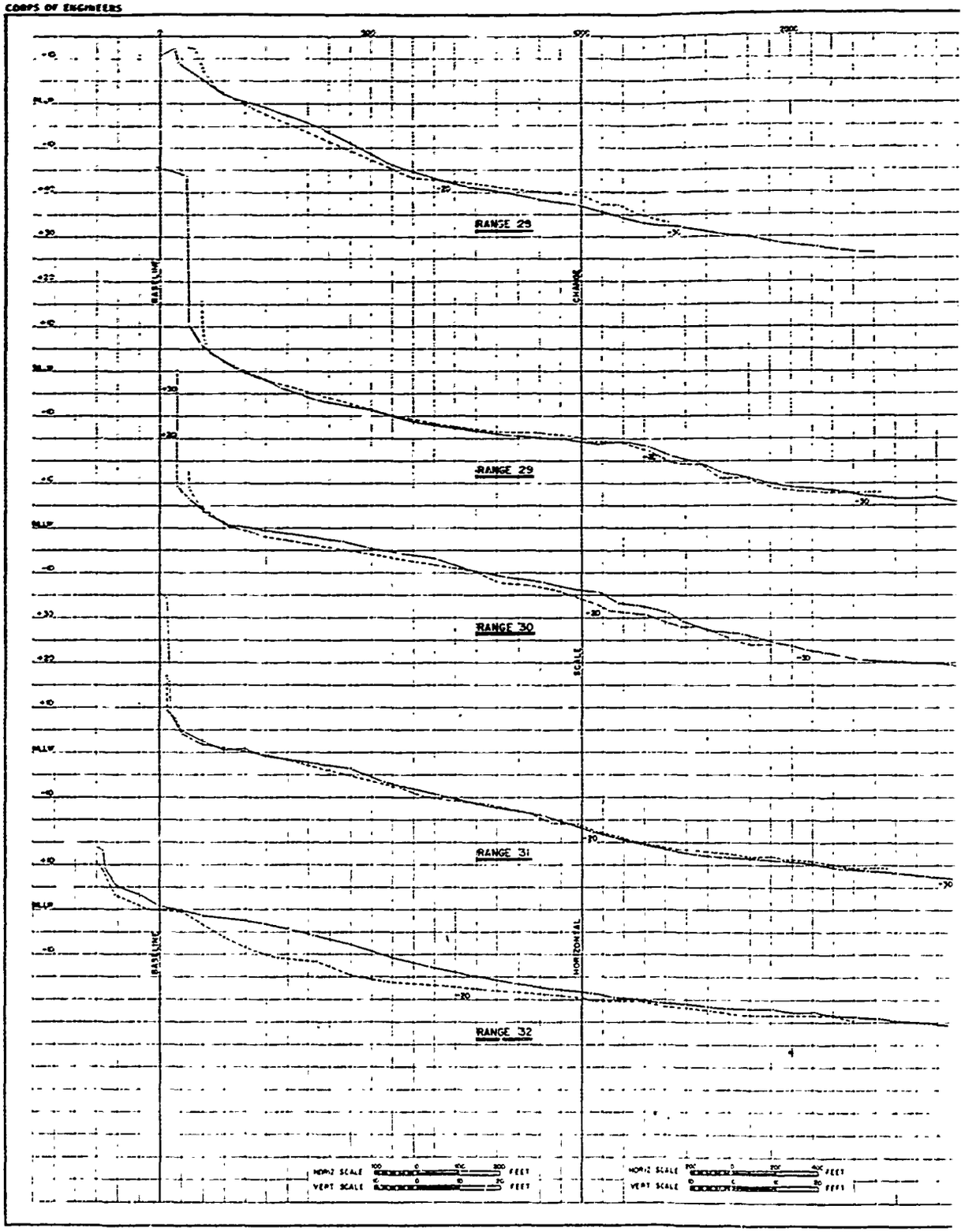
OFFICE OF THE DISTRICT ENGINEER LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON COL., C.E. DISTRICT ENGINEER

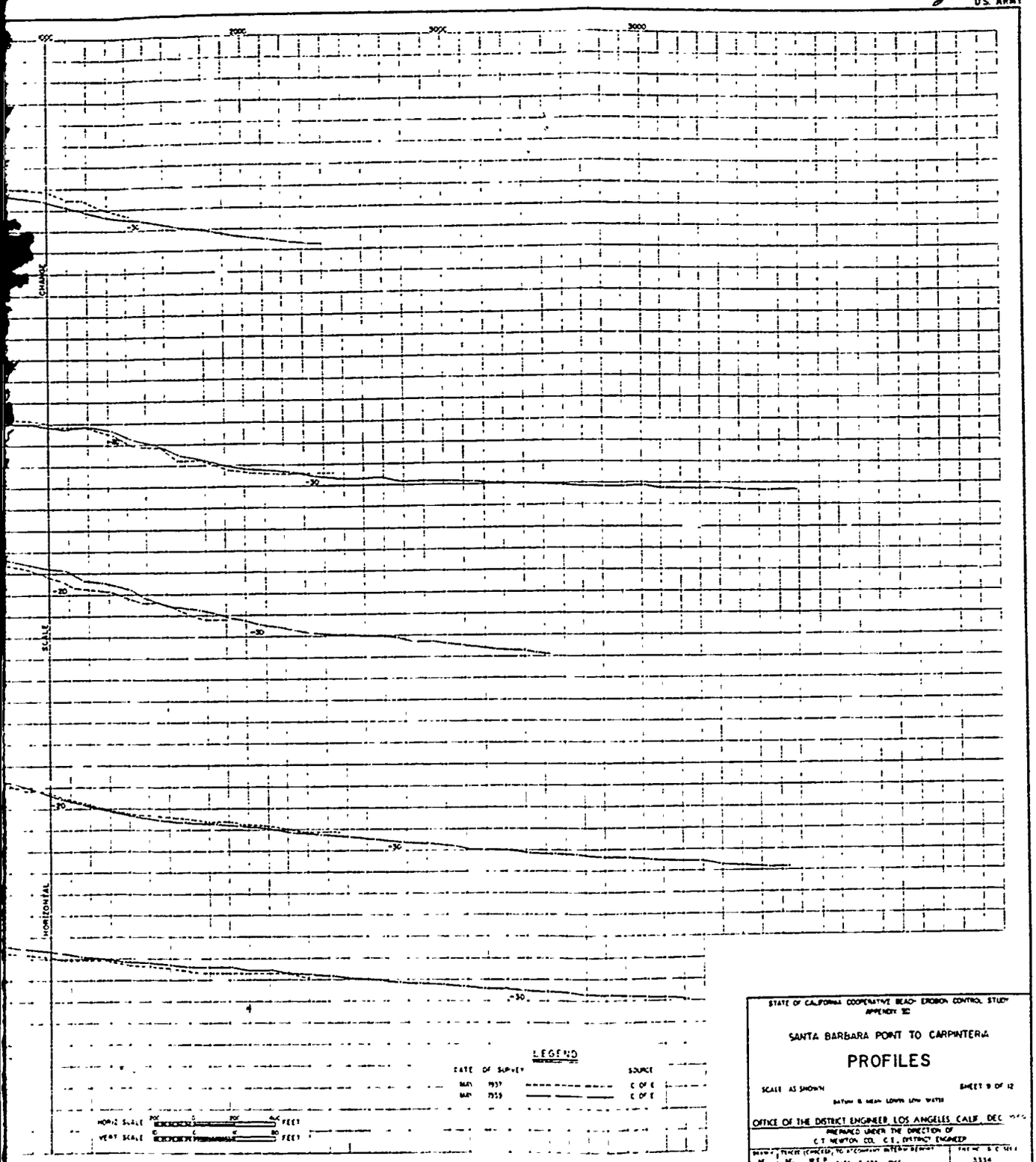
DRAWN BD	TRACED & CHECKED BY NC / WEB	TO ACCOMPANY INTERIM REPORT DATED 1 APRIL 1960	FILE NO. 3333

PLATE 14

CORPS OF ENGINEERS



U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 9 OF 12

DATUM IS MEAN LOWER LOW WATER

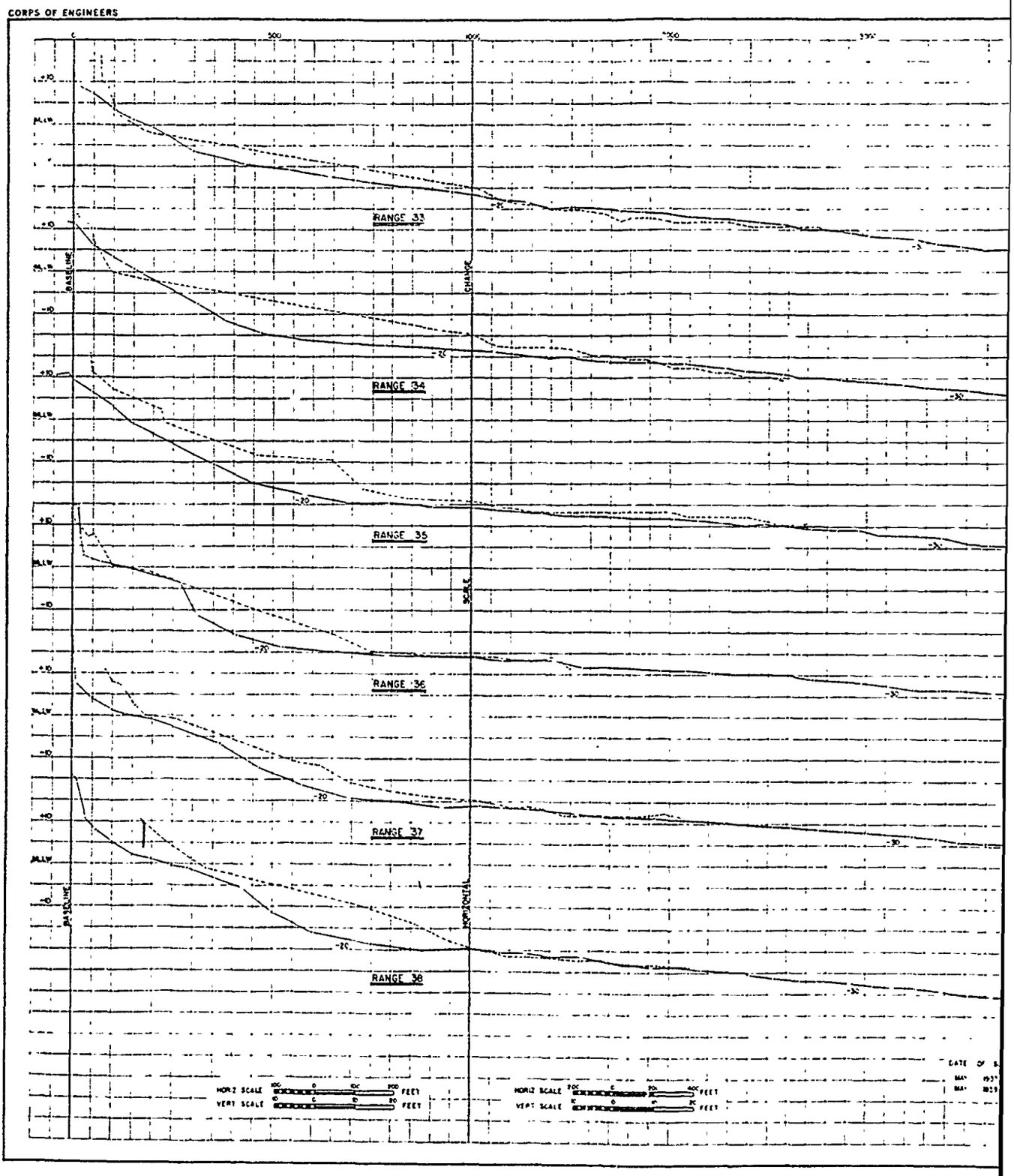
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON COL. C.E., DISTRICT ENGINEER

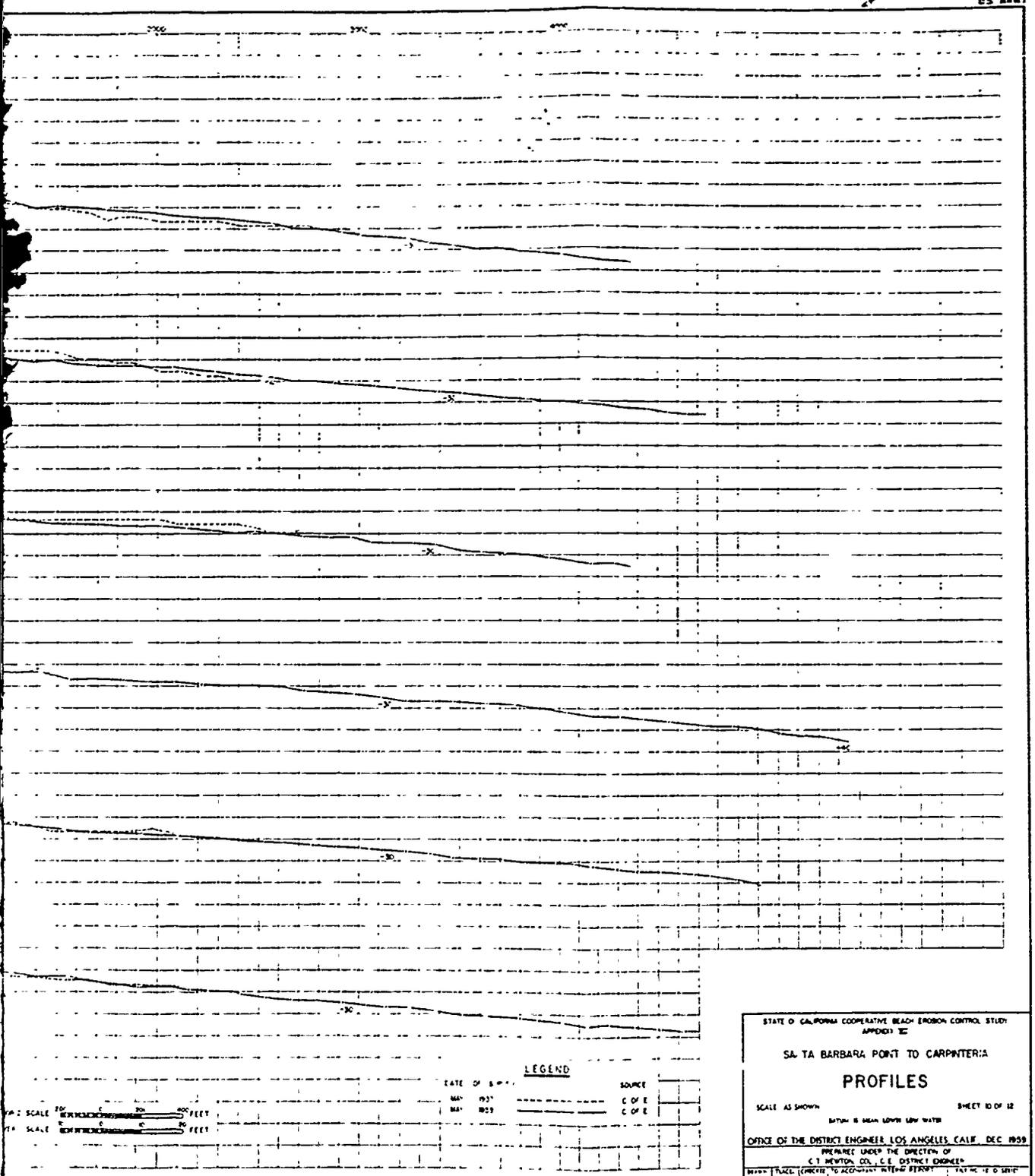
3334

PLATE 15

CORPS OF ENGINEERS



U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX IV

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 10 OF 12

DATUM IS MEAN LOWER LOW WATER

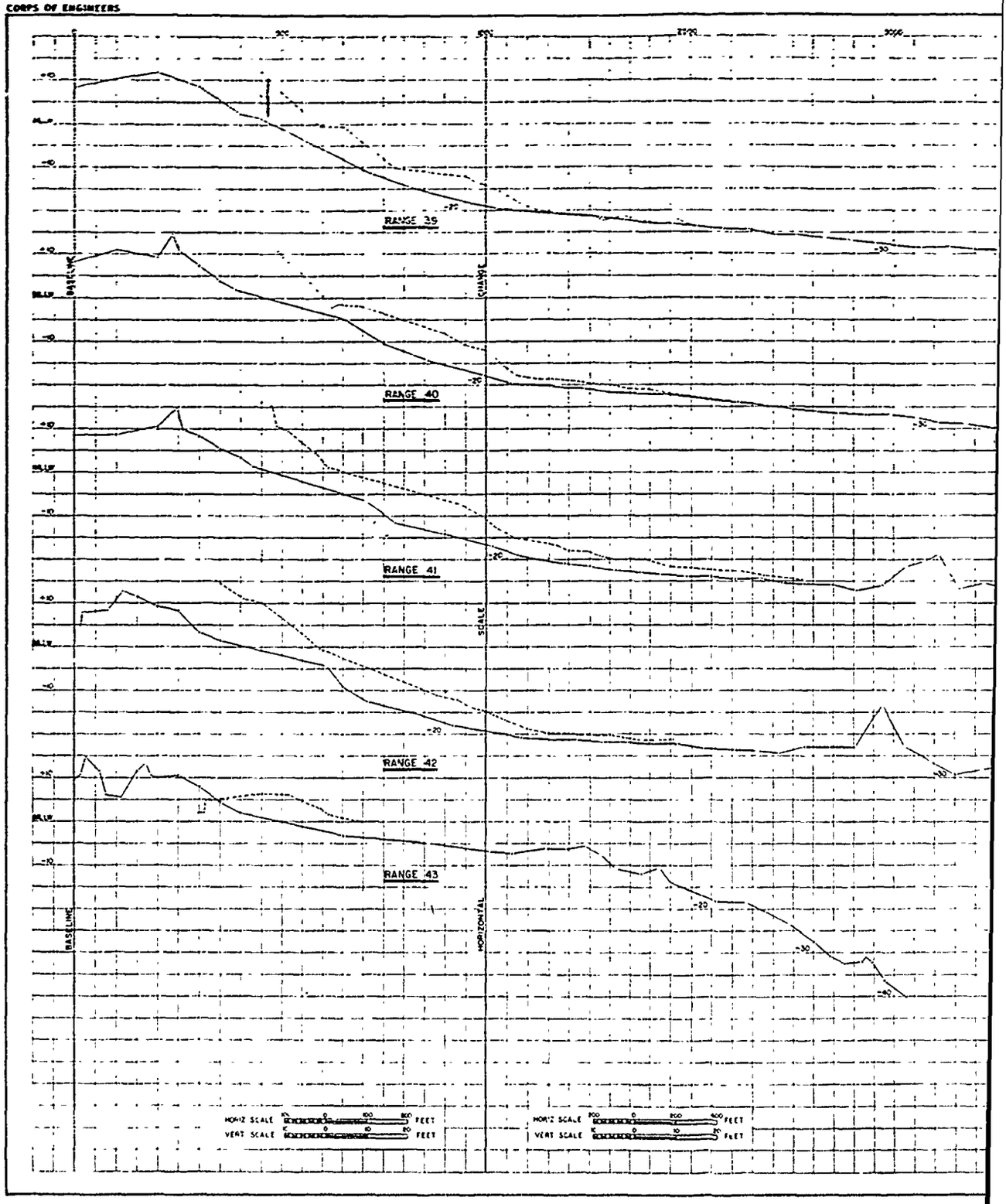
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL., C.E. DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. 12 D SERIES
MC	MC	WER	DATED 5 APRIL 1960	3335

