SOUTHERN CALIFORNIA EDISON COMPANY

ENGINEERING DEPARTMENT

COAST NUCLEAR STEAM STATION SITE C

REPORT ON PRELIMINARY SITE INVESTIGATION

Report 67

November 3, 1967

COAST NUCLEAR [illegible] STATION SITE C

REPORT ON PRELIMINARY SITE INVESTIGATION

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COAST NUCLEAR STEAM STATION SITE C

REPORT ON PRELIMINARY SITE INVESTIGATION

SECTION I - INTRODUCTION

A. Purpose and Scope of Investigation

This investigation was authorized under Function 0156 to obtain information on the onshore and offshore site conditions that would effect the design, construction and operation of a major nuclear steam station. An engineering budget cost of $35,000 was estimated for the preliminary site investigation.

The intent of this investigation and report was to identify subsurface soil types and to provide engineering data suitable for preparing preliminary design and cost studies.

Contained in the report is a description of the physical characteristics of both onshore and offshore subsurface soils along with a discussion of special site conditions that will effect the cost of the main plant and its appurtenant structures.

Reference is made to a report designated SL 1836 prepared by Sargent & Lundy and dated October 20, 1960. This report, though referring to a nearby previously investigated and abandoned site, discusses several pertinent site features similar to those existing at Site C.

Further reference is made to a letter report entitled, "Geologic Reconnaissance of San Onofre Beach and Vicinity" by P. J. West. A copy of this report is included in the Appendix.

B. General Description of Project

The proposed Site C is located on Camp Pendleton approximately five miles south of San Clemente in San Diego County. The property consists of approximately 90 acres extending 5000 feet along the coast line between U.S. Highway 101 and the beach. The main line of the A.T.& S.F. Railroad is adjacent and easterly of the highway.

Major features of the proposed project include an initial installation of one 375 mw unit with a 200-foot diameter containment sphere housing the reactor, an outdoor type turbine-generator, and a beach discharge structure. Plans provide for the future addition of three similar units.

SECTION II - CONCLUSION AND DISCUSSION

A. General Conclusion

It is concluded from this preliminary investigation that Site C is suitable for the construction of a major nuclear steam station.

No major problem concerning either site or near-site conditions that would detrimentally affect the plant construction, operation or maintenance is anticipated. Adequate site access by both highway and railroad is readily available, site soil conditions are favorable for minimum cost structure foundations, and the offshore hydrography is such that the conventional cooling water conduit system can be utilized.

This investigation did not include a comprehensive study of such site location features as nuclear safety, local farm affects, salinity corrosion, or ocean currents and temperatures; however, none of these are expected to present a problem of more than minor concern.

B. Site Preparation

The grading for roads, railroad spur, building sites, and for the development of effective site drainage will require both cut and fill in the surface, fine-grained and bouldery terrace deposits and in the underlying San Mateo sand formation.

Both materials can be excavated using scrapers with pushcats with little to moderate difficulty. The use of rippers, though probably not required, could be economically utilized. Both soils would be acceptable for use in compacted fills, especially the San Mateo sand, and both soils could be easily compacted to a high density using a 50-ton, rubber-tire roller.

Cut slopes could be expected to remain stable at a slope as steep as 1:1 and compacted fill slopes at 1.5:1, however, adequate protection against slope erosion would be important. Such protection should include planting of the slopes along with the construction of paved lateral drainage ditches.

The disposal of excess cut material could be accomplished by several methods. The most favorable scheme is possibly one of the beach disposal that would create a construction working area to increase that now available at beach level for offshore construction. Downhill loading and hauling could be utilized, and the haul distance would be short. A conveyor belt system might also prove to be feasible.

The several large barrancas both on the site and on adjacent properties could be used for placing excess material, however, the problem of achieving adequate soil compaction would exist. A method of "hydraulic placement" such as used at Rose Hills Memorial Park in Whittier might be economically feasible.

The large slump area adjacent to the site southerly boundary might also be developed as a disposal area.

SECTION II - CONCLUSIONS AND DISCUSSION

The placement of fill on the entire bluff-top portion of the site to raise the ground surface to the elevation of the highway would serve as a disposal area and would also permit raising the bottom of the containment sphere elevation by 15 or 20 feet thereby reducing the required volume of excavation. Containment for nuclear safety would be maintained. Uphill hauling of fill would be required.