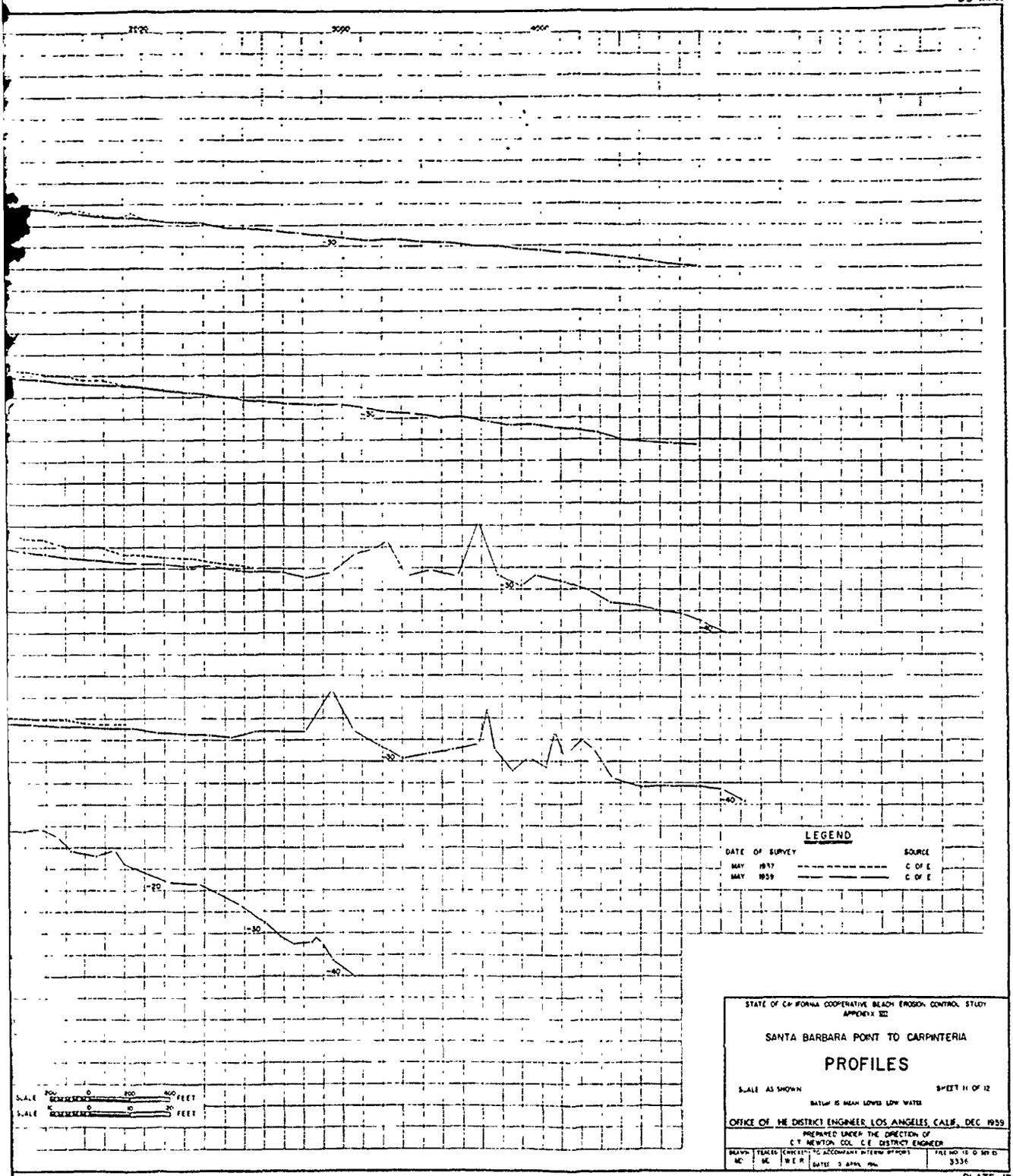
PLATE 16

CORPS OF ENGINEERS



2

US ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 11 OF 12

DATUM IS MEAN LOWER LOW WATER

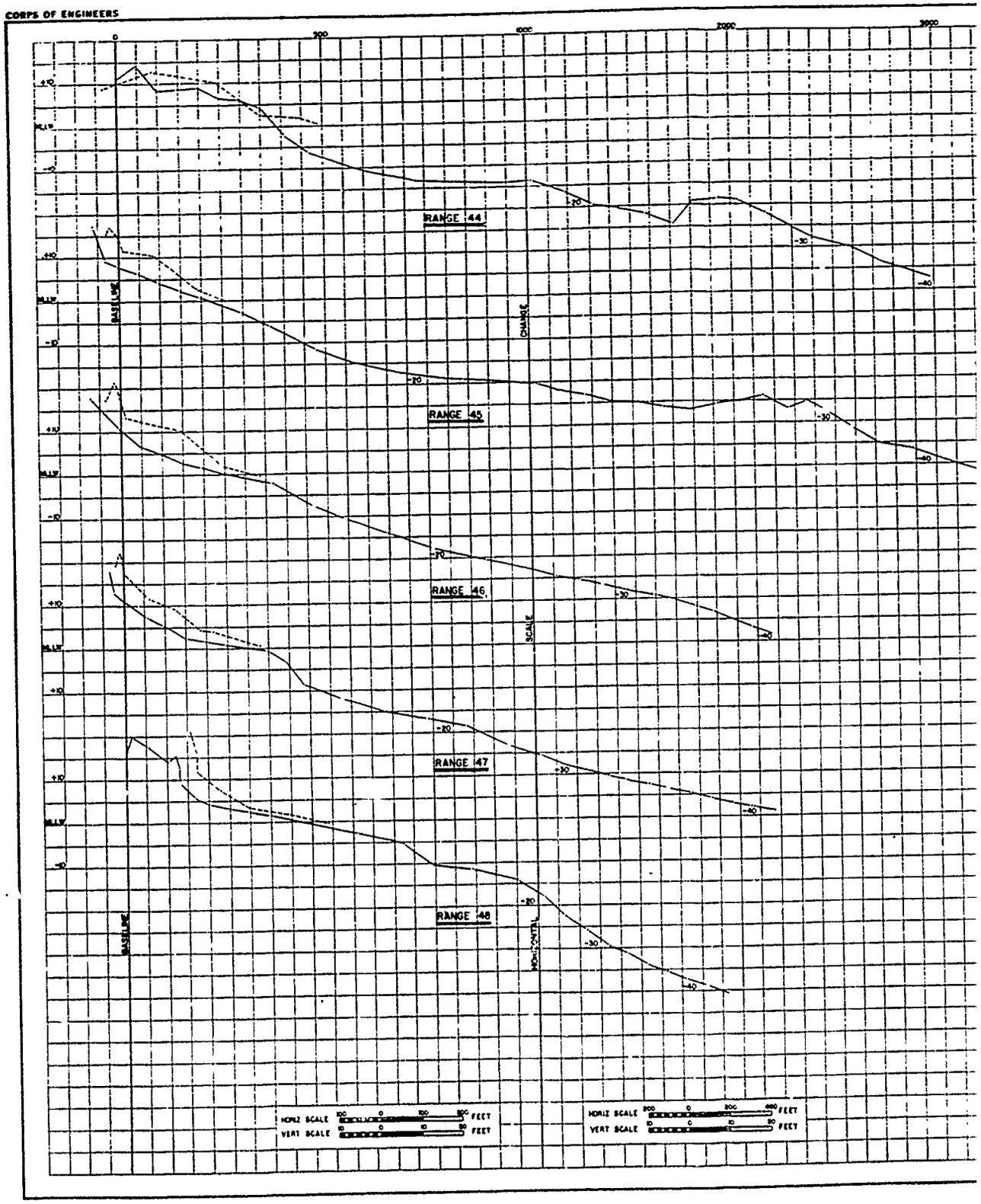
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., DEC 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL. C.E. DISTRICT ENGINEER

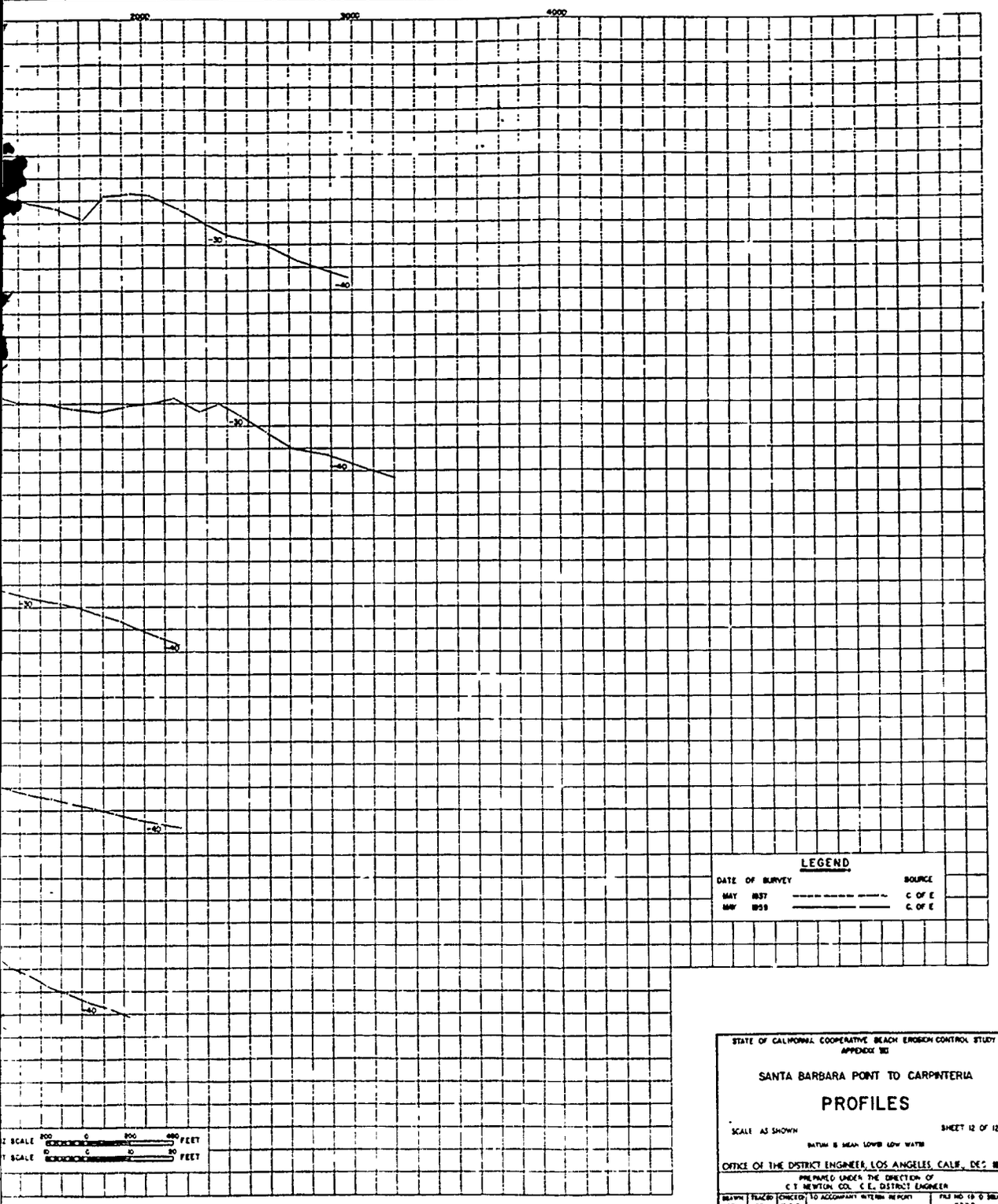
DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. 15 0 50 15
MC	MC	W.E.R.	DATED 2 APRIL 1964	3336

PLATE 17

CORPS OF ENGINEERS



U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

SANTA BARBARA POINT TO CARPINTERIA

PROFILES

SCALE AS SHOWN

SHEET 12 OF 12

DATUM IS MEAN LOWER LOW WATER

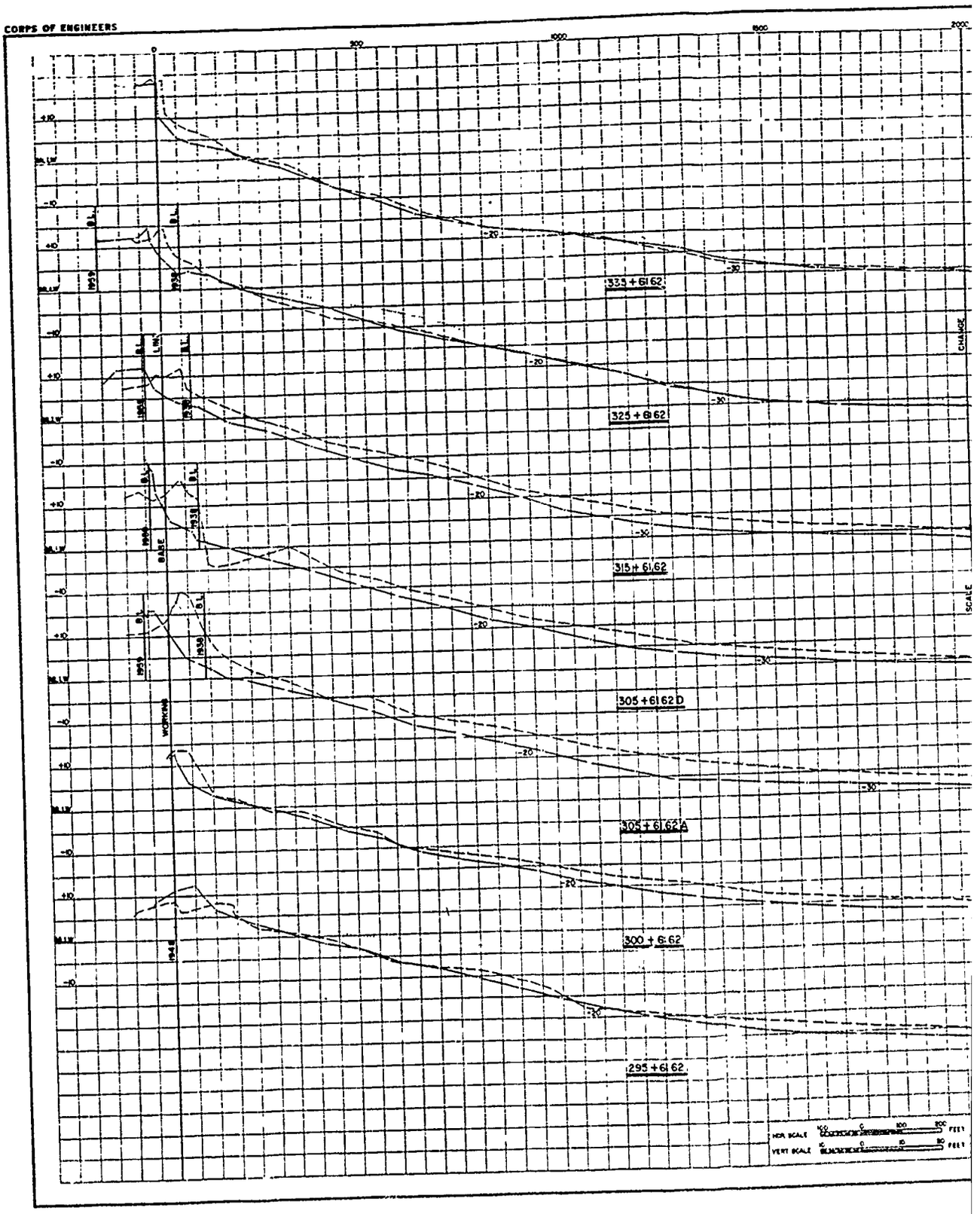
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., DEC. 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL. C.E., DISTRICT ENGINEER

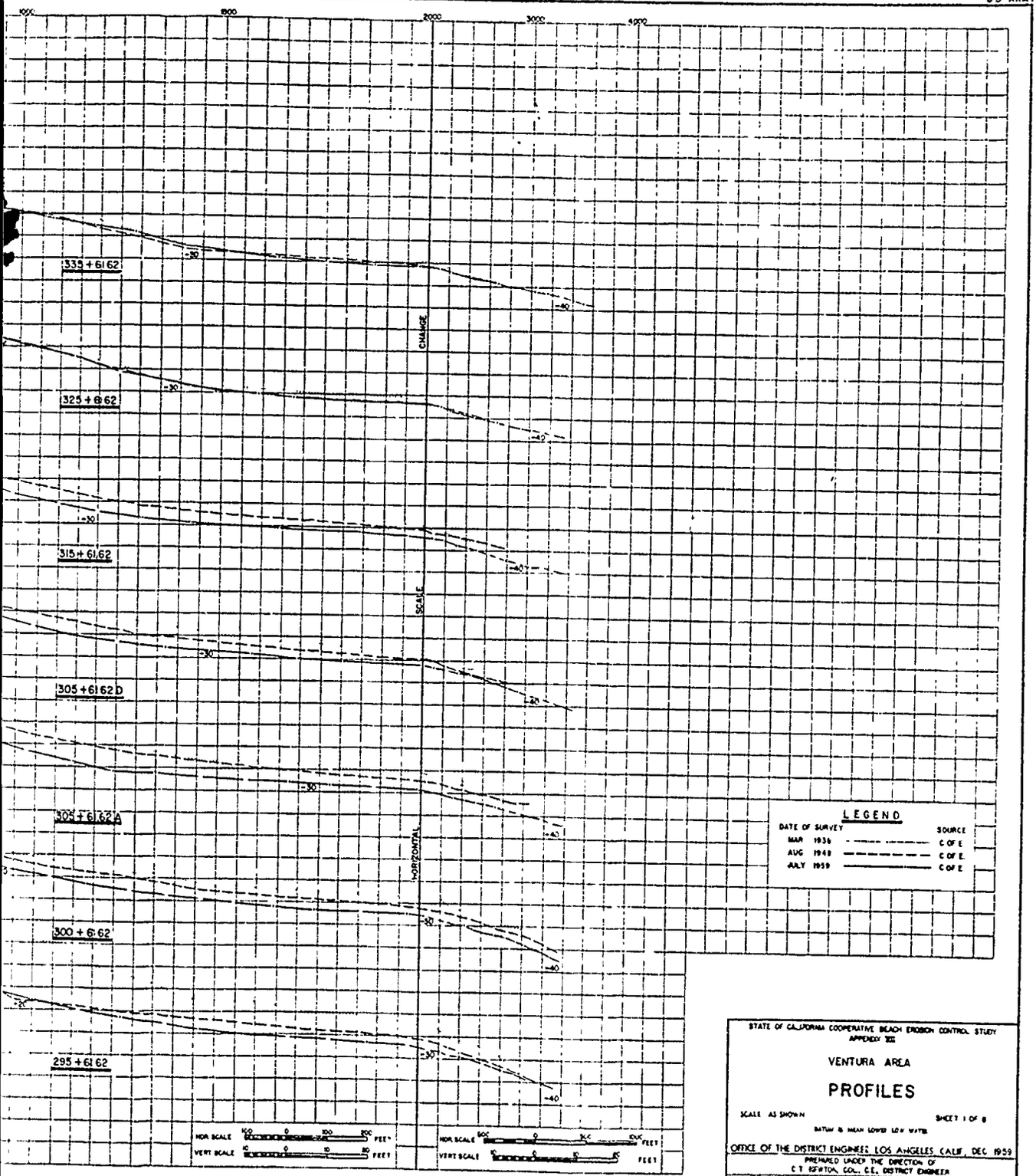
DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. 16-0-38465
BD	BD	W.E.P.	DATED 5 APR. 1960	3337

PLATE 18

CORPS OF ENGINEERS



US ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX XXI

VENTURA AREA

PROFILES

SCALE AS SHOWN

SHEET 1 OF 8

DATUM IS MEAN LOWER LOW WATER

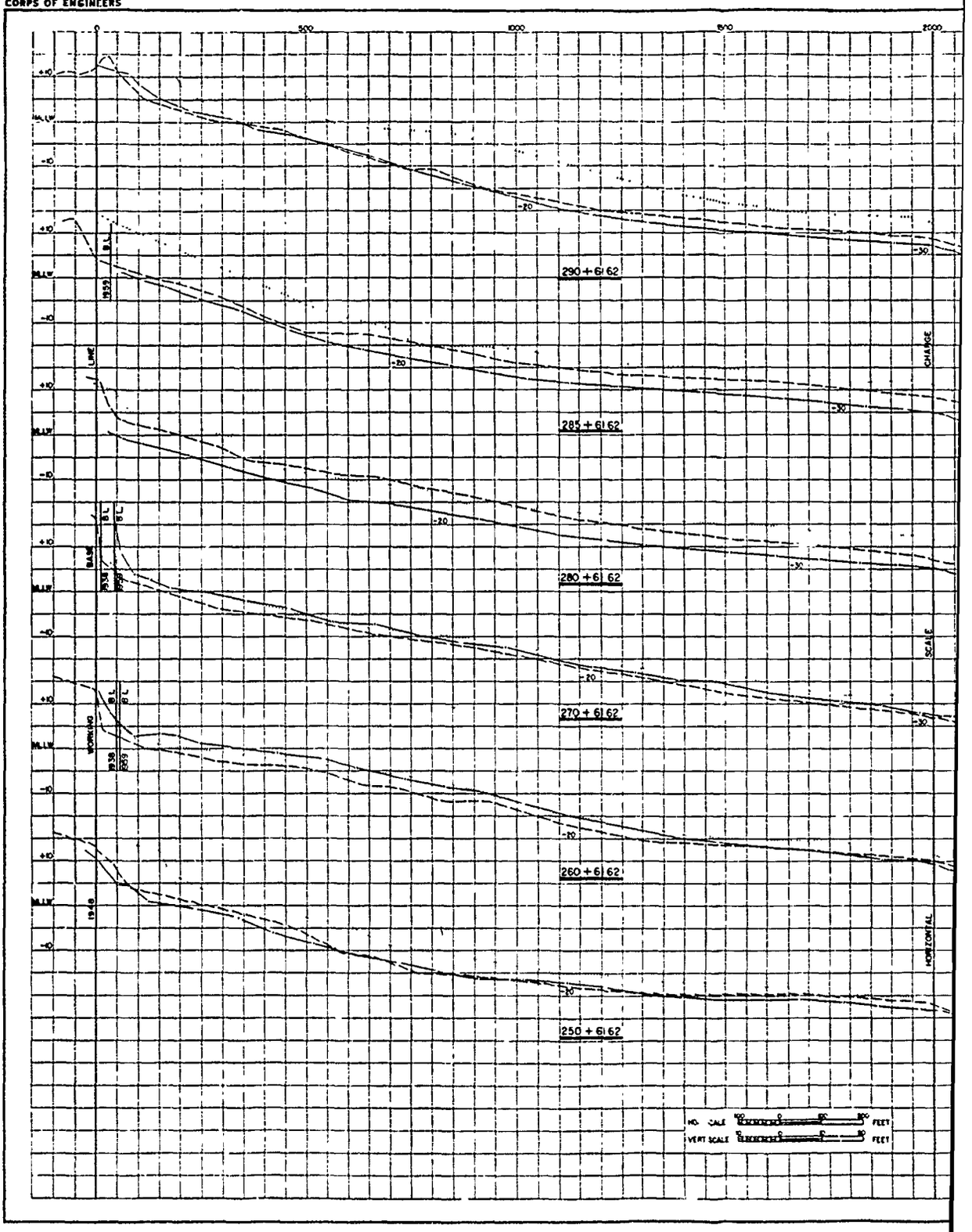
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C T BENTON, COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. 18 0 SERIES
MD	BD	WER	DATE 5 APR. 1960	3336

PLATE 19

CORPS OF ENGINEERS



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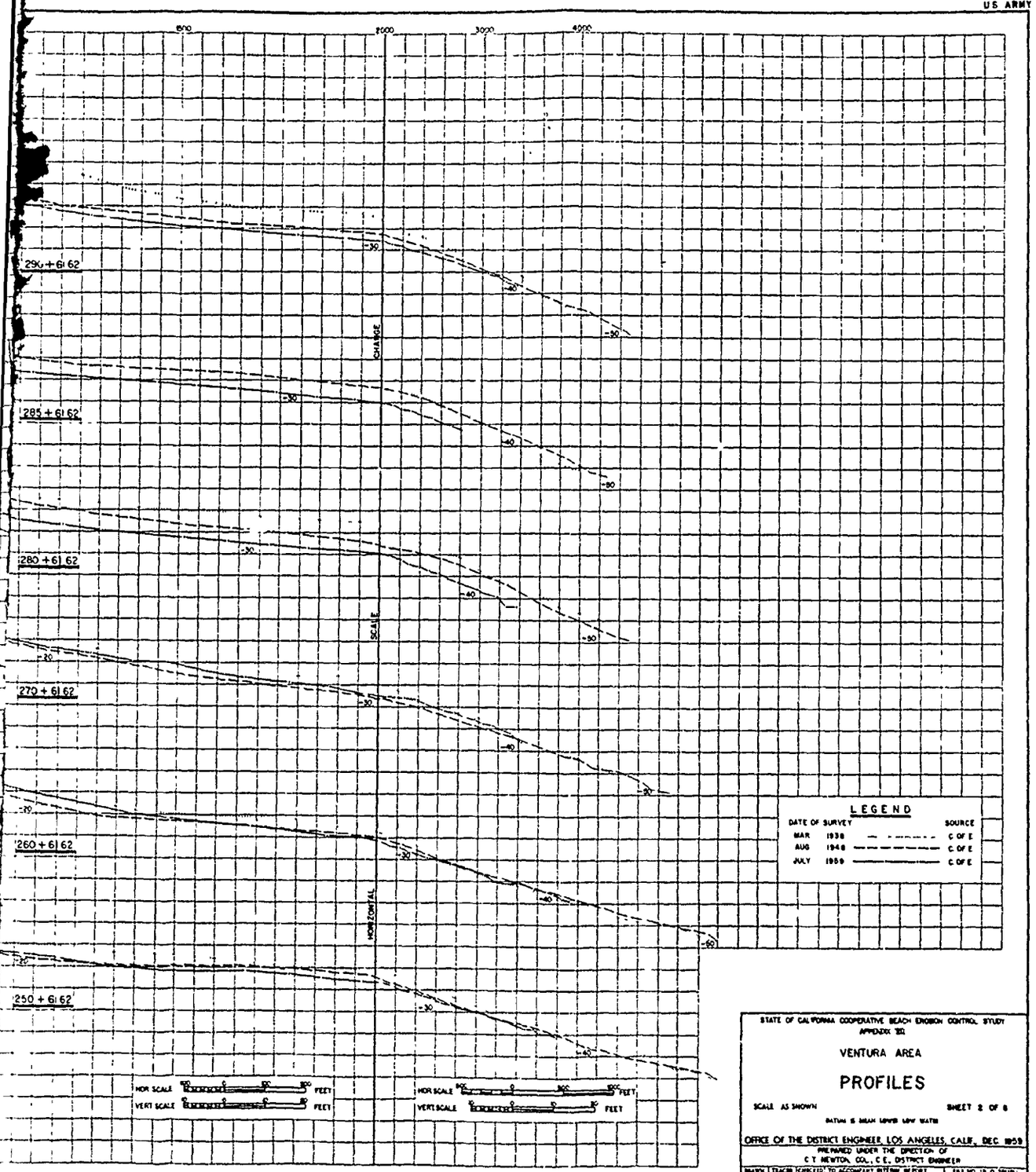
US ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

VENTURA AREA

PROFILES

SCALE AS SHOWN

SHEET 2 OF 6

DATUM IS MEAN LOWER LOW WATER

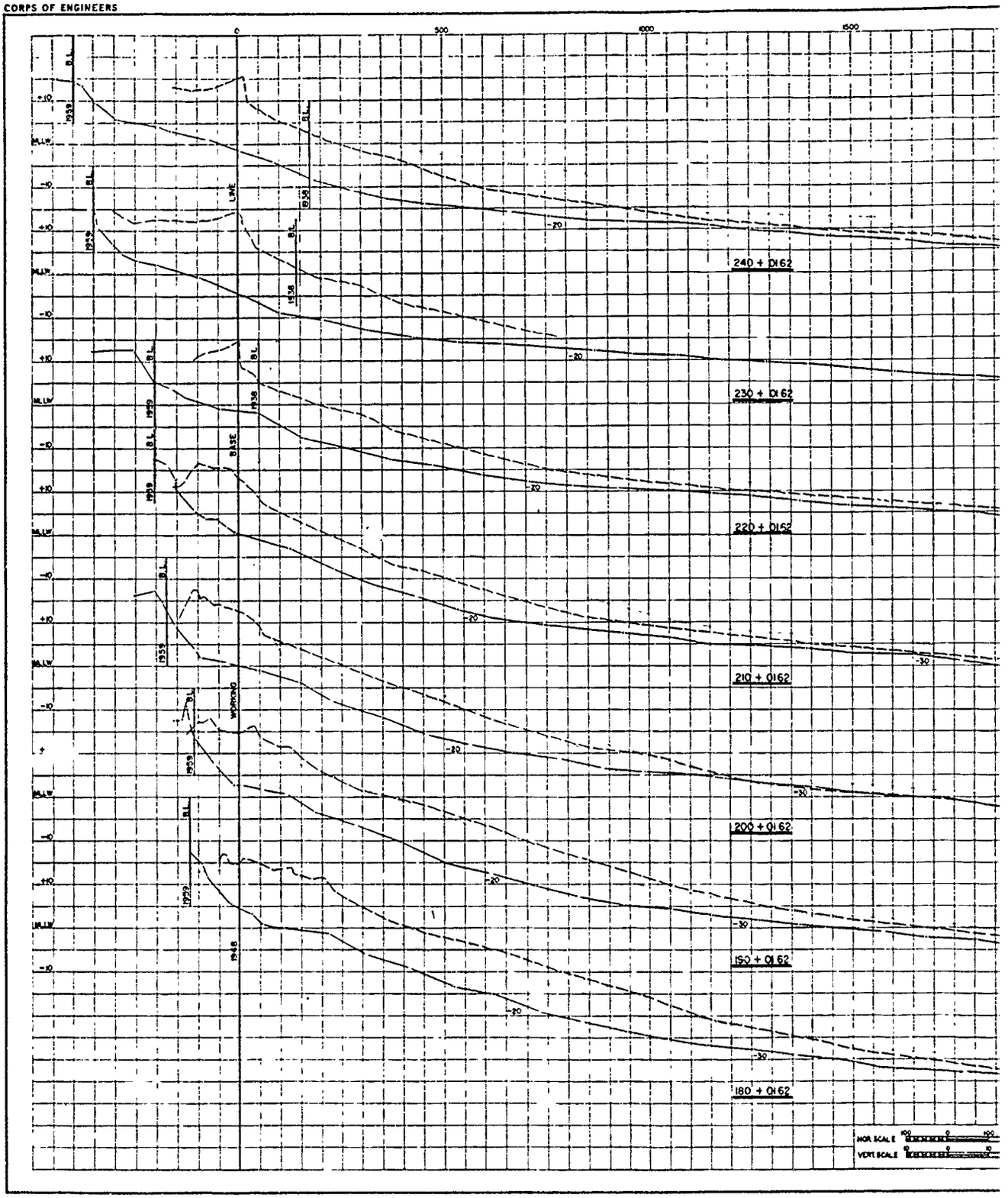
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., DEC 1959

PREPARED UNDER THE DIRECTION OF
C T NEWTON, COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO.
ID	MD	WER	DATED 5 APRIL 1960	3339

PLATE 20

CORPS OF ENGINEERS



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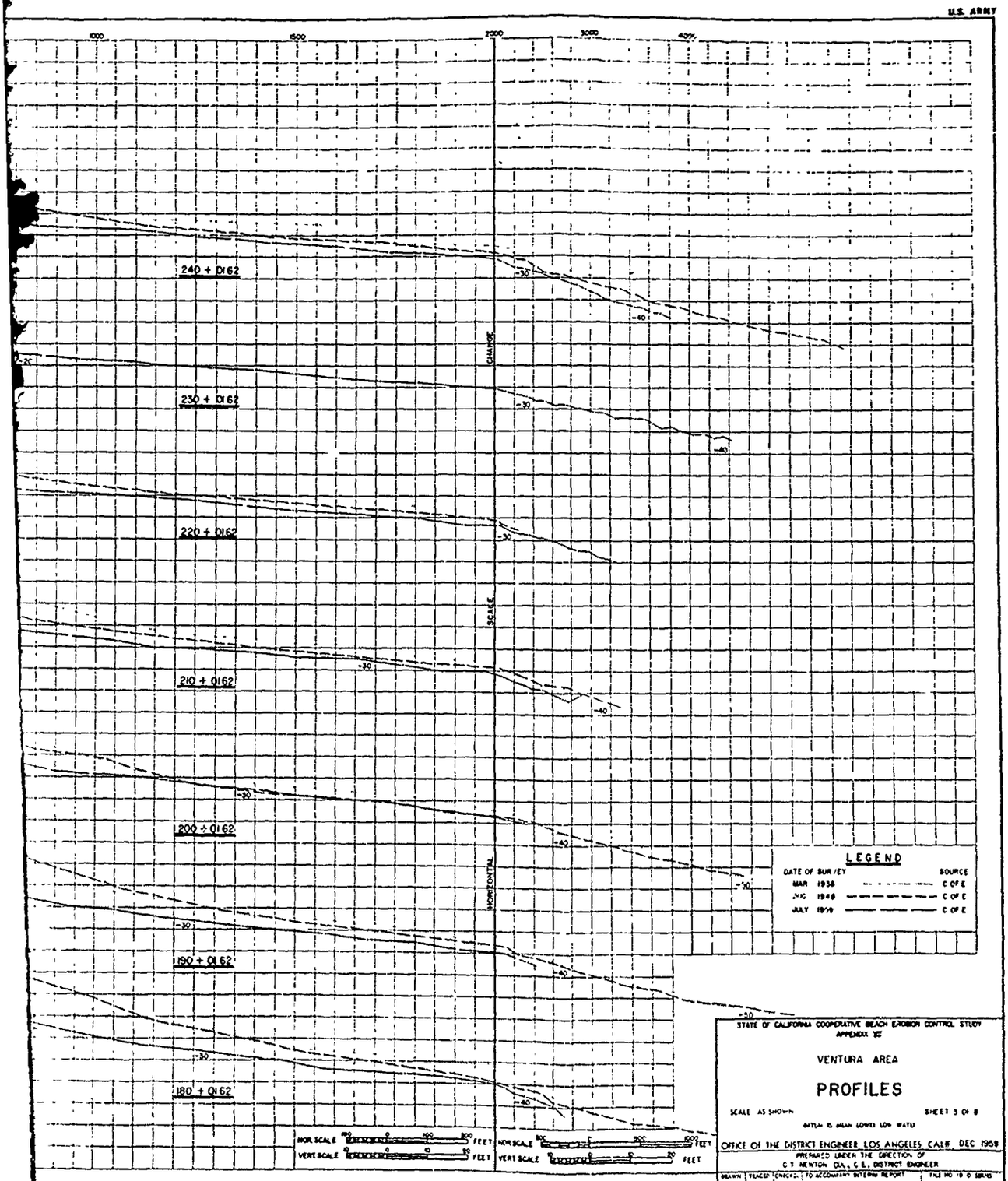
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX "E"

VENTURA AREA

PROFILES

SCALE AS SHOWN

SHEET 3 OF 8

DATUM IS MEAN LOWER LOW WATER

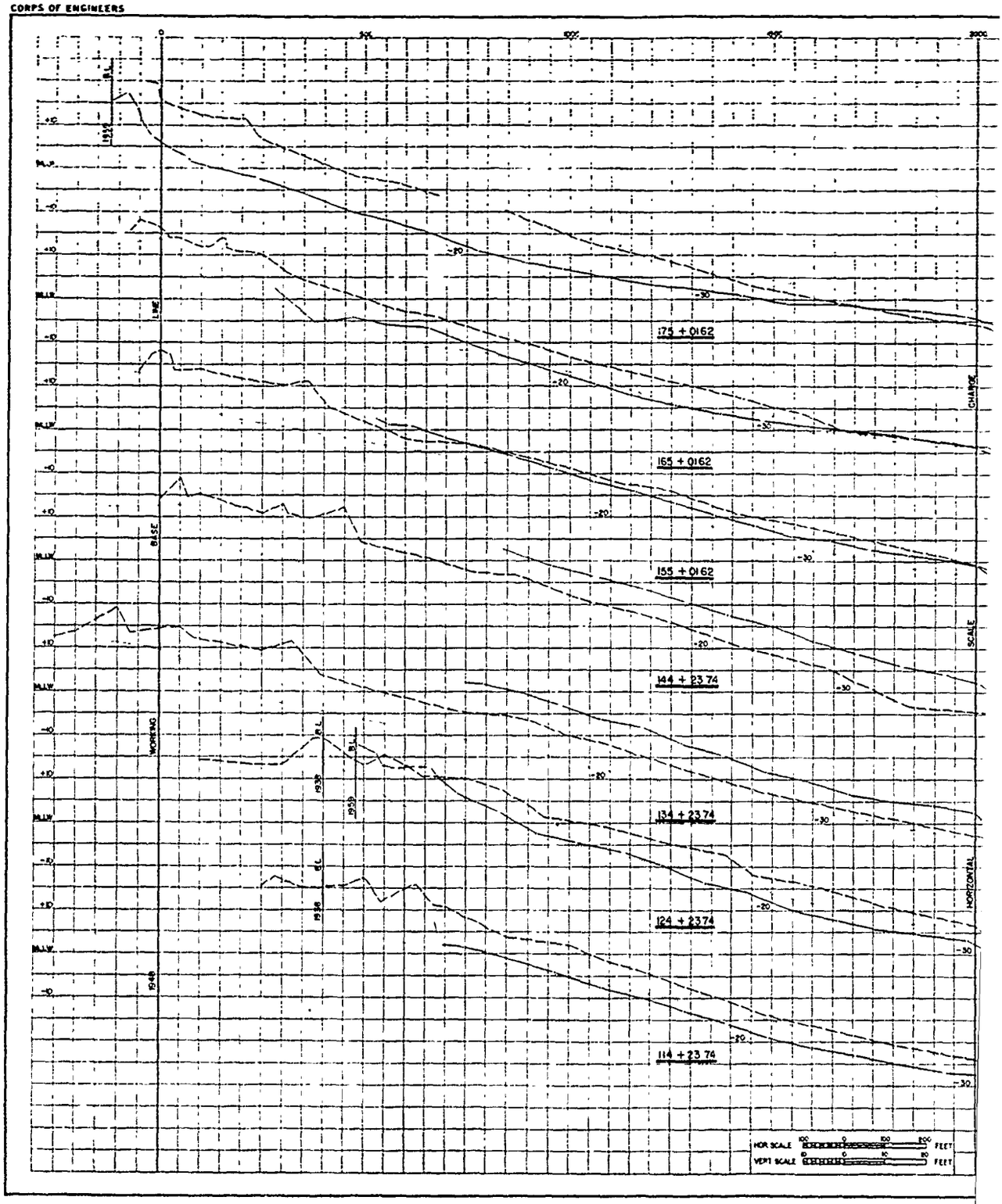
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO.
MD	MD	WEH	DATED 9 APRIL 1960	3340

PLATE 21

CORPS OF ENGINEERS



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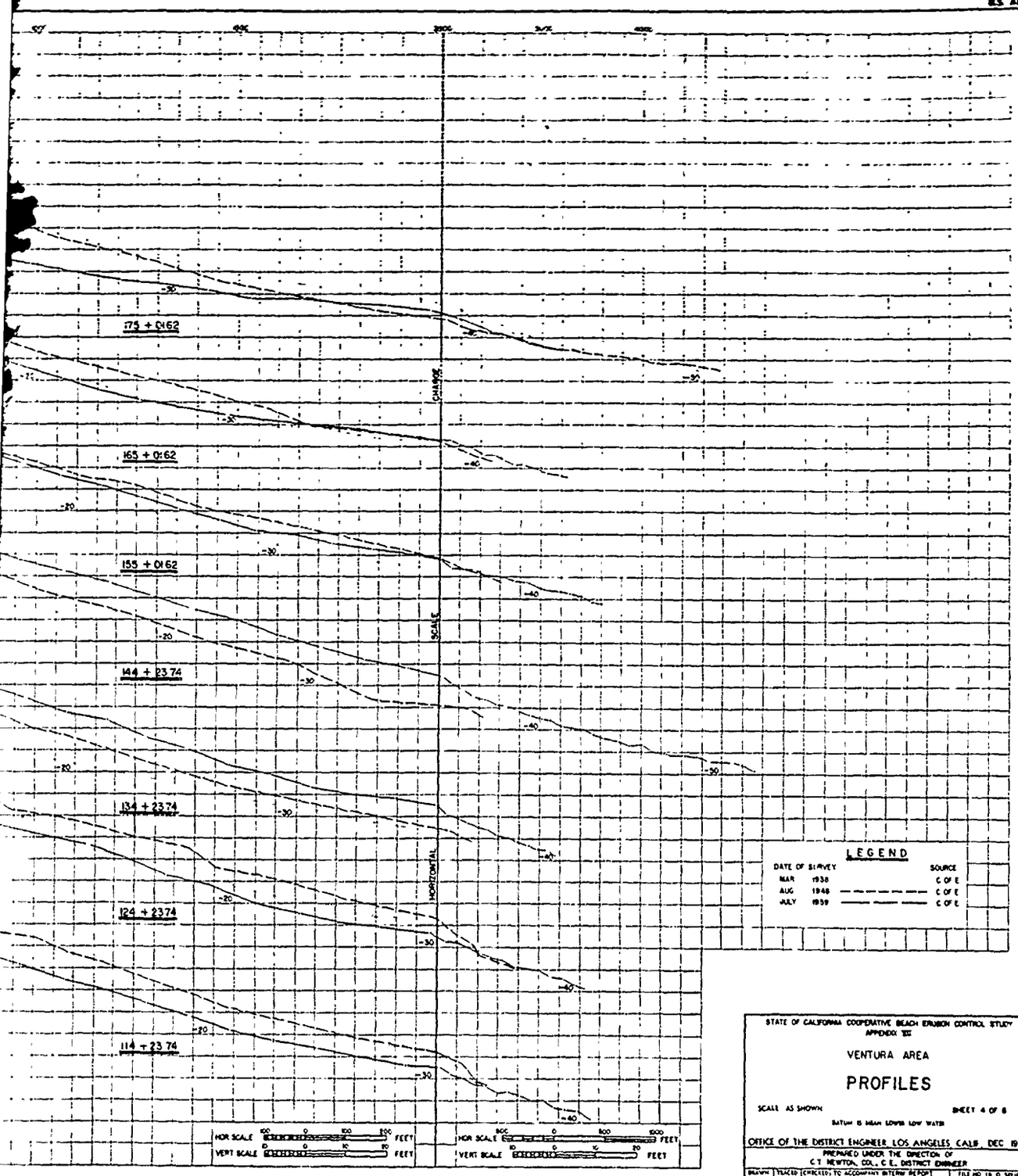
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

VENTURA AREA

PROFILES

SCALE AS SHOWN

SHEET 4 OF 8

DATUM IS MEAN LOWER LOW WATER

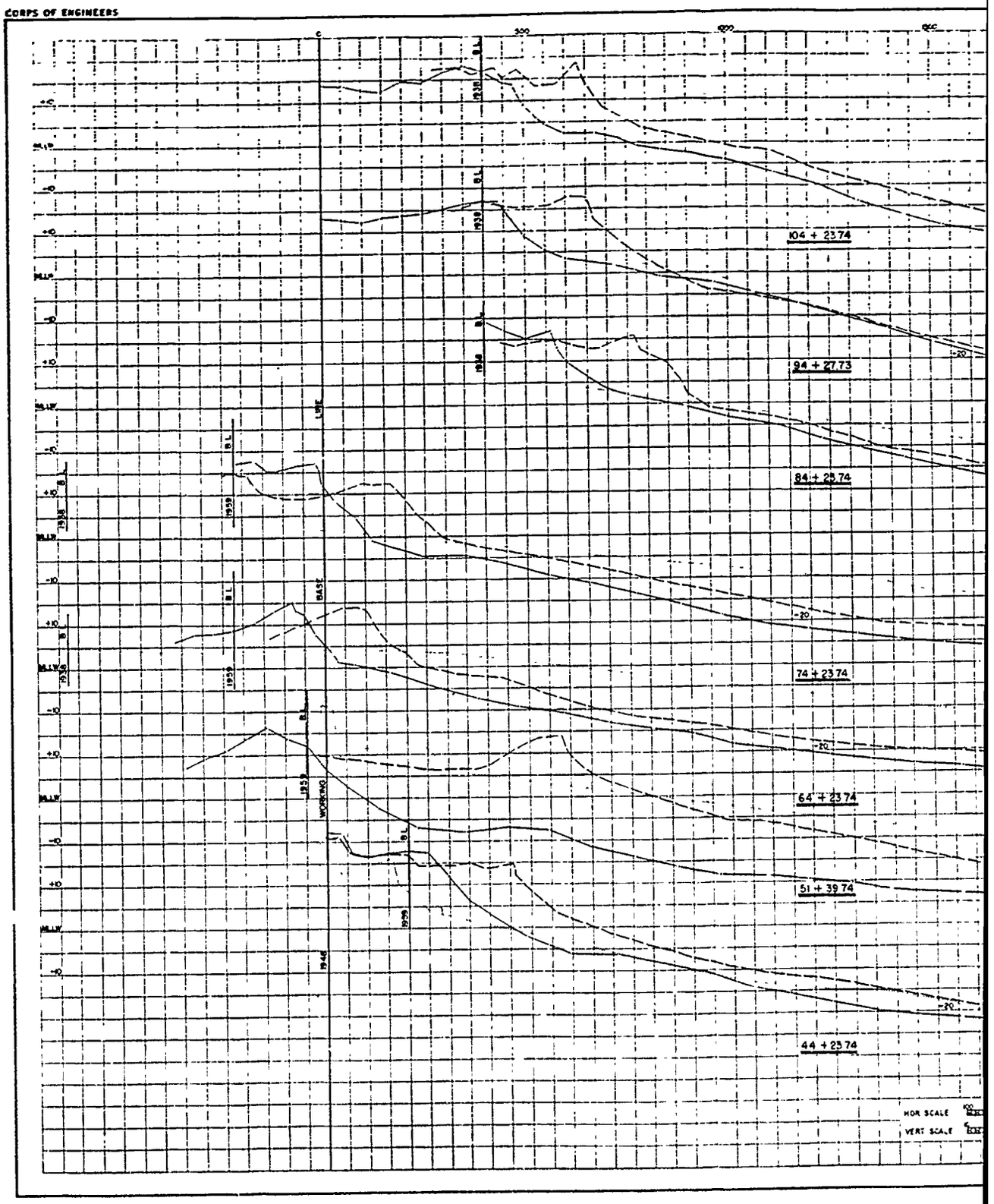
OFFICE OF THE DISTRICT ENGINEER LOS ANGELES CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C.T. NEWTON, COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. 19 0 SERIES
MD	MD	W.E.R.	DATED 5 APRIL 1960	334.