The possibility that the State might accept the excess cut material for placement at San Clemente State Park has been suggested. The responsibility and cost for fill transport would determine the feasibility of this scheme.

The drainage areas tributary to run-off flows crossing the site are minor, and the development of adequate site drainage and the protection against erosion damage can be accomplished by the placement of several small diameter culverts and paved drainage ditches. Further hydrologic study will be required to determine the magnitude of run-off protection needed.

C. Plant Foundations

Most of the major structures will be founded on the San Mateo sand formation. It is estimated that this material, a well-graded, dense sand, will safely support a net unit foundation loading of at least 8,000 to 10,000 pounds per square foot at a depth of embedment of 4 to 6 feet. The determination of the net load at the foundation elevation should include an allowance for the reduction of intergranular pressure due to the removal of overlying soil.

To determine the maximum allowable soil bearing pressures for final design, it will be necessary to conduct a field load test at the depth and elevation of the proposed foundations.

It is probable that all major structures can be safely supported upon spread or small mat type footings. The silty inclusions within the sand formation appear to be of high strength, and they should not contribute a significant amount of footing differential settlement.

Foundation excavations for the containment sphere and for the screenwell and beach discharge structures will extend below the ground water level, and extensive well-pointing of these excavations will be necessary.

An allowance for transient seismic lateral acceleration of 0.20 g should be applied to the design loads imposed on all structures.

SECTION II - CONCLUSIONS AND DISCUSSION

The placement of riprap will be required for the protection of the lower elevation structures. Two sources of acceptable hard rock are Catalina Island and a quarry near Riverside. Placing riprap obtained from Catalina by barge would encounter the problem of near-shore, shallow water unloading conditions. Possible local quarries in the vicinity of Camp Pendleton should be investigated.

D. Cooling Water Conduits

The offshore sediments should present no unusual problem in the construction of the cooling water lines. The cobbles and sand described in Section III, B, can be easily jetted, and therefore, the installation of piles for the temporary trestle by concurrent jetting and driving should be effective. Excavation of the pipeline trench can be accomplished by the use of conventional equipment. The cobble blanket, however, might preclude the use of a dredge. It is anticipated that trench sideslopes will stand as steep as 3:1 or 4:1.

The distance offshore from the beach at Unit 1 to a bottom elevation of -30 MLLW is approximately 3,200 feet.

SECTION III - SITE DESCRIPTION

A. Onshore Area

1. Soil Description

The subsurface soils to the explored depth of 340 feet are composed of two major soil types that do not vary substantially over the entire site.

The surface material is a terrace deposit of gray-tan to brown, silty or clayey, well-graded sand in the upper portion that is slightly plastic with moderate cohesion. Penetration resistance measurements indicate the soil is moderately consolidated in-place. The dry shear strength is estimated to be high, however, upon saturation it could be expected to significantly decrease.

The 30-foot to 40-foot thick surface layer grades into a predominantly granular structure with several cobbly sand layers in the bottom 15 feet to 20 feet. The sands and cobbles are densely packed with possibly very light cementation.

The lower cobbly portion of the terrace materials forms a near horizontal contact with the underlying formation at about average elevation +45 MLLW.

Below the terrace deposits and extending to a probable depth of from 700 feet to 1,000 feet is the San Mateo sand formation. This material is composed of yellow, predominantly well-graded, medium to coarse sands with scattered pebbles. Within the massive sand structure are lateral variations or lenses of silty and fine sands to pebbly and gravelly sands.

The sands are dense to very dense with little cementation. Soil samples exhibit slight cohesion when moist, probably because of a trace of clay or silt binder, however, the sands washed-out easily during drilling.

A 20-foot thick pocket or inclusion of dark gray, silty to fine sandy, shaley material was encountered at elevation -58 MLLW in Hole 1. Penetration resistance measurements indicate this shaley silt is very stiff and is well-consolidated. Inclusions that vary in size from several inches to probably several tens of feet are characteristic of the massive San Mateo sand formation.

2. Ground Water

The present ground water level slopes downward from about elevation +10 MLLW at the highway to sea level at the beach. The average gradient is approximately one per cent.

SECTION III - SITE DESCRIPTION

The ground water level in Hole 1 at the center of the Unit 1 sphere presently stands at elevation +4 MLLW.