PLATE 22

CORPS OF ENGINEERS



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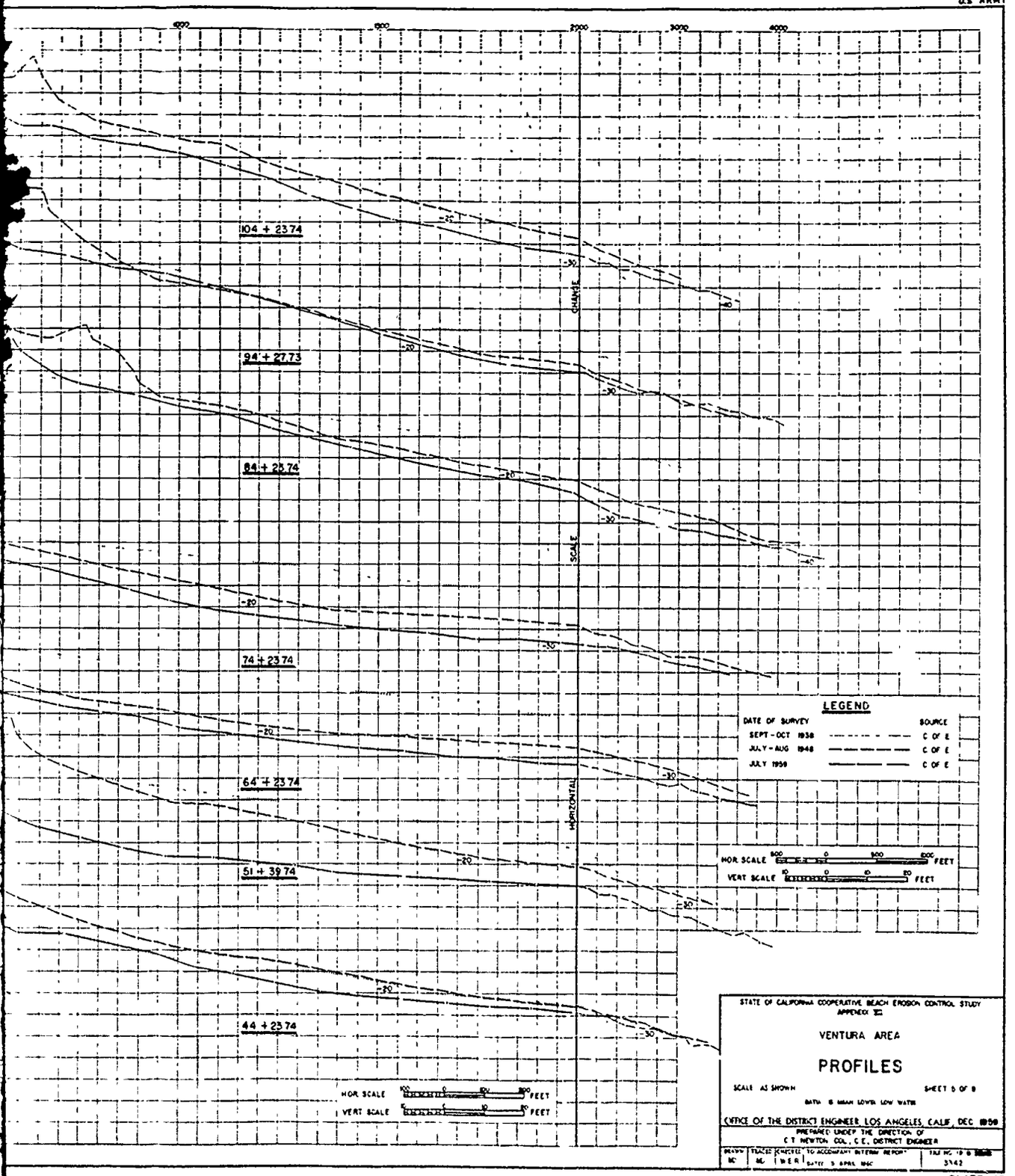
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX

VENTURA AREA

PROFILES

SCALE AS SHOWN

SHEET 5 OF 8

DATA IS MEAN LOWER LOW WATER

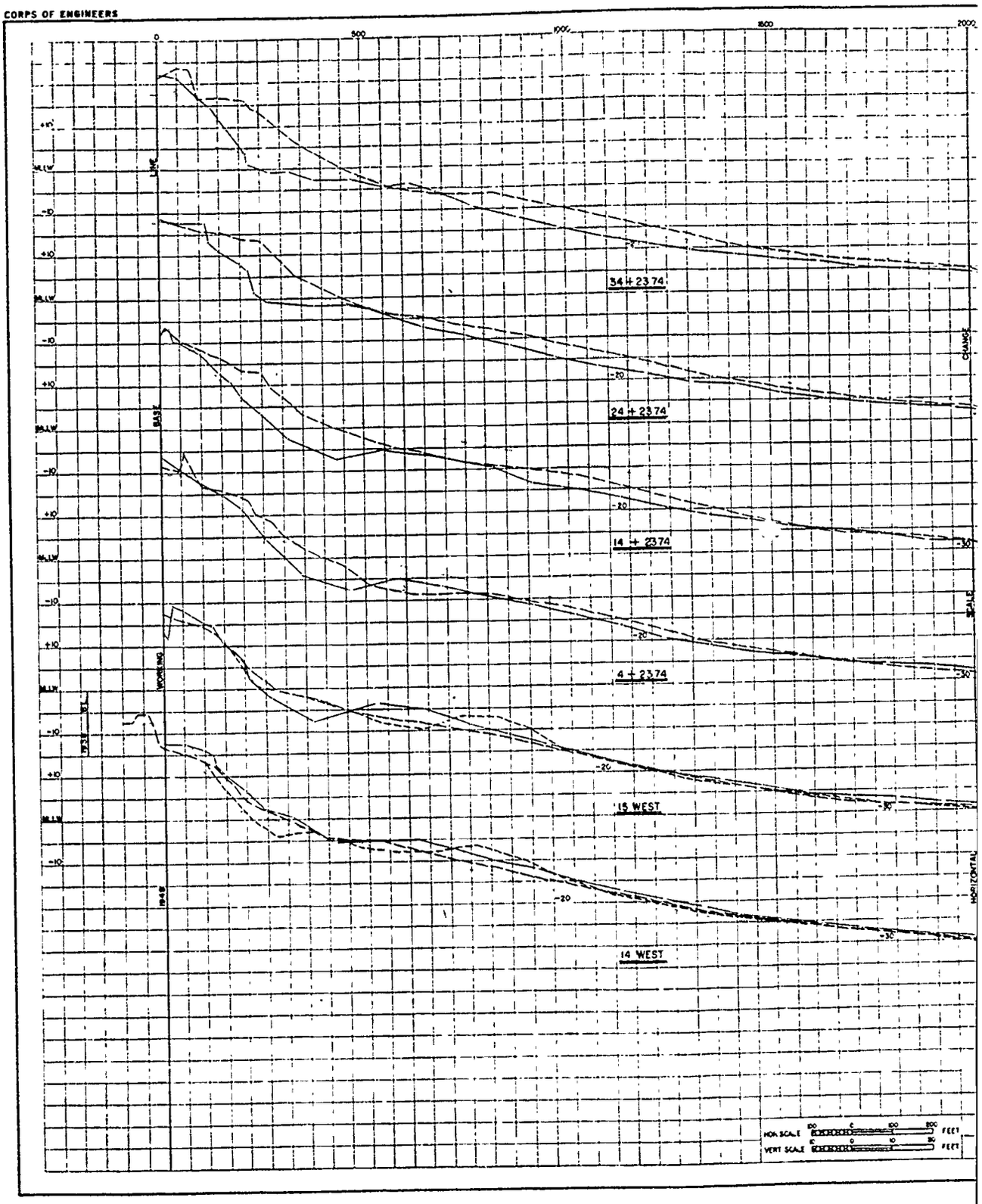
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL., C.E., DISTRICT ENGINEER

DRAWN BY	TRACED BY	CHECKED BY	TO ACCOMPANY INTERIM REPORT	FILE NO.
			DATED 5 APRIL 1960	3142

PLATE 23

CORPS OF ENGINEERS



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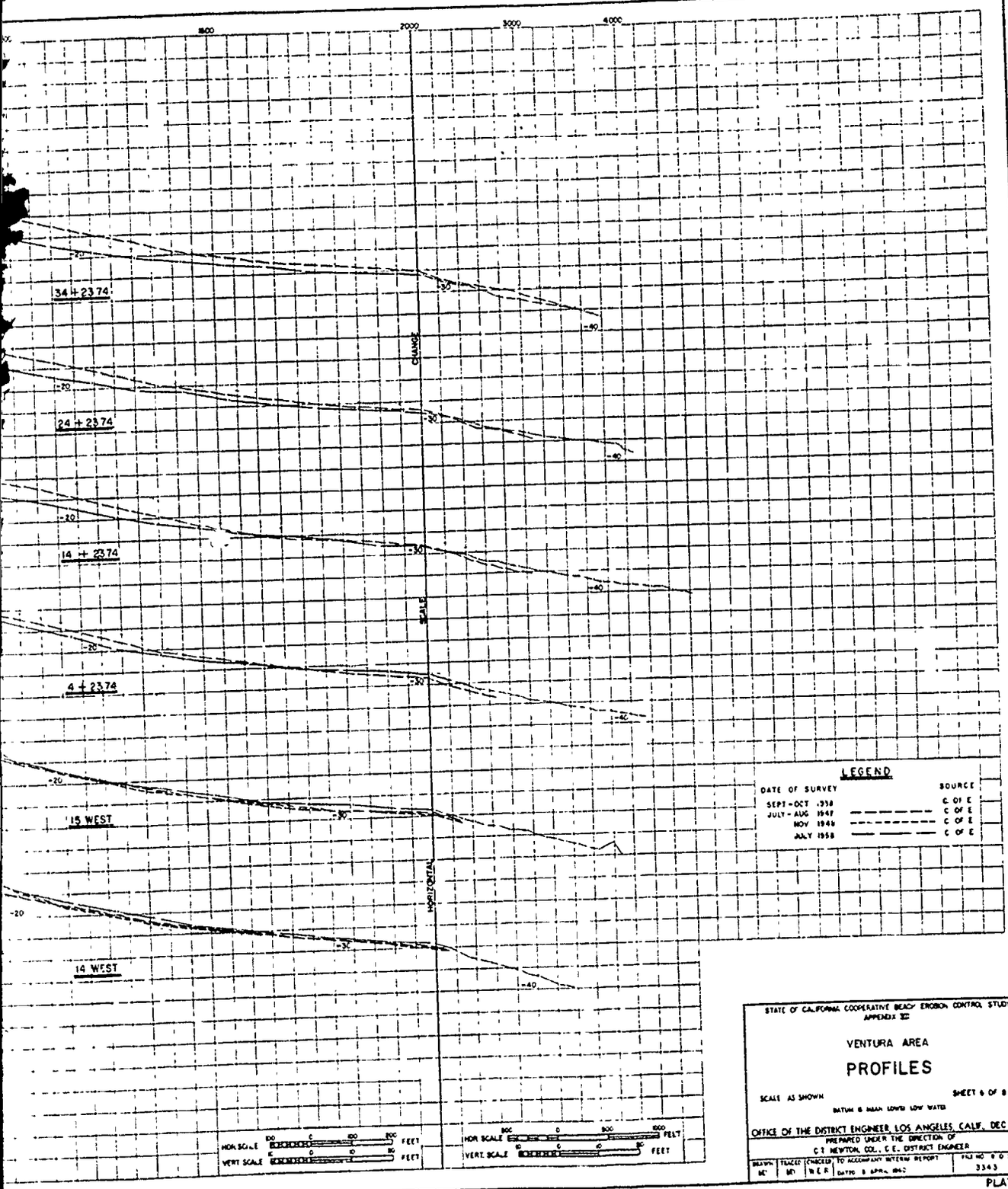
US ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX XII

VENTURA AREA

PROFILES

SCALE AS SHOWN

SHEET 6 OF 8

DATUM IS MEAN LOWER LOW WATER

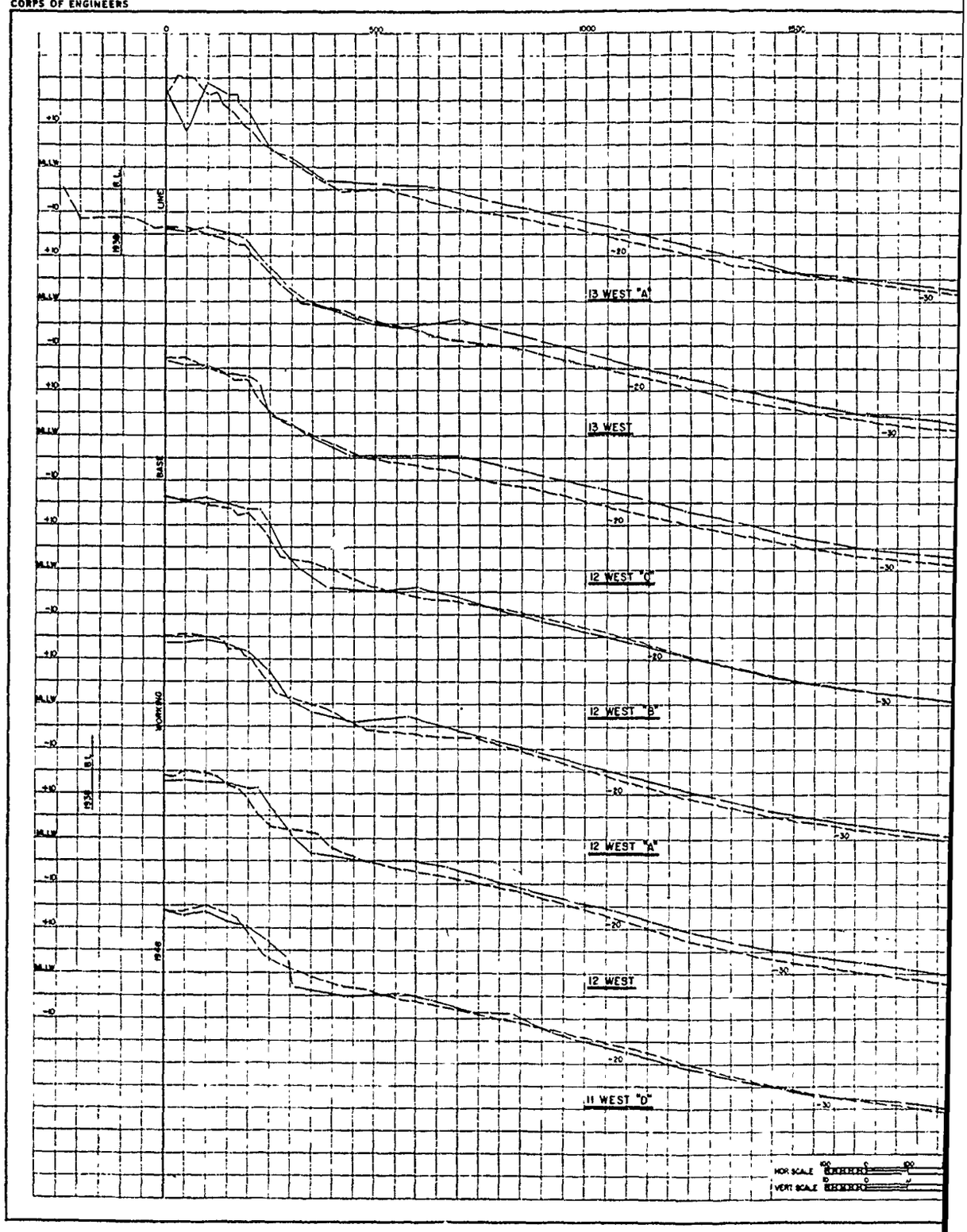
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL., C.E. DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO.
BC	MT	W E R	DATED 8 APRIL 1960	3343

PLATE 24

CORPS OF ENGINEERS



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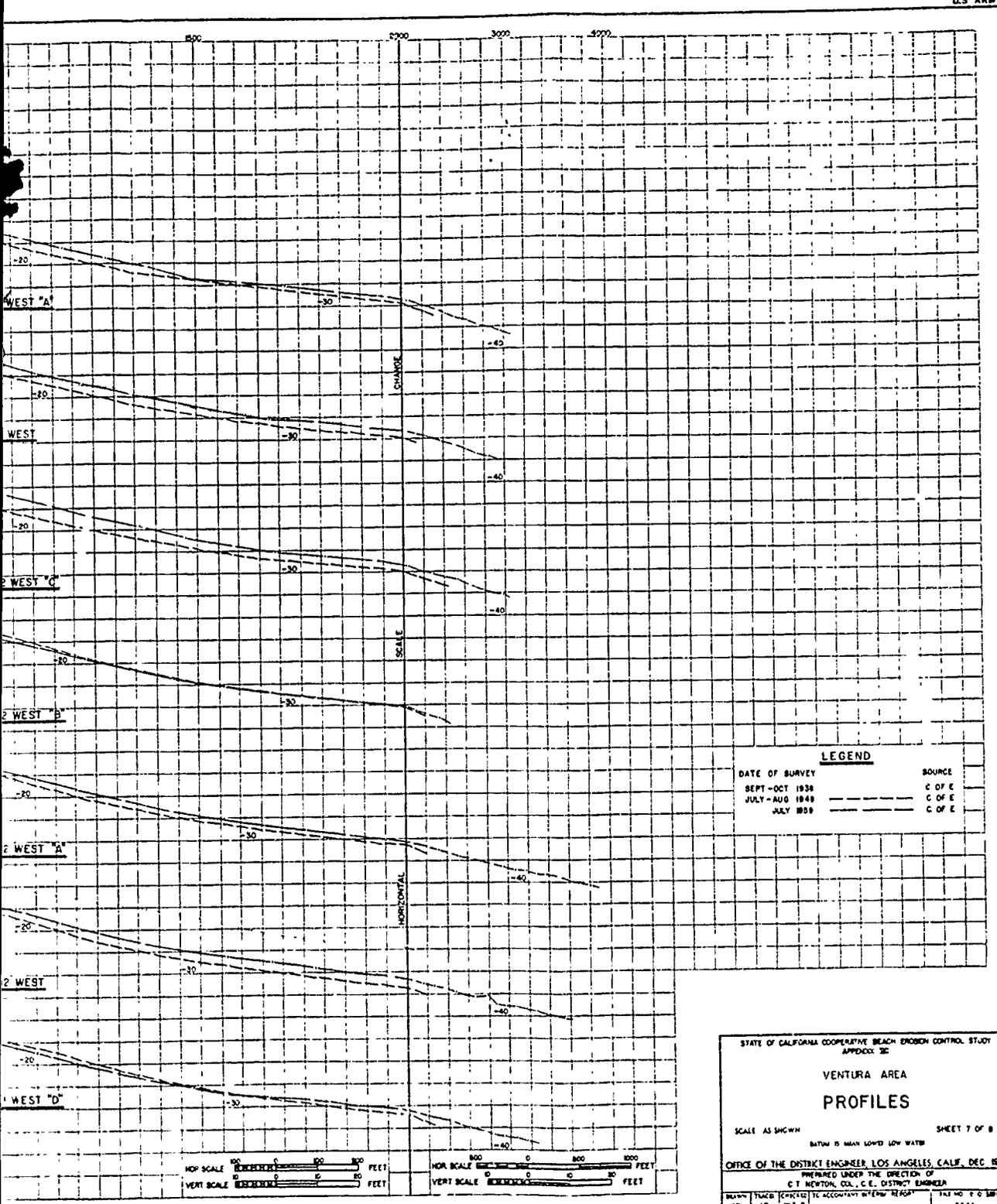
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX 2C

VENTURA AREA

PROFILES

SCALE AS SHOWN

SHEET 7 OF 8

DATUM IS MEAN LOWER LOW WATER

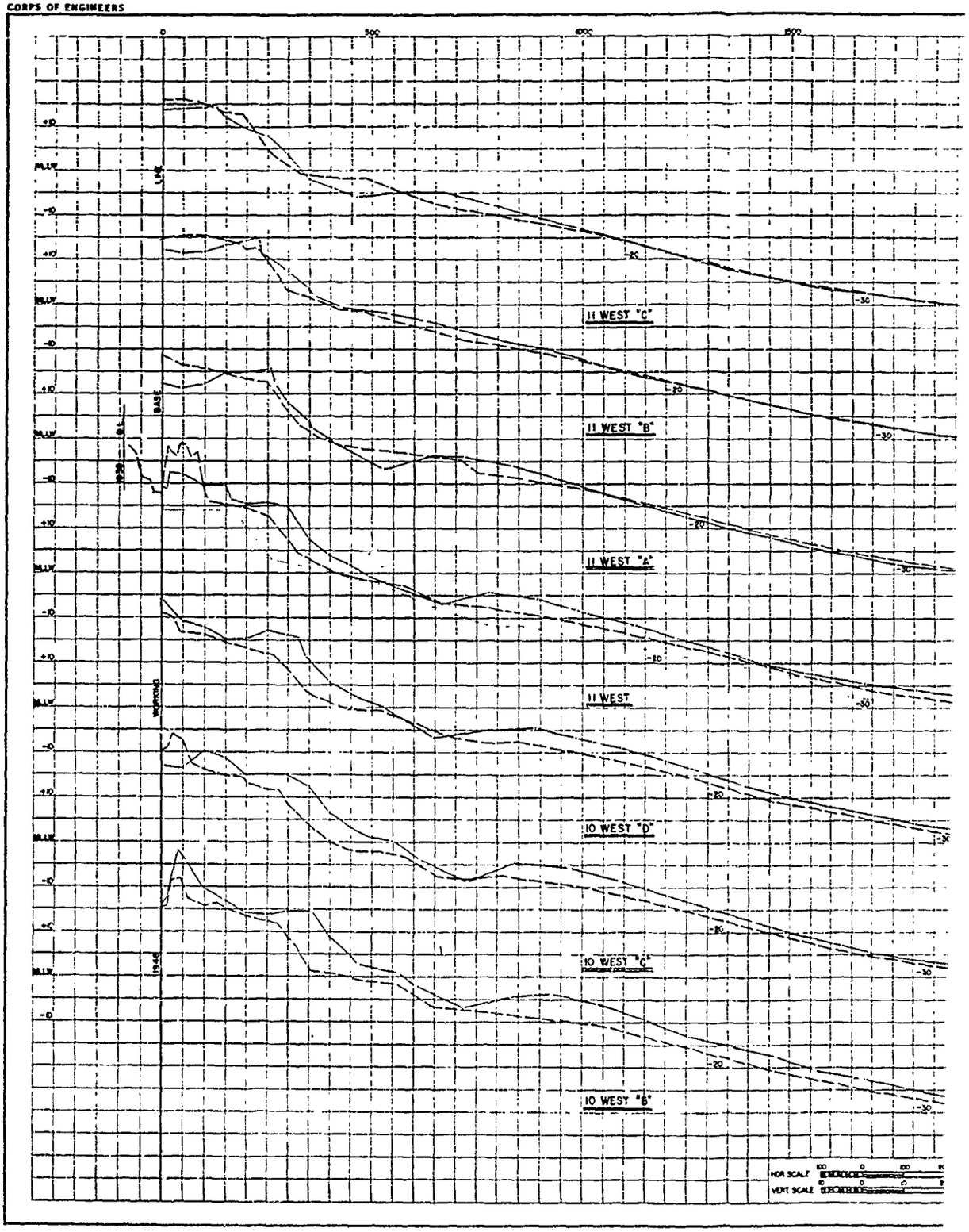
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C. T. NEWTON, COL., C.E., DISTRICT ENGINEER

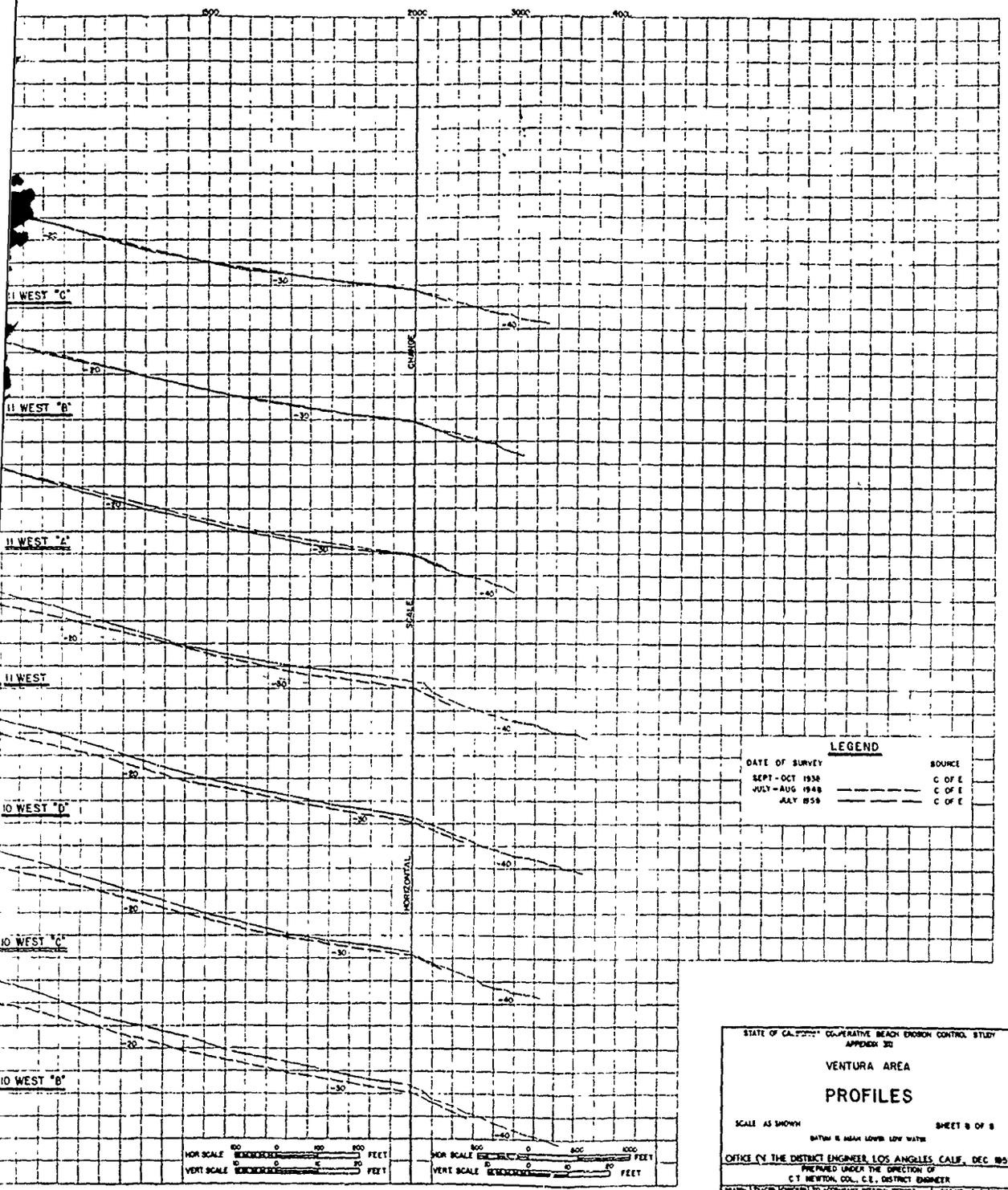
DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO.
MD	MC	W.E.R.	DATED 8 APRIL 1960	3344

PLATE 25

CORPS OF ENGINEERS



U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

VENTURA AREA

PROFILES

SCALE AS SHOWN

SHEET 8 OF 8

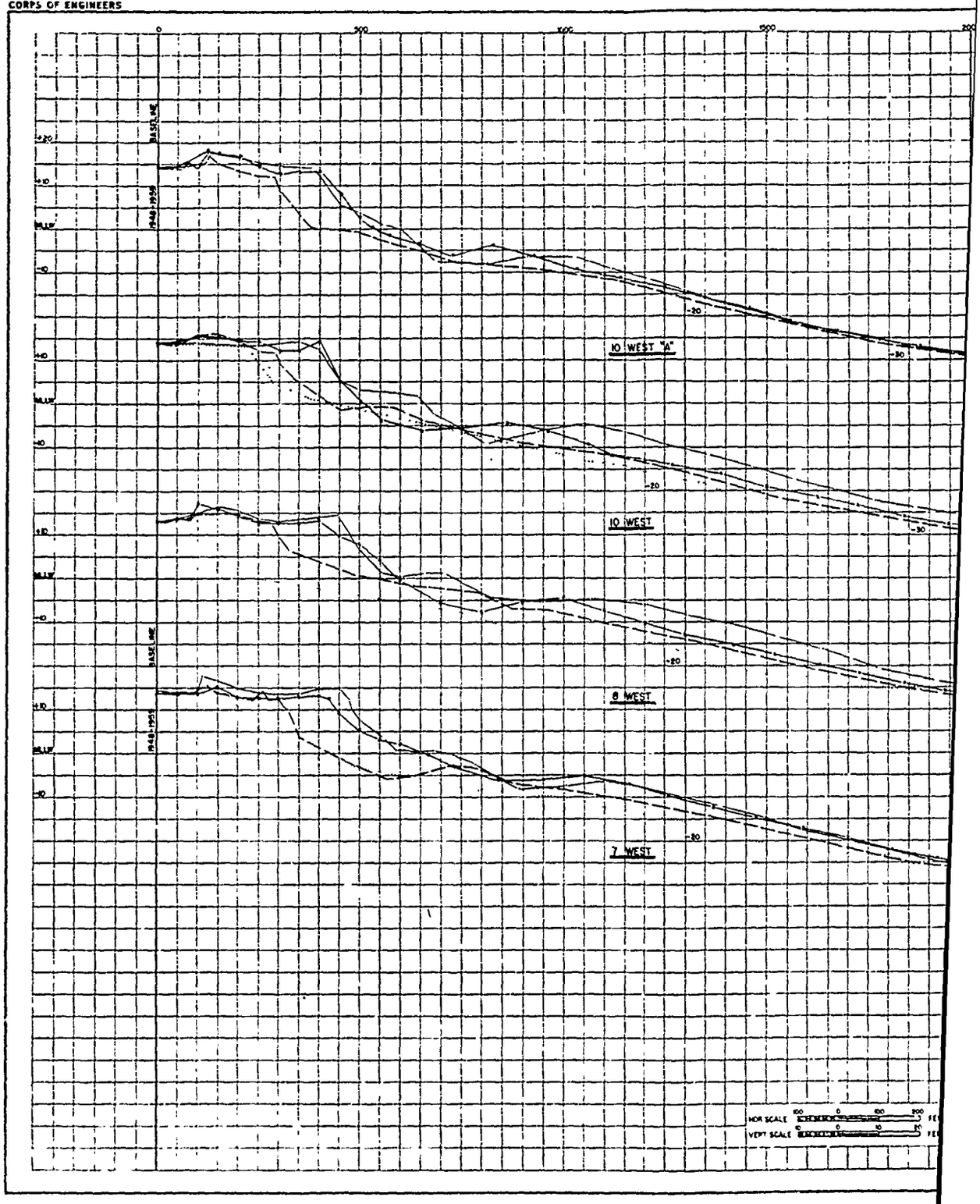
DATUM IS MEAN LOWER LOW WATER

OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES CALIF. DEC 1959
PREPARED UNDER THE DIRECTION OF
C T NEWTON, COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO.
BD	BD	WEA	DATED 8 APRIL 1960	3345

PLATE 26

CORPS OF ENGINEERS



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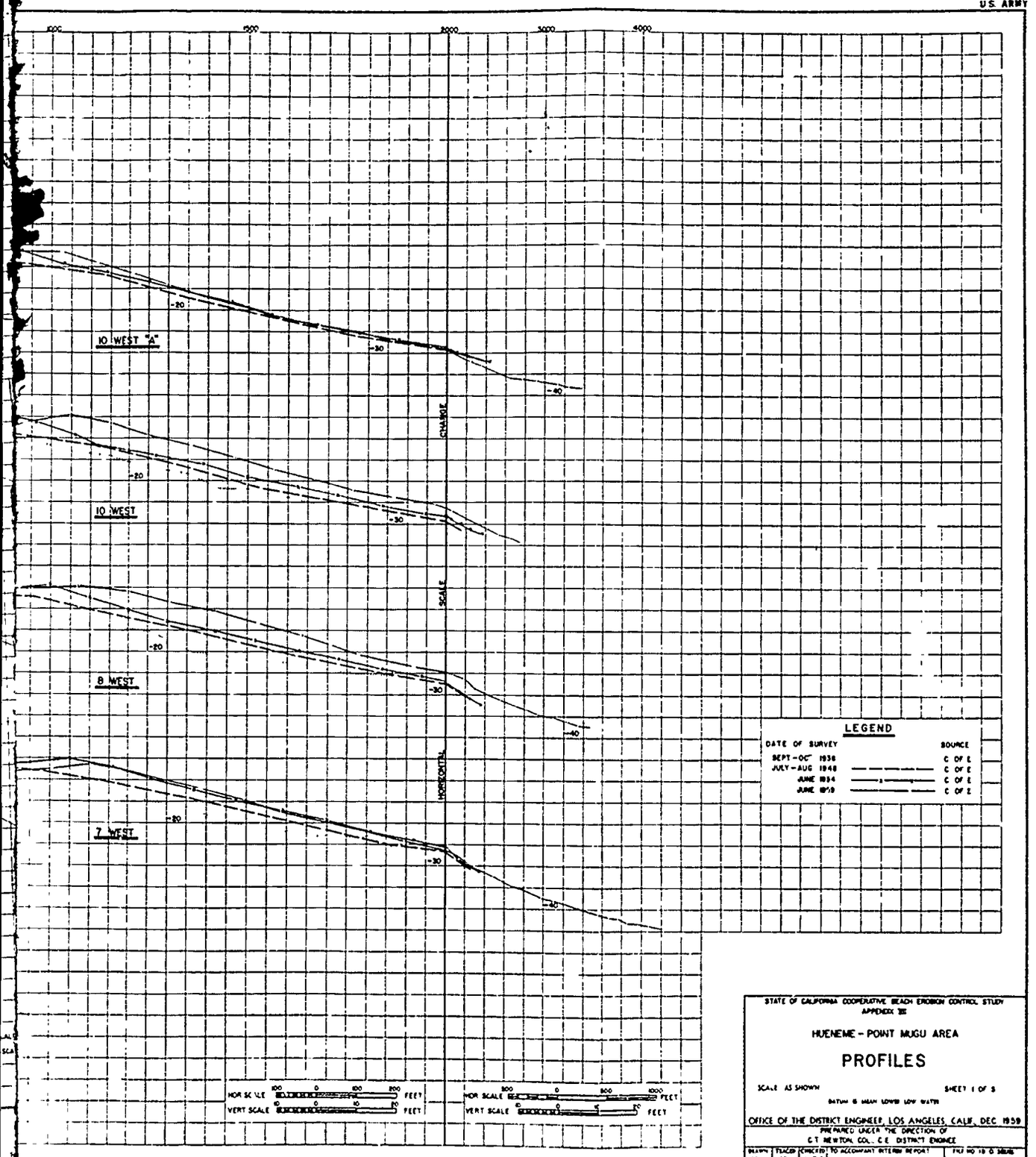
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

HUENEME - POINT MUGU AREA

PROFILES

SCALE AS SHOWN

SHEET 1 OF 3

DATUM IS MEAN LOWER LOW WATER

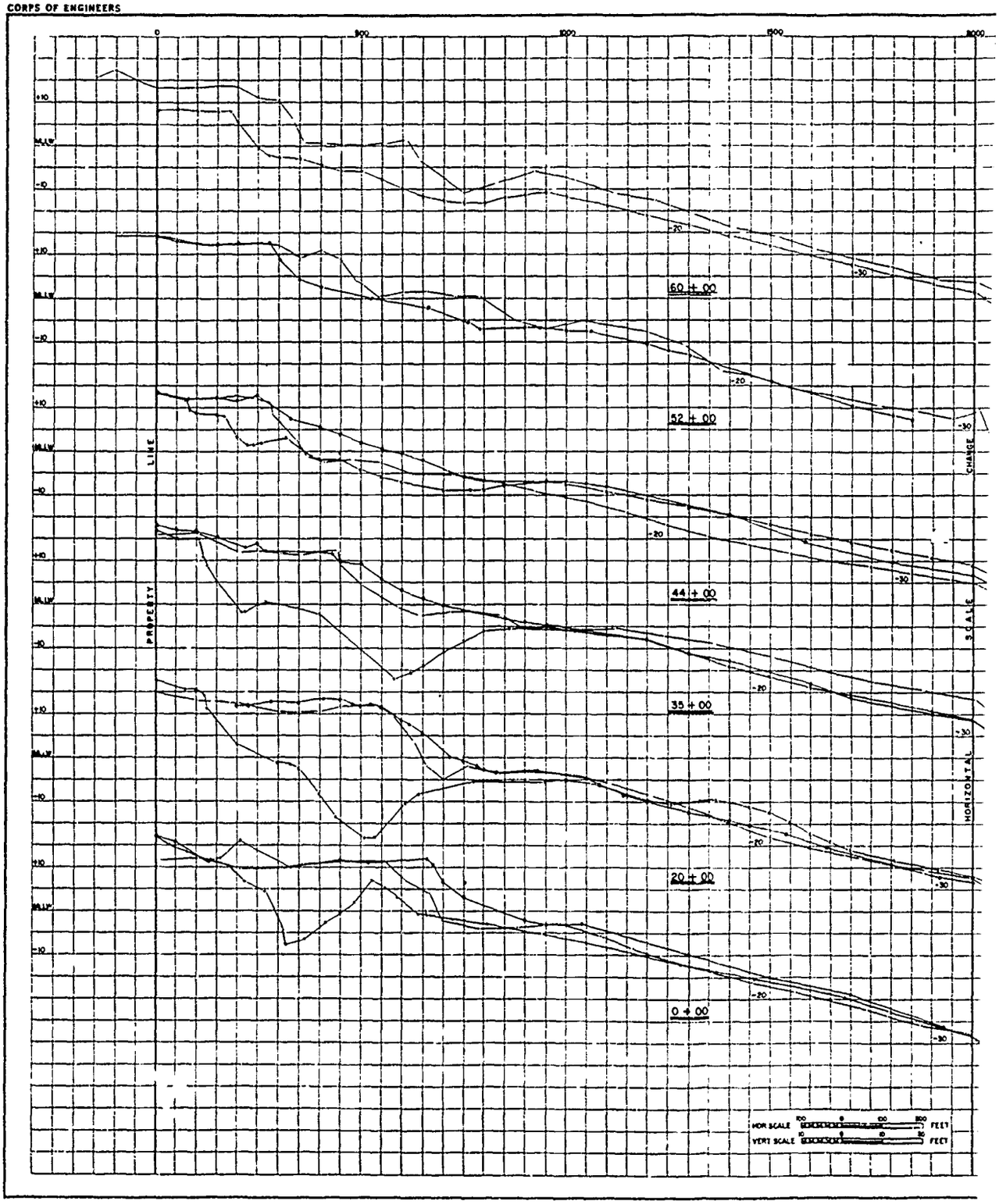
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC 1959

PREPARED UNDER THE DIRECTION OF
C.T. NEWTON COL. C.E. DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO 10 0 3848
MD	MD	WER	DATED 5 APRIL 1960	3348

PLATE 27

CORPS OF ENGINEERS



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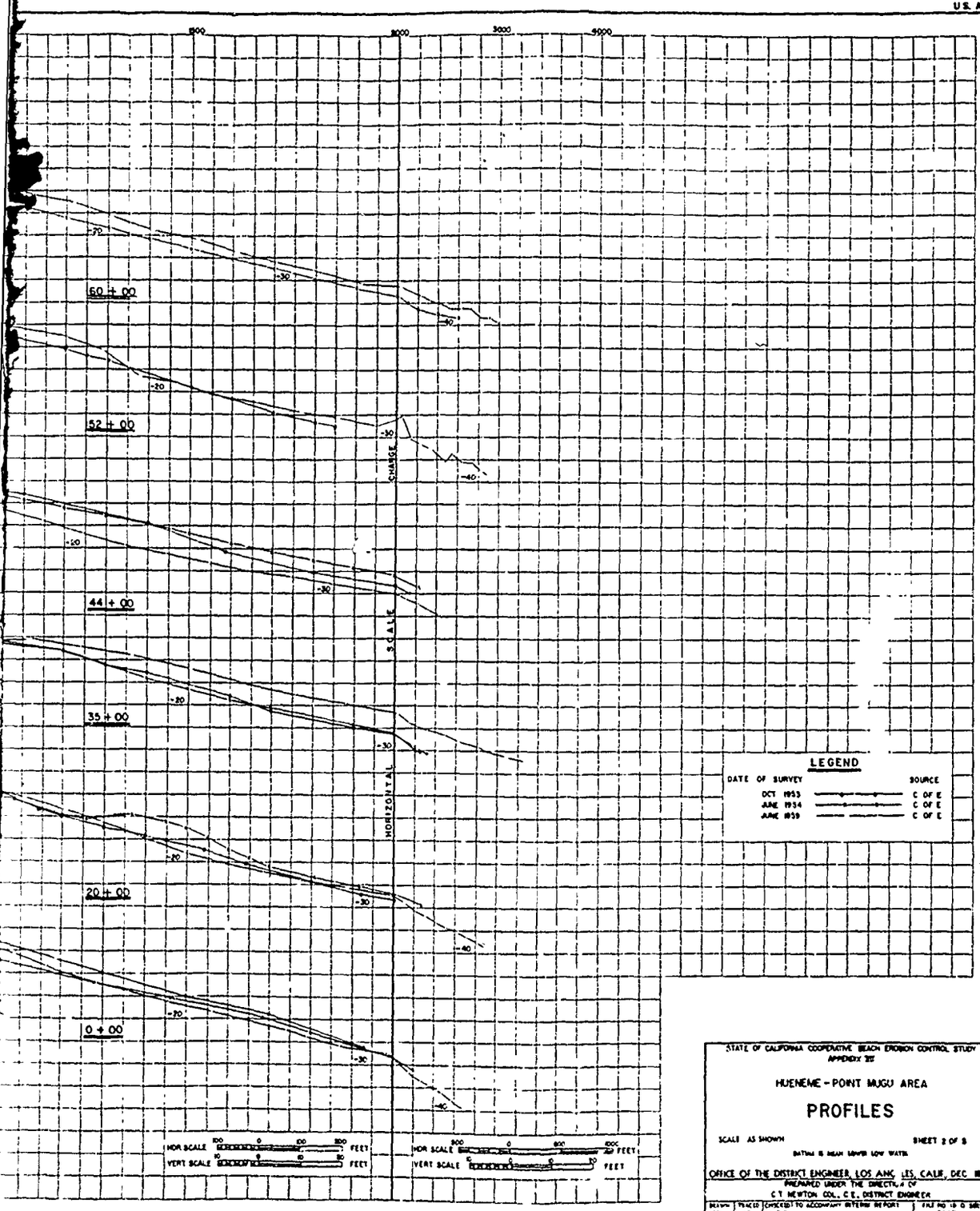
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX XII

HUENEME - POINT MUGU AREA

PROFILES

SCALE AS SHOWN

SHEET 2 OF 5

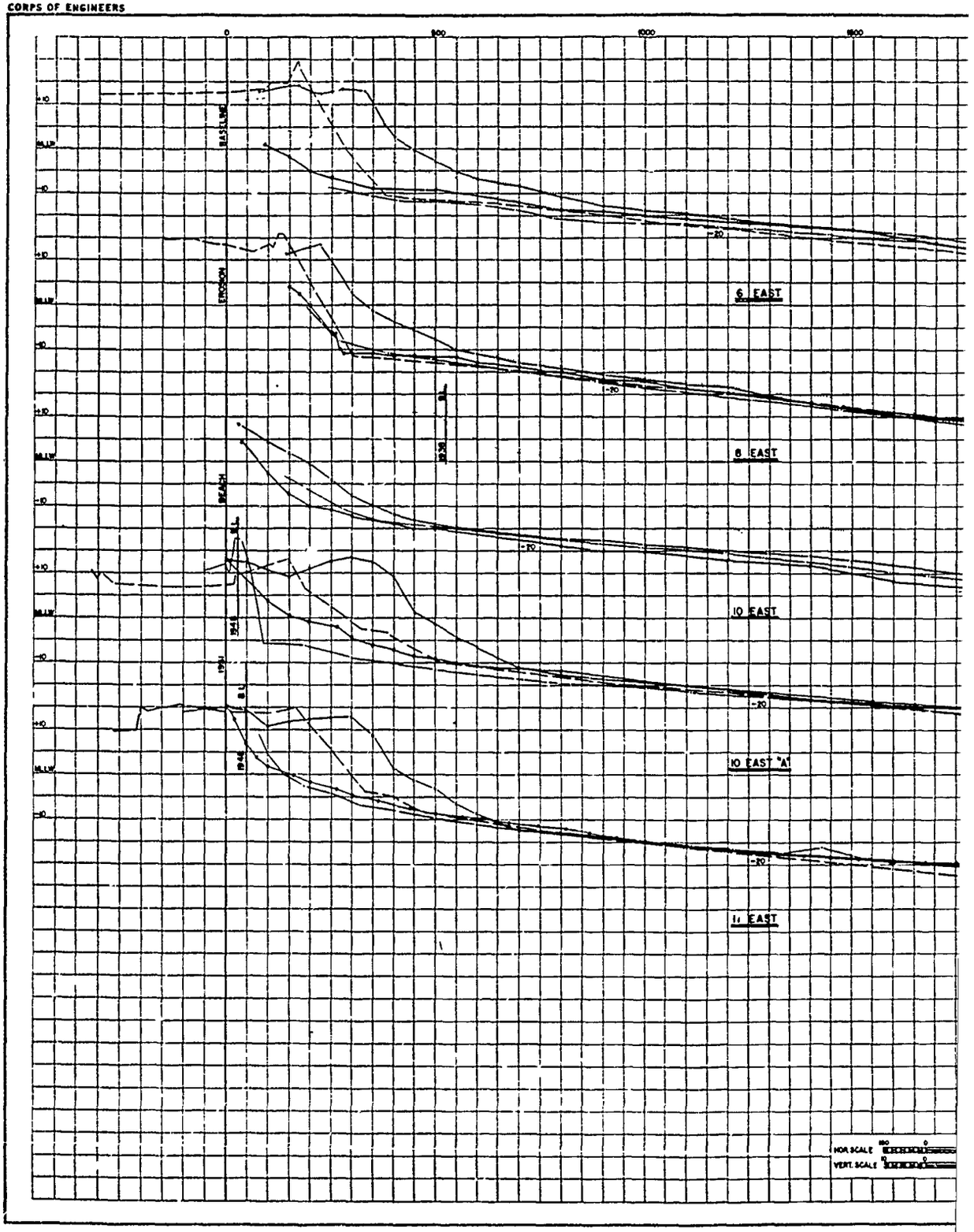
DATUM IS MEAN LOWER LOW WATER

OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., DEC 1959
PREPARED UNDER THE DIRECTION OF
C. T. NEWTON COL., C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED TO ACCOMPANY INTERIM REPORT	FILE NO. 16 D 3842
MD	MC	H E R 25 & APRIL 1960	3347

PLATE 28

CORPS OF ENGINEERS



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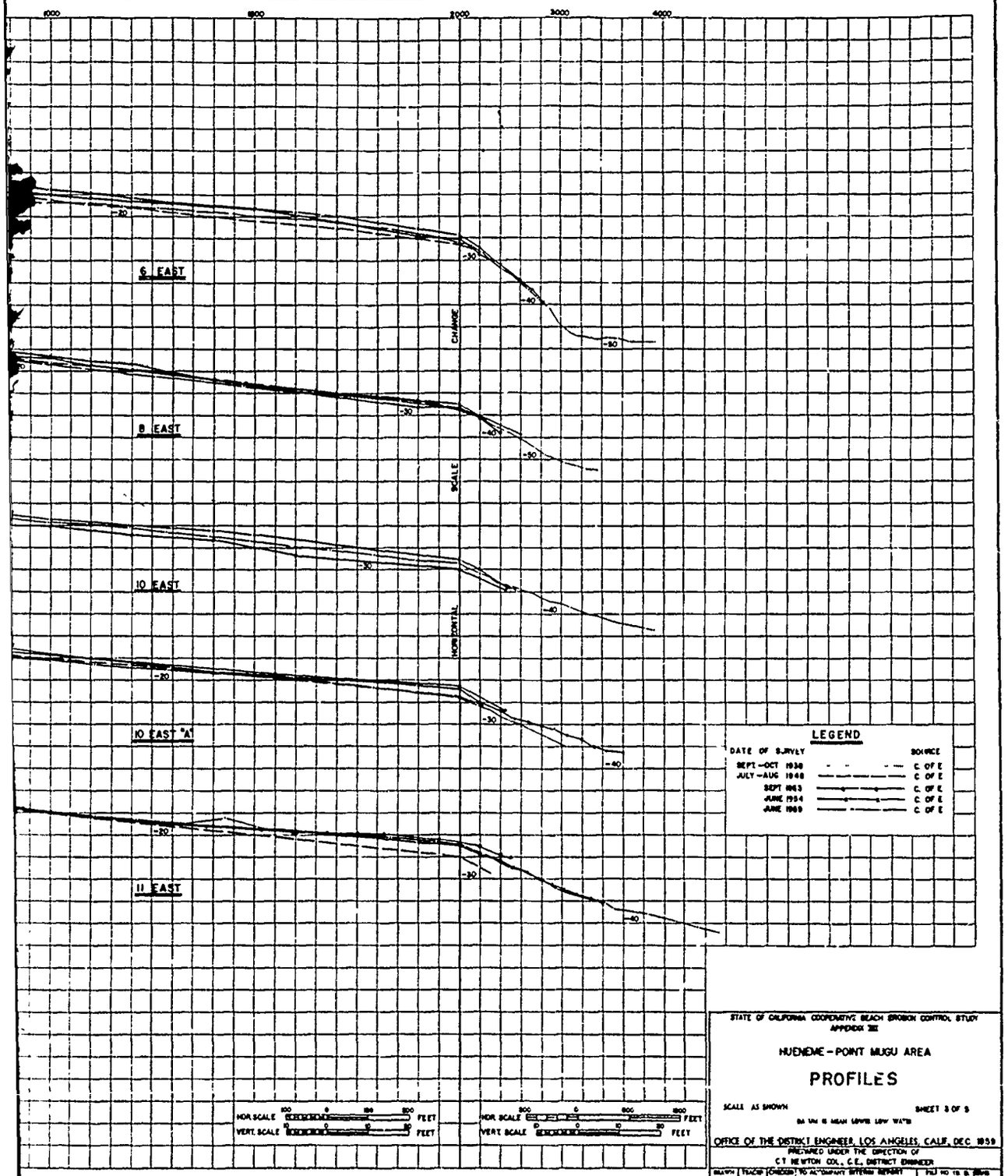
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX III

HUENEME - POINT MUGU AREA

PROFILES

SCALE AS SHOWN

SHEET 3 OF 5

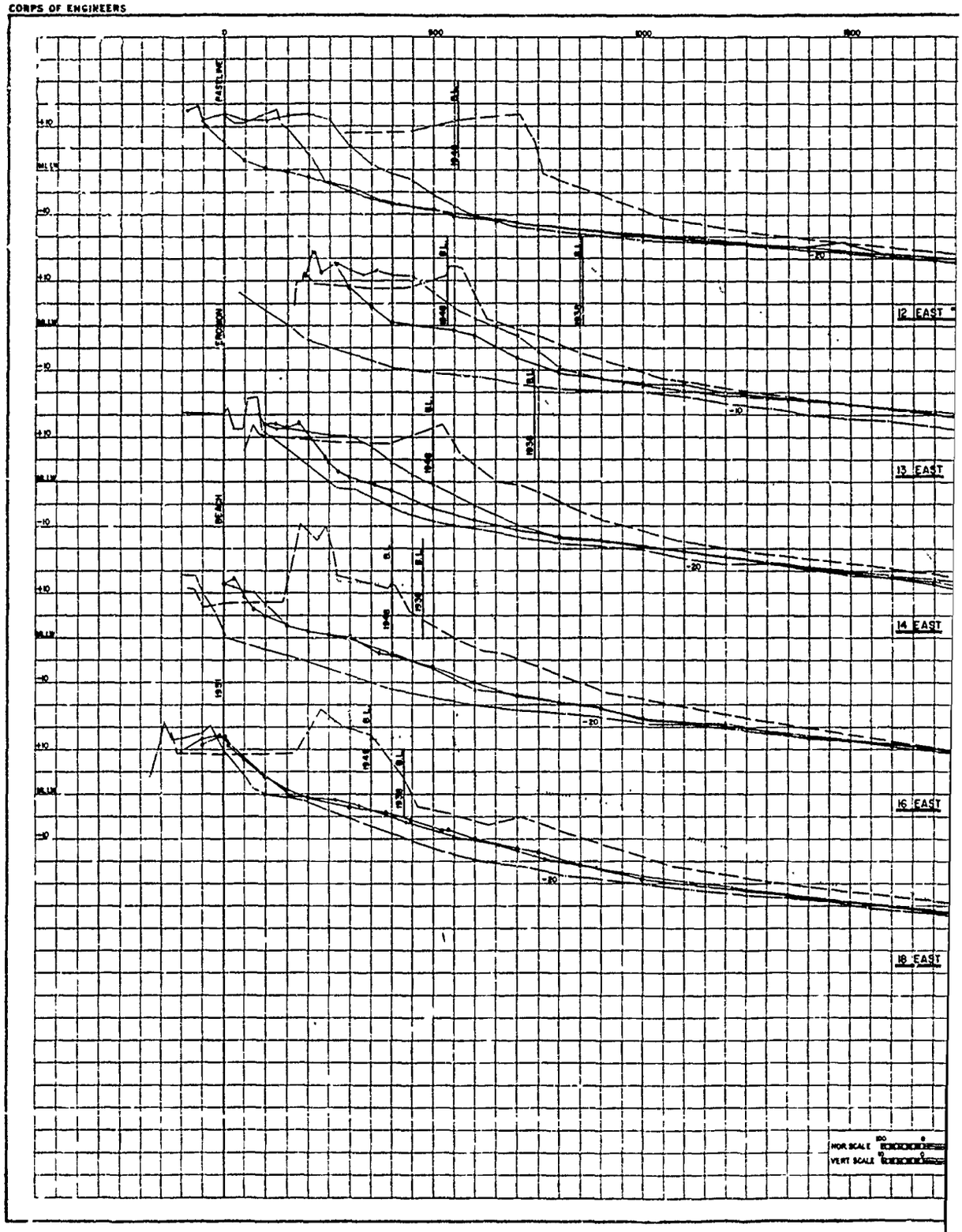
DATUM IS MEAN LOWER LOW WATER

OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF. DEC 1959
PREPARED UNDER THE DIRECTION OF
C T NEWTON COL., C.E., DISTRICT ENGINEER

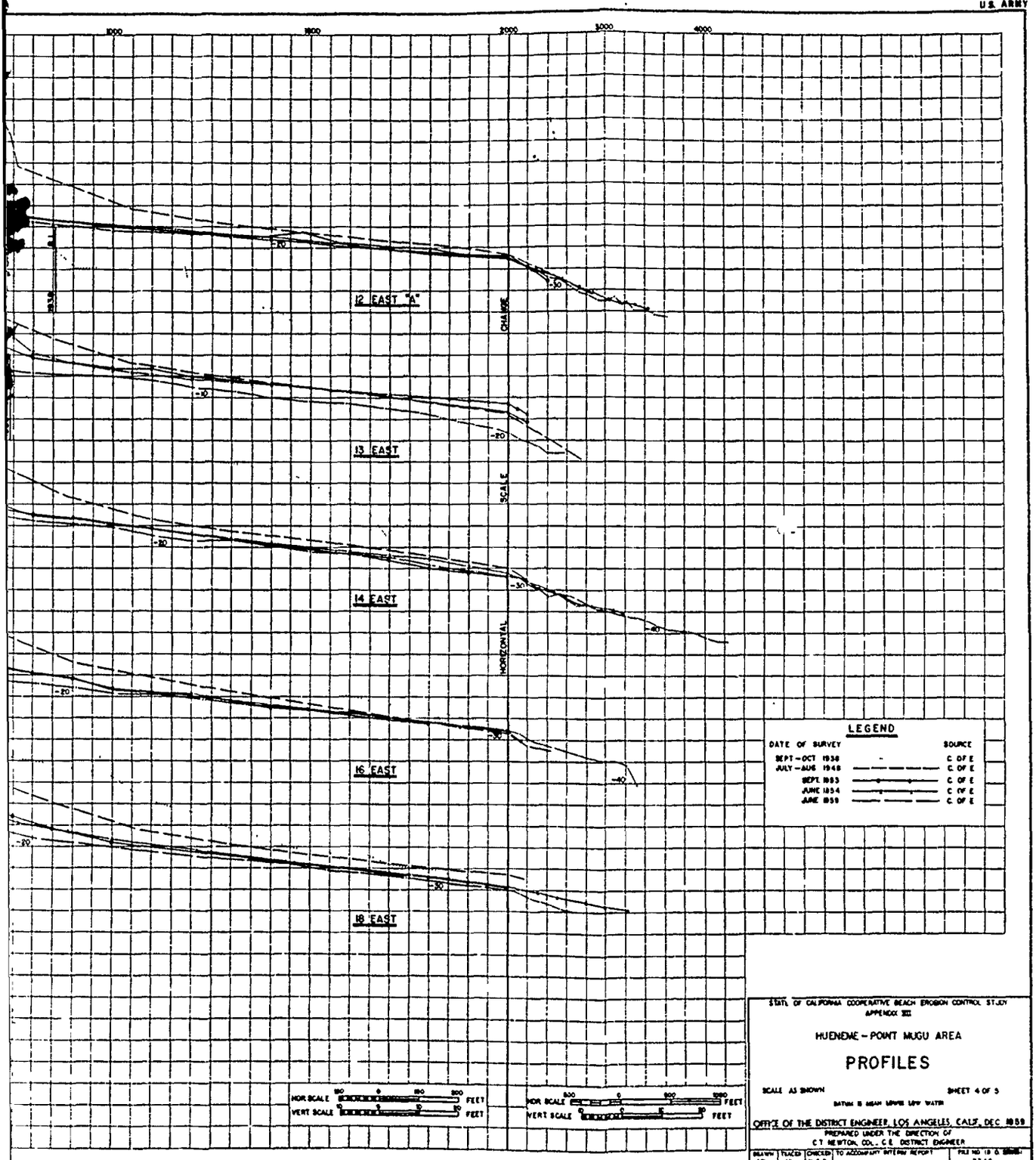
DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO.
MD	MD	W.E.P.	DATED 3 APRIL 1960	3348

PLATE 29

CORPS OF ENGINEERS



U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX XII

HUENEME - POINT MUGU AREA

PROFILES

SCALE AS SHOWN

SHEET 4 OF 5

DATUM IS MEAN LOWER LOW WATER

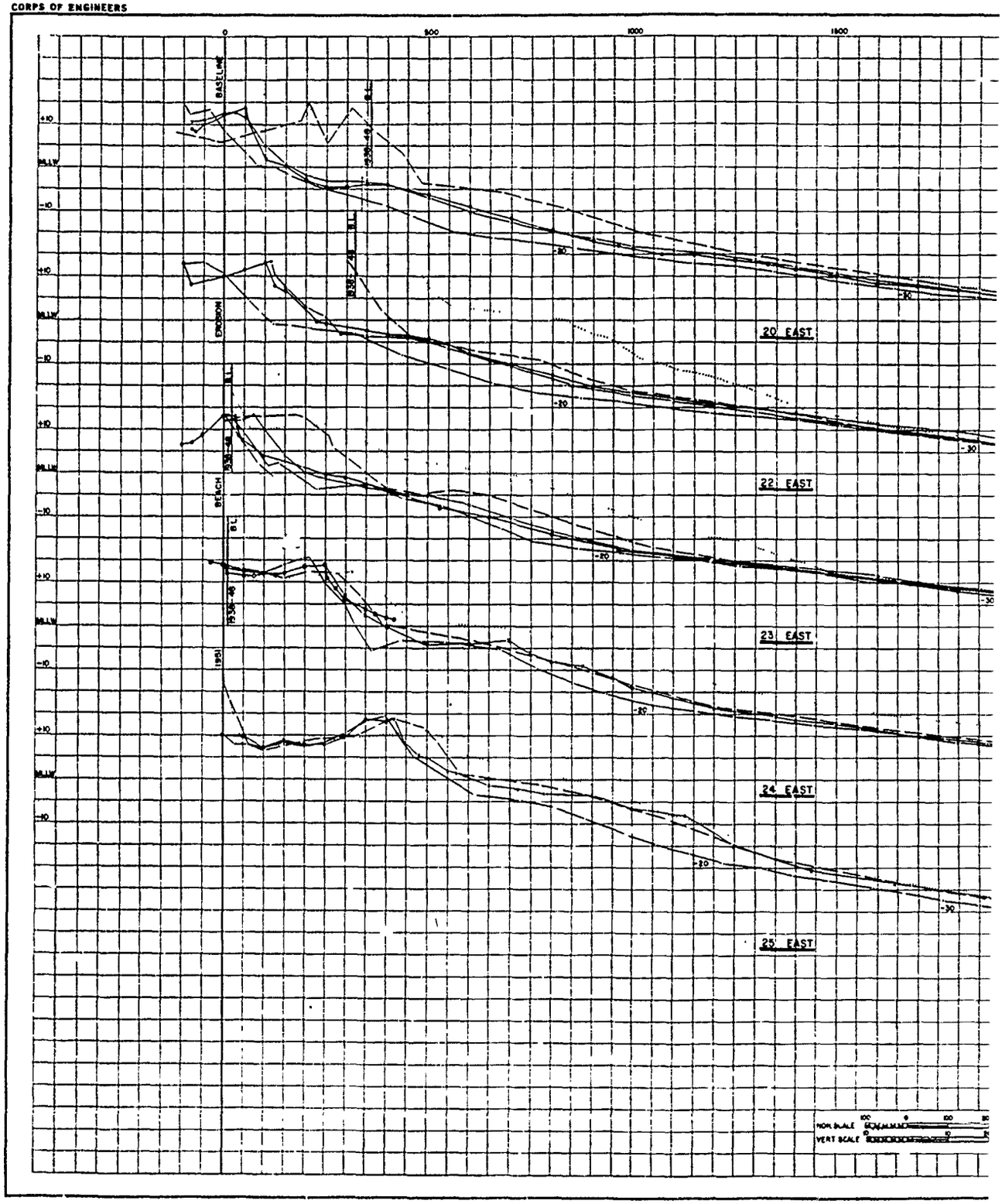
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., DEC. 1959

PREPARED UNDER THE DIRECTION OF
C.T. NEWTON, COL., C.E. DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO. 18 G.
MD	MC	WCR	DATED 5 APR. 1960	3349

PLATE 30

CORPS OF ENGINEERS



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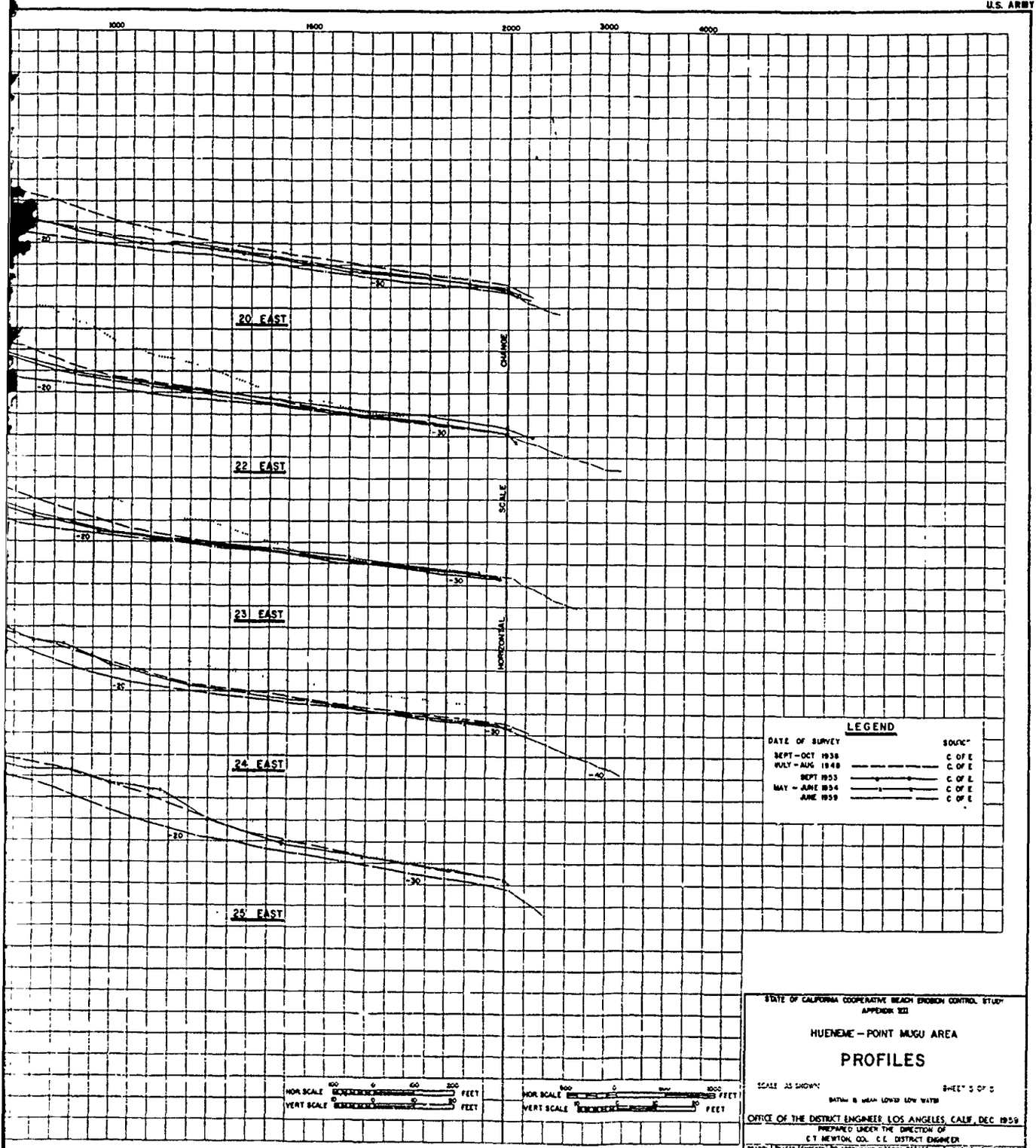
U.S. ARMY



STATE OF CALIFORNIA COOPERATIVE BEACH EROSION CONTROL STUDY
APPENDIX XXI

HUENEME – POINT MUGU AREA

PROFILES

SCALE AS SHOWN

SHEET 3 OF 3

DATUM IS MEAN LOWER LOW WATER

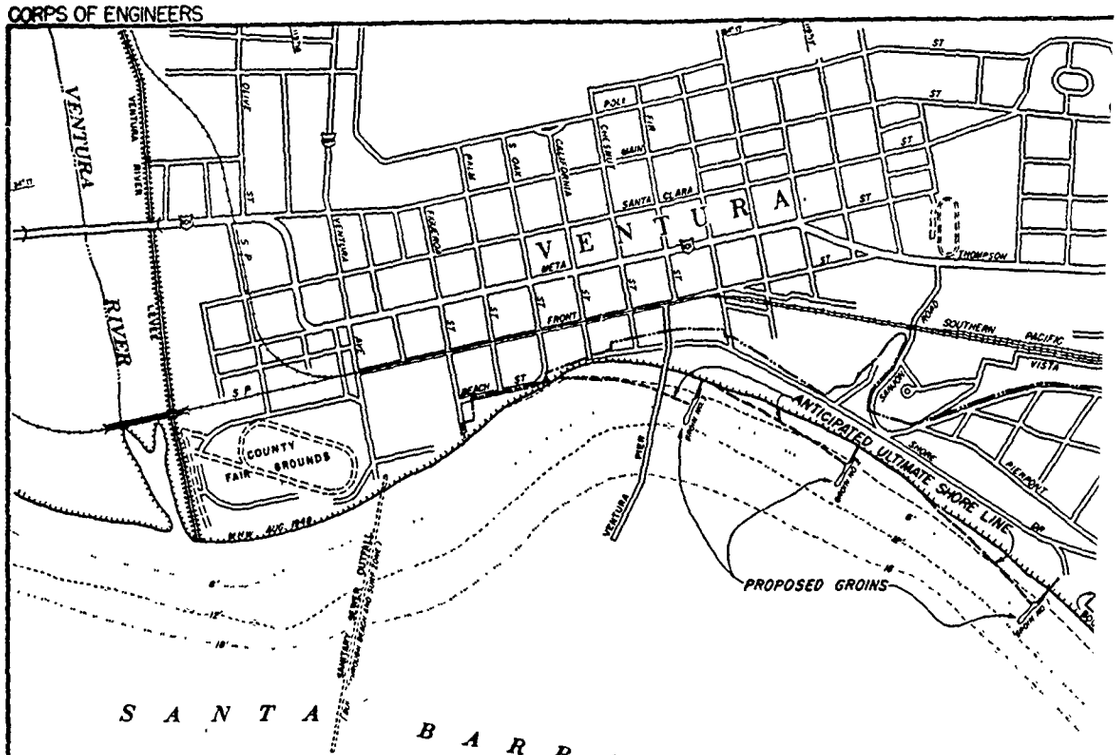
OFFICE OF THE DISTRICT ENGINEER, LOS ANGELES, CALIF., DEC 1959

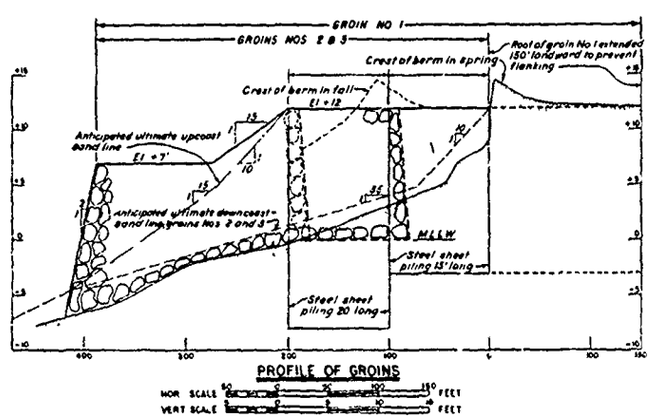
PREPARED UNDER THE DIRECTION OF
C.T. NEWTON, COL. C.E. DISTRICT ENGINEER

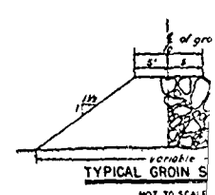
DRAWN	TRACED	CHECKED	TO ACCOMPANY INTERIM REPORT	FILE NO.
MD	MD	WER	DATED 9 APRIL 1960	3350

PLATE 3

CORPS OF ENGINEERS







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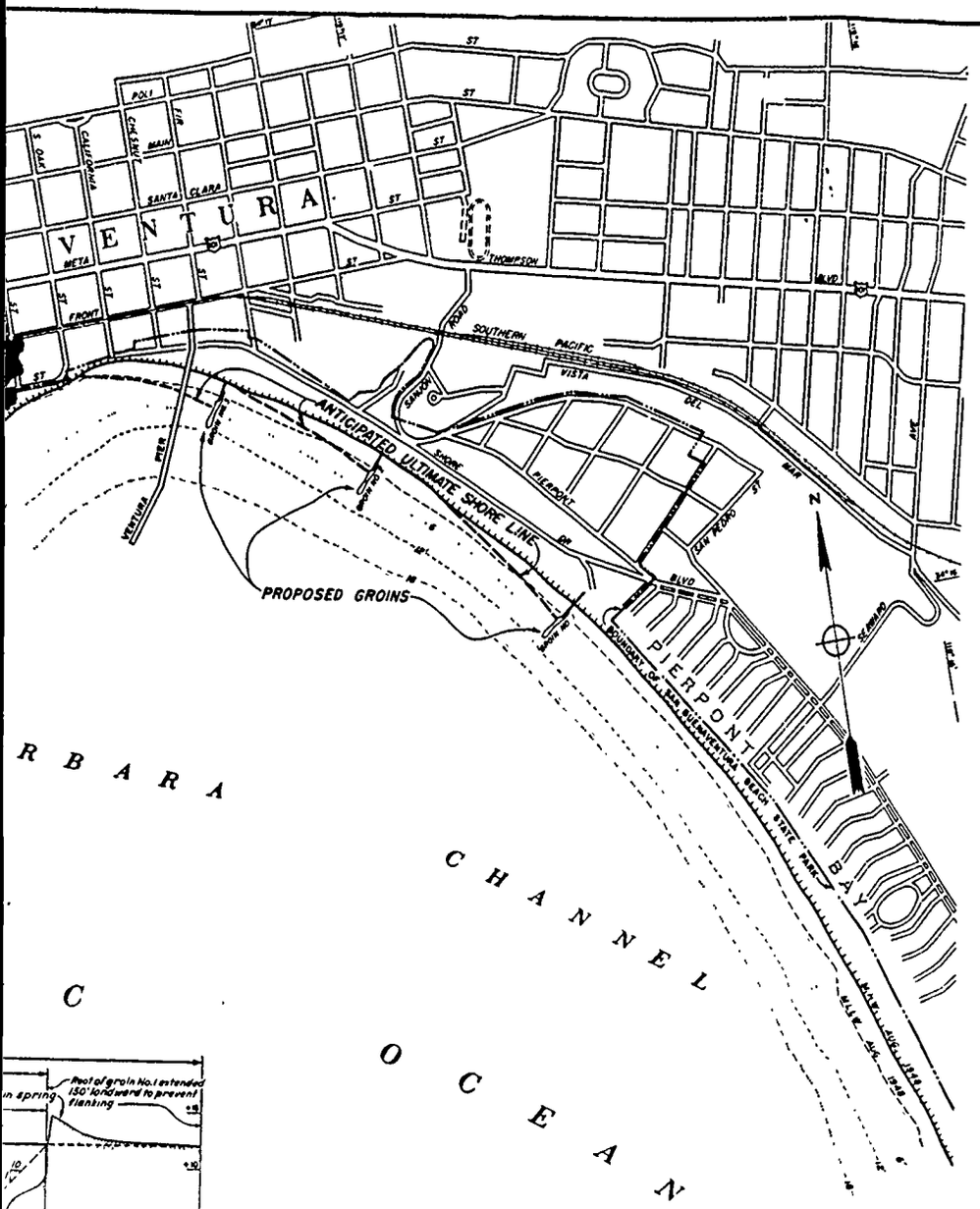
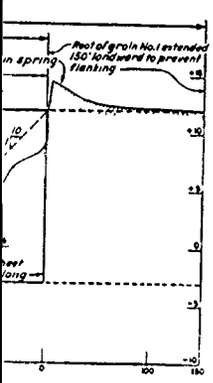
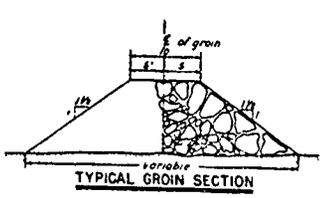
U.S AR
SERIAL NC







TYPICAL GROIN SECTION

NOT TO SCALE

NOTE

Maintenance of project to be accomplished by Local Interests

Federal participation in the amount equal to one-third of the first cost of construction of the three groins

Elevations and depth contours are in feet and refer to Mean Lower Low Water

Base from U.S.C.&G.S. Chart No 5007

RIVER AND HARBOR IMPROVEMENT

CARPINTERIA TO POINT MUGU, CALIFORNIA

(SHORE PROTECTION)

SCALE IN FEET

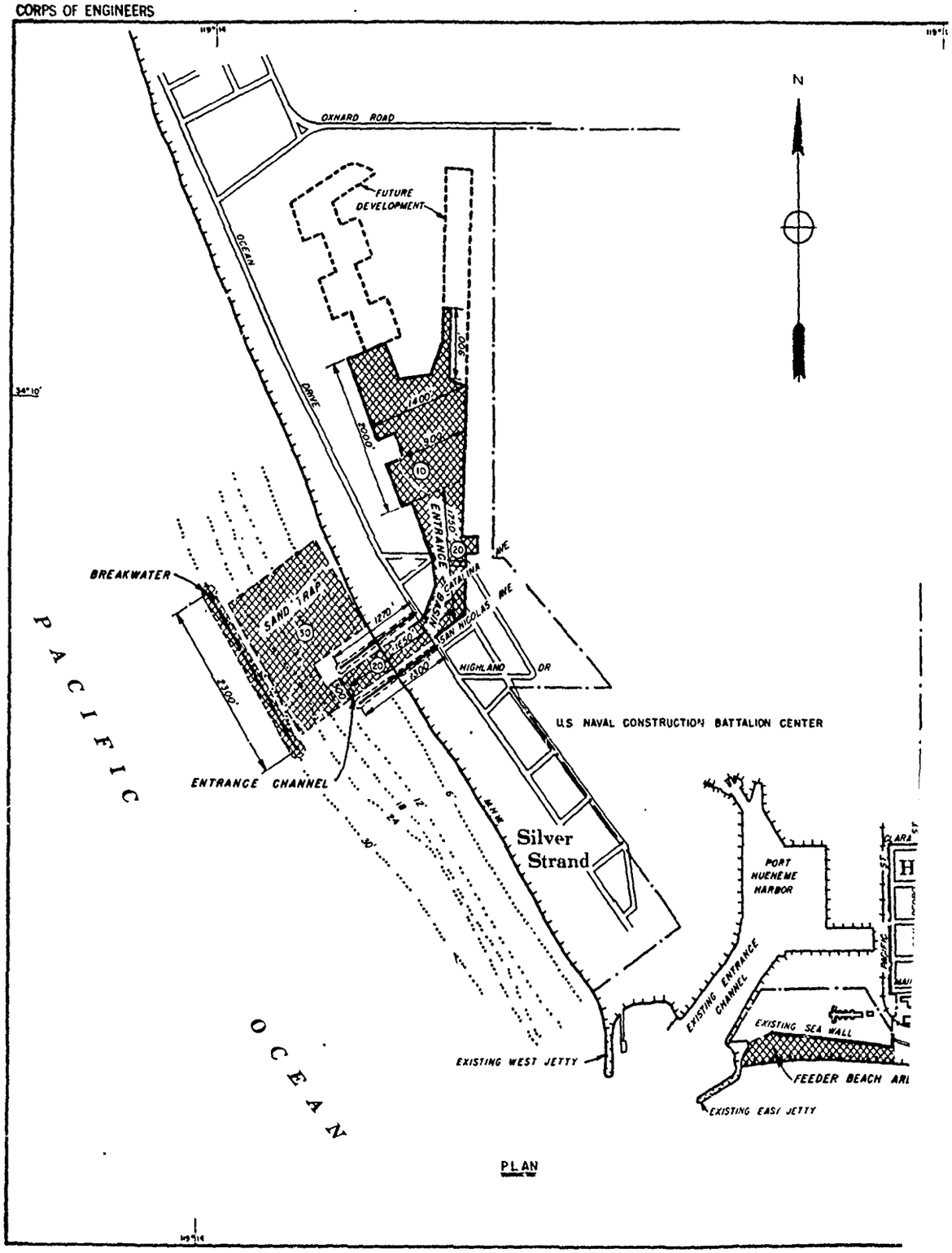
1000 0 1000 2000

OFFICE OF THE DISTRICT ENGINEER
LOS ANGELES, CALIFORNIA

30 JUNE 1957

PLATE 3

CORPS OF ENGINEERS



PLAN

2

U. S ARMY
SERIAL NO 10

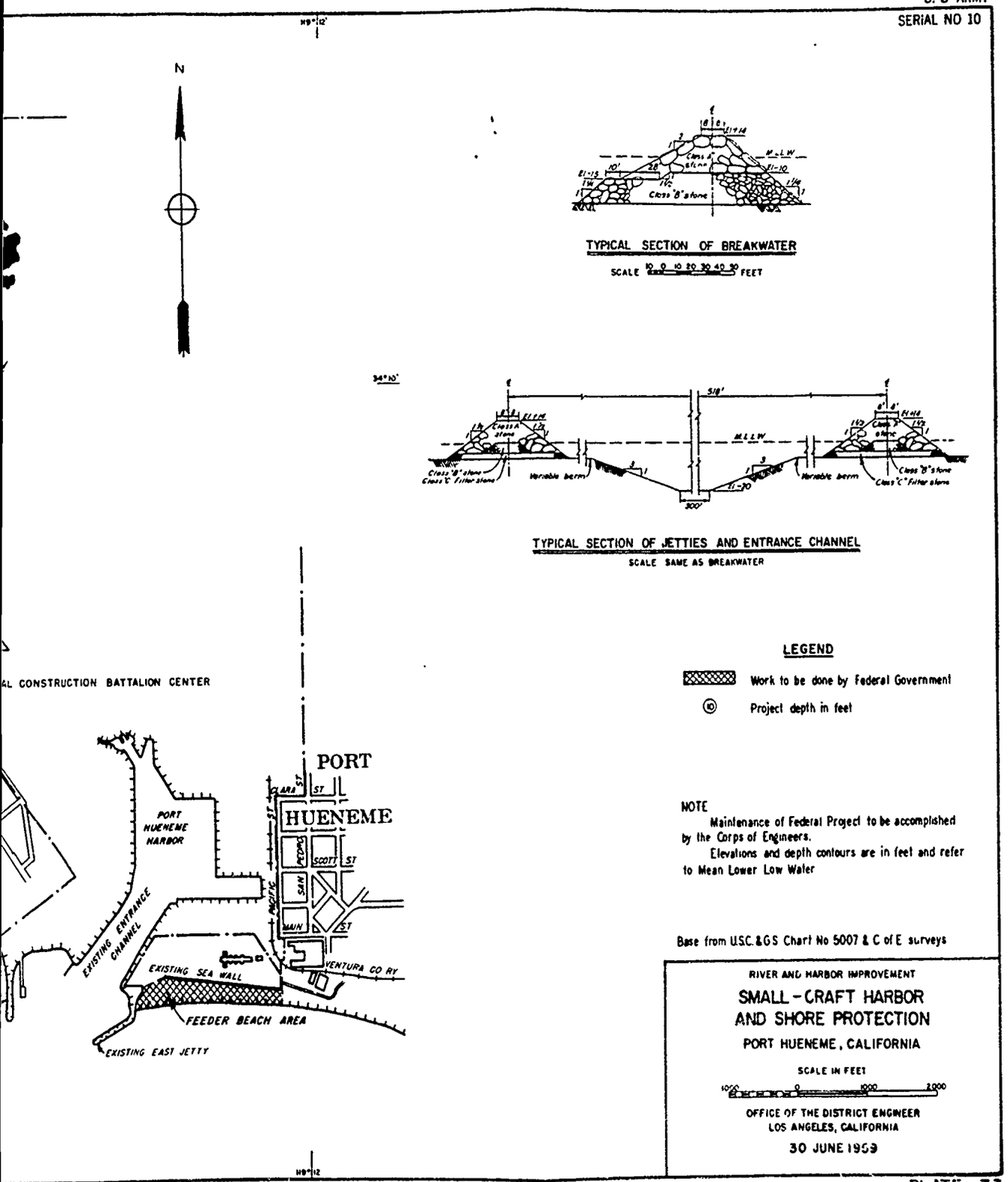
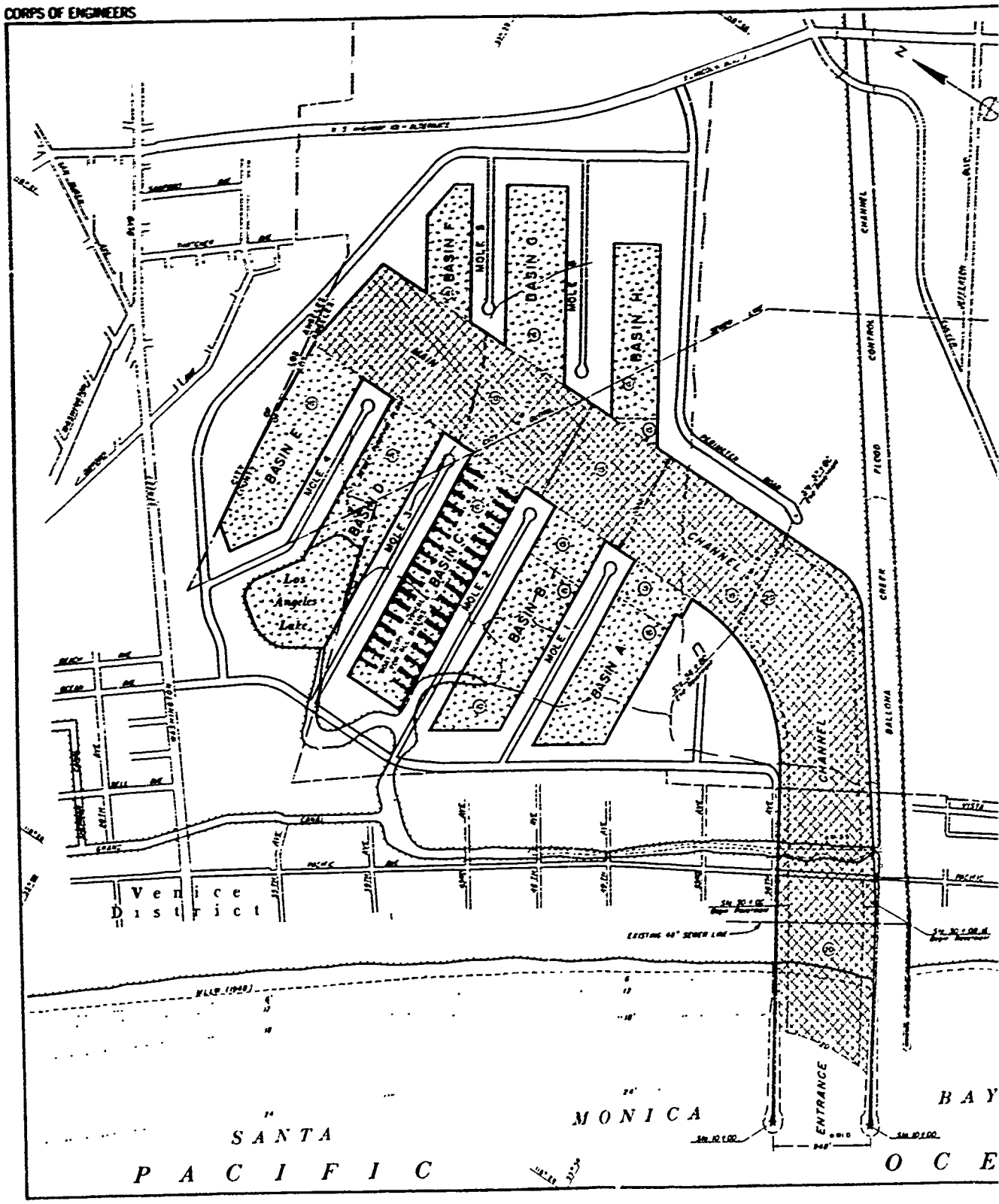


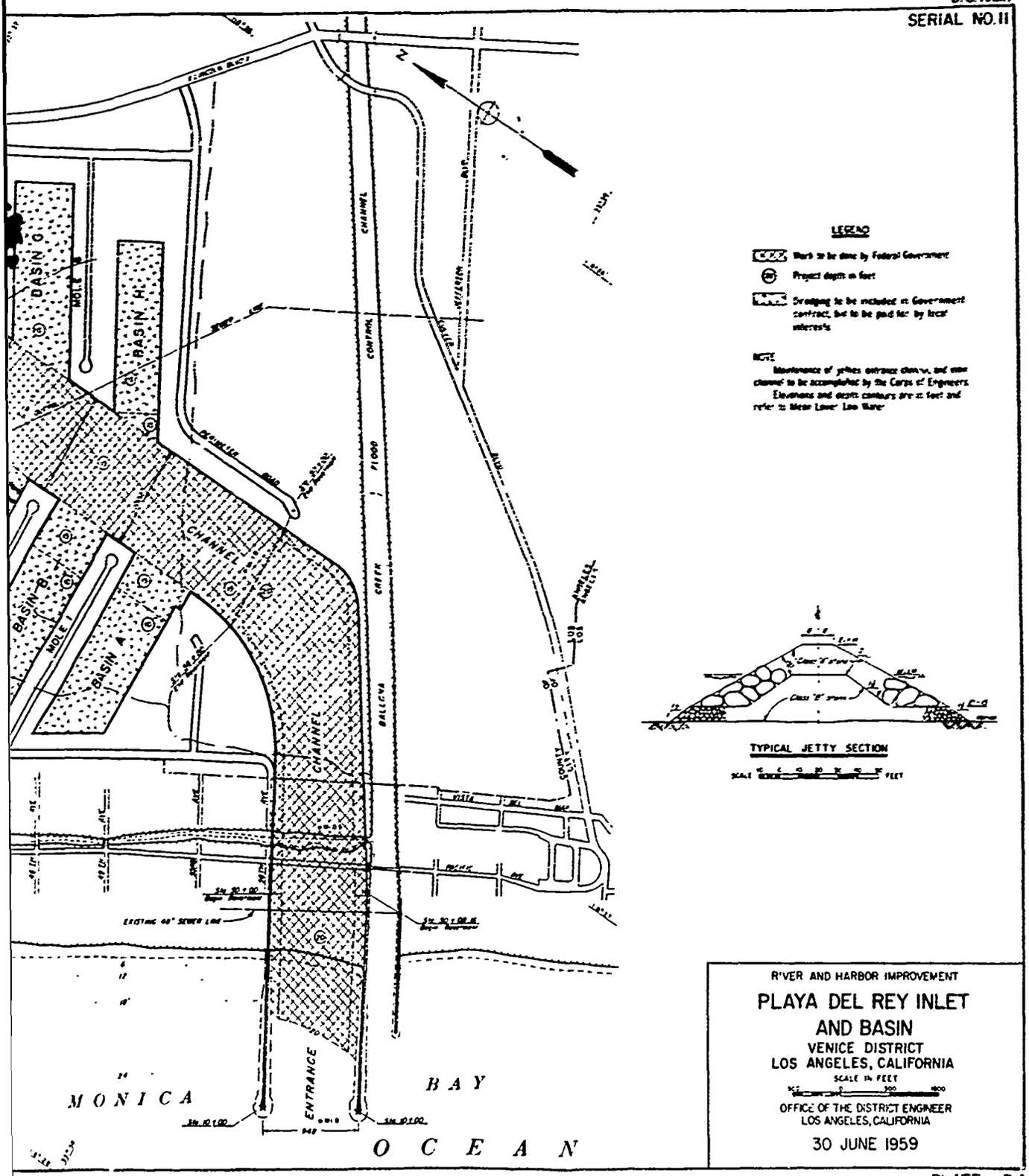
PLATE 33

CORPS OF ENGINEERS



U. S. ARMY

SERIAL NO. 11



RIVER AND HARBOR IMPROVEMENT

PLAYA DEL REY INLET AND BASIN

VENICE DISTRICT
LOS ANGELES, CALIFORNIA

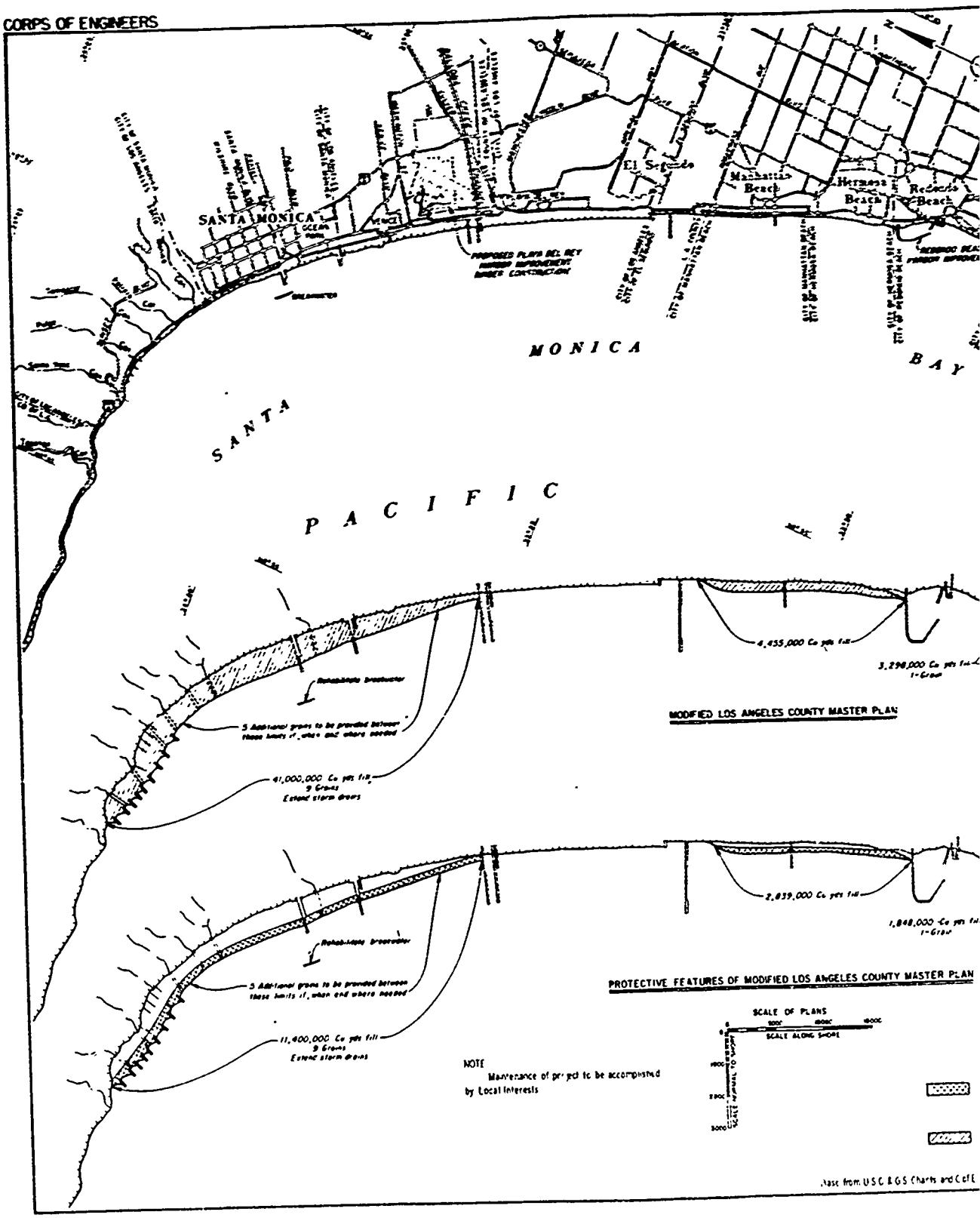
SCALE IN FEET

OFFICE OF THE DISTRICT ENGINEER
LOS ANGELES, CALIFORNIA

30 JUNE 1959

PLATE 34

CORPS OF ENGINEERS



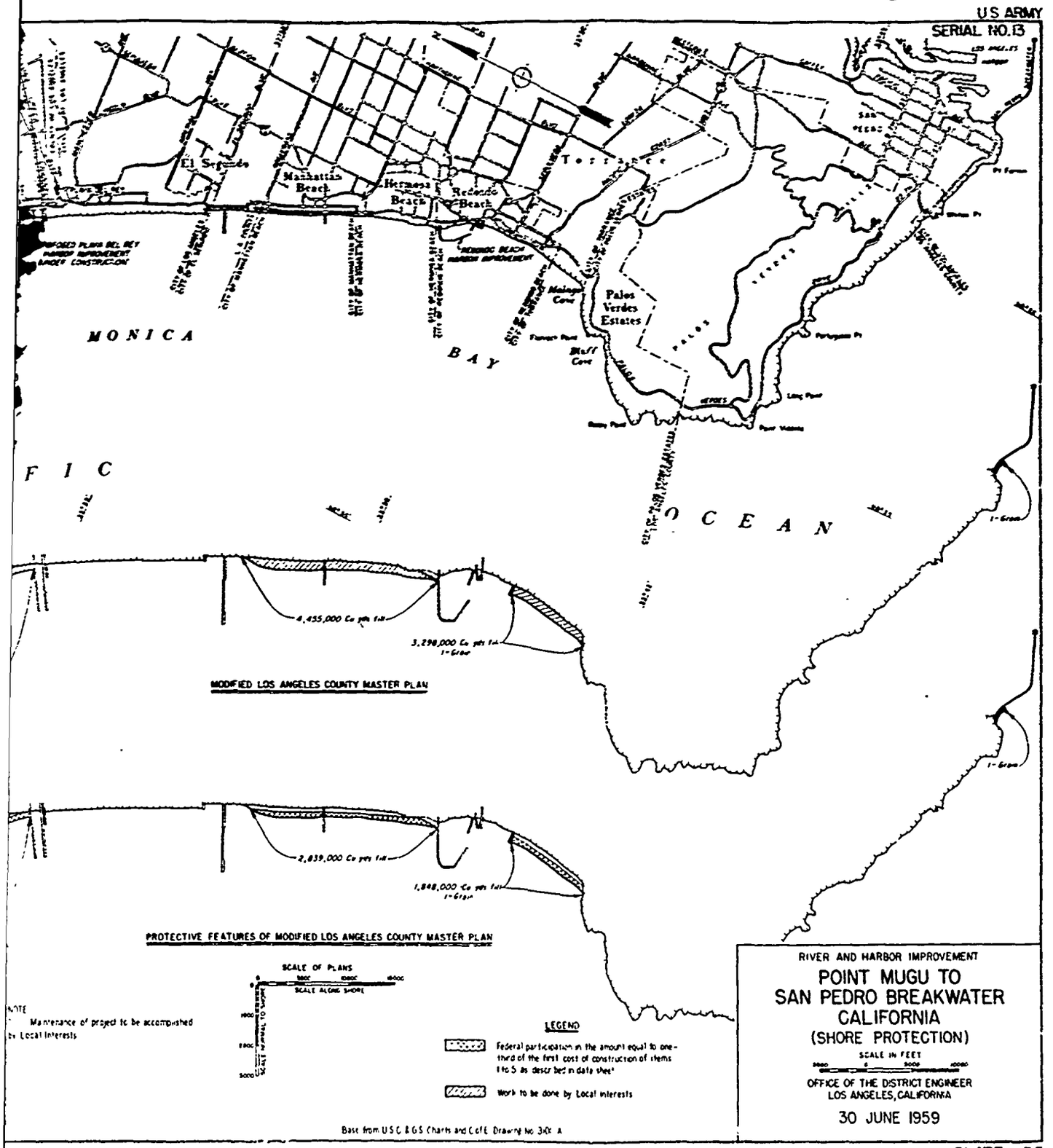
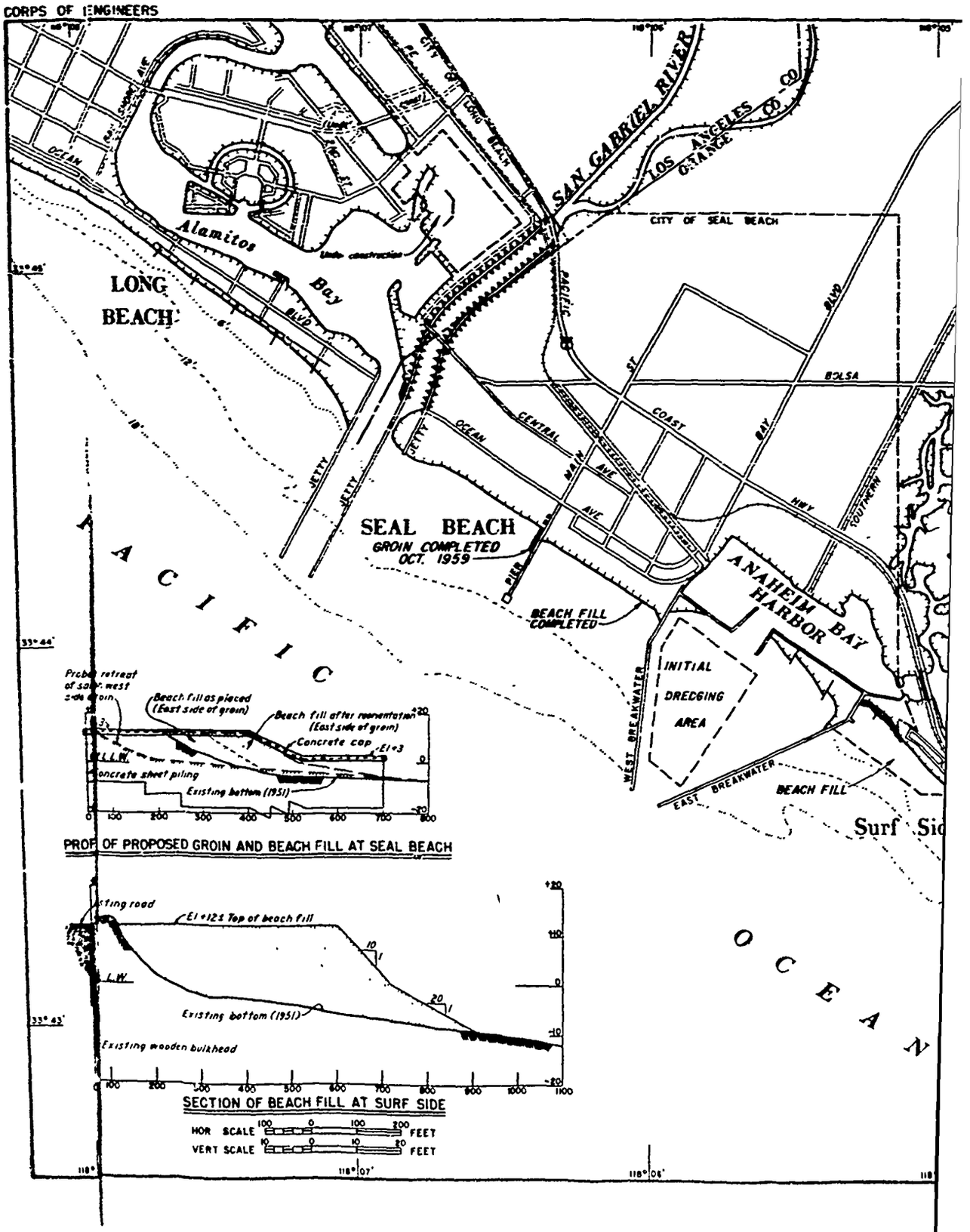
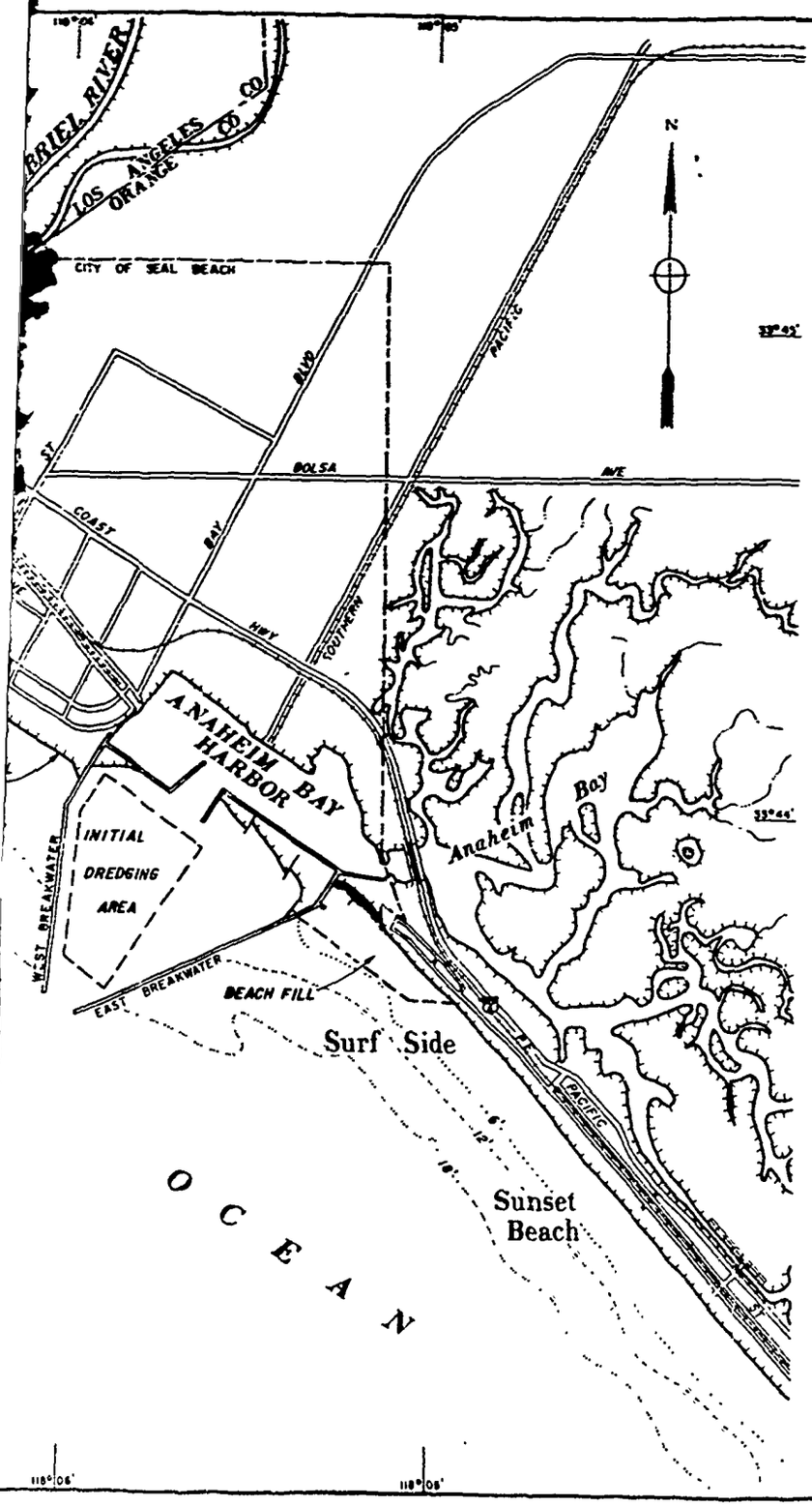

U.S. ARMY
SERIAL NO. 13
El Segundo
Manhattan Beach
Hermosa Beach
Redondo Beach
Palos Verdes Estates
MONICA
BAY
F I C
O C E A N
4,455,000 Cu yds f.o.b.
3,298,000 Cu yds f.o.b.
1-Grav
MODIFIED LOS ANGELES COUNTY MASTER PLAN
2,839,000 Cu yds f.o.b.
1,848,000 Cu yds f.o.b.
1-Grav
PROTECTIVE FEATURES OF MODIFIED LOS ANGELES COUNTY MASTER PLAN
SCALE OF PLANS
SCALE ALONG SHORE
NOTE
Maintenance of project to be accomplished by Local Interests
LEGEND
Federal participation in the amount equal to one-third of the first cost of construction of items 1 to 5 as described in data sheet
Work to be done by Local interests
Base from U.S.C. & G.S. Charts and C.of E. Drawing No. 3-01 A
RIVER AND HARBOR IMPROVEMENT
POINT MUGU TO
SAN PEDRO BREAKWATER
CALIFORNIA
(SHORE PROTECTION)
SCALE IN FEET
OFFICE OF THE DISTRICT ENGINEER
LOS ANGELES, CALIFORNIA
30 JUNE 1959

PLATE 35

CORPS OF ENGINEERS



U. S. ARMY
SERIAL NO. 14



NOTE

Maintenance of project to be accomplished by Local Interests.

Federal participation in the amount equal to one-third of the first cost of protecting publicly owned shores and the full first cost of protecting federally owned shores

Elevations and depth contours are in feet and refer to Mean Lower Low Water

Based on U.S.C. & G.S. Chart No. 5143

RIVER AND HARBOR IMPROVEMENT

ANAHEIM BAY HARBOR
CALIFORNIA

(SHORE PROTECTION)

SCALE IN FEET
1000 0 1000 2000

OFFICE OF THE DISTRICT ENGINEER
LOS ANGELES, CALIFORNIA

30 JUNE 1959

PLATE 36