A water loss test was conducted in Hole 1 where 500 gallons of water were put into the hole at a rate of about 50 gpm. The water surface dropped rapidly to a stable level at elevation +5 MLLW, thus indicating the sands are quite pervious near the surface.

B. Offshore Area

The offshore sediments consist of a generally continuous gravel through boulder blanket that is underlain by sand.

The surface layer of tightly packed gravels, cobbles and boulders appears to vary in thickness from one foot to three feet with possibly local pockets up to 10 feet in depth. A thin layer of sand covers much of the rock blanket.

The underlying sand to the investigated depth of 30 feet appears to consist of several feet of sediment resting upon the San Mateo sand formation. No important physical difference between the consolidated sediment and the San Mateo is evident. Both sands were easily probed with a one-inch diameter, high pressure, jet pipe.

No bedrock or other obstruction to penetration was encountered within the area where offshore facilities would be constructed.

SECTION IV - REVIEW OF CONTRACT SERVICES

A. Onshore Exploratory Drilling

The onshore exploratory drilling was performed by the J. L. Helton Drilling Company using a Failing 1500, rotary, wash boring drill rig. Four 8-inch diameter borings were made using drilling mud to keep the holes open.

The boring locations and depths are summarized below:

Boring No.	Location	Elevation at Surface MLLW	Depth Ft.
1	Unit 1 sphere	+28	295
2	Switchyard area	+98	155
3	Unit 4 sphere	+97	340
4	Unit 1 sphere	+35	140

Undisturbed and mason jar soil samples were taken for visual inspection and for possible future laboratory testing.

A 3-inch diameter Pitcher Sampler was used to obtain the undisturbed samples, and the jar samples were taken with the Edison split-tube drive sampler.

The field logs of the exploratory borings are included in the Appendix.

B. Offshore Jet Probes

The offshore jet probing was performed by the Pacific Towboat and Salvage Company using both a 2-1/2 inch diameter and a 1-inch diameter jet pipe. The pump pressure varied up to about 150 psi at a flow of approximately 400 gpm.

The probe locations and depths are summarized below:

Probe No.	Jet Diameter	Unit No.	Distance Offshore ft	Depth of Water ft	Depth of Penetration ft
1	2-1/2	1	2300	28	12
2	2-1/2	1	2150	25	8
3	2-1/2	1	2150*	24	5
	*50' downcoast from Probe 2				
4	2-1/2	1	3300	30	30
4a	2-1/2	1	3310	30	45
5	1	4	1600	20	30
6	1	4	2100	24	30
7	1	4	2875	30	25
8	1	1	2000	26	29

SECTION IV - REVIEW OF CONTRACT SERVICES

The working ship was a converted Navy Net-tender 160 feet long with a draft of about 15 feet.

Probe locations were determined by measuring horizontal angles between shoreline targets with a sextant.

C. Offshore Geologic Survey

The offshore geologic mapping was performed by General Oceangraphics from San Diego, California. The ocean floor was explored by SCUBA equipped diving geologists, and an acoustic reflection device, called a Sono-Probe, was used to obtain a profile of the shallow marine sediments.

Reference is made to their report entitled "Sea Floor Geology and Sono-probe Survey of an Area Off San Onofre, California" and dated October 21, 1962.

D. [illegible]al Topographic Mapping

[illegible]nshore topographic maps, drawing numbers 8409 and 8410, were [illegible]ared by Pafford & Associates utilizing aerial photography along [illegible] supplemental ground plane table mapping where necessary along [illegible]bluffs.

[illegible]ontal and vertical ground control were established by reference [illegible]arby state highway and U.S.C. & G.S. triangulation stations and [illegible]marks.

[illegible]line targets set for the aerial photography were used for both [illegible]ontal and vertical control of all onshore and offshore explora- thereby providing a uniform datum for correlation.

E. [illegible]graphic Survey

[illegible]ydrographic mapping was done by Pafford & Associates utilizing both [illegible]d in shallow water with readings being taken from onshore and an [illegible]ctronic sounding device in water over 12 feet in depth.

The offshore ground contours are shown on drawing E-17284, Site Hydrography.

E. E. Chandler

E. E. Chandler
Assistant Civil Engineer

Approved:

J. A. Randall
Senior Civil Engineer
EEC:mh

APPENDIX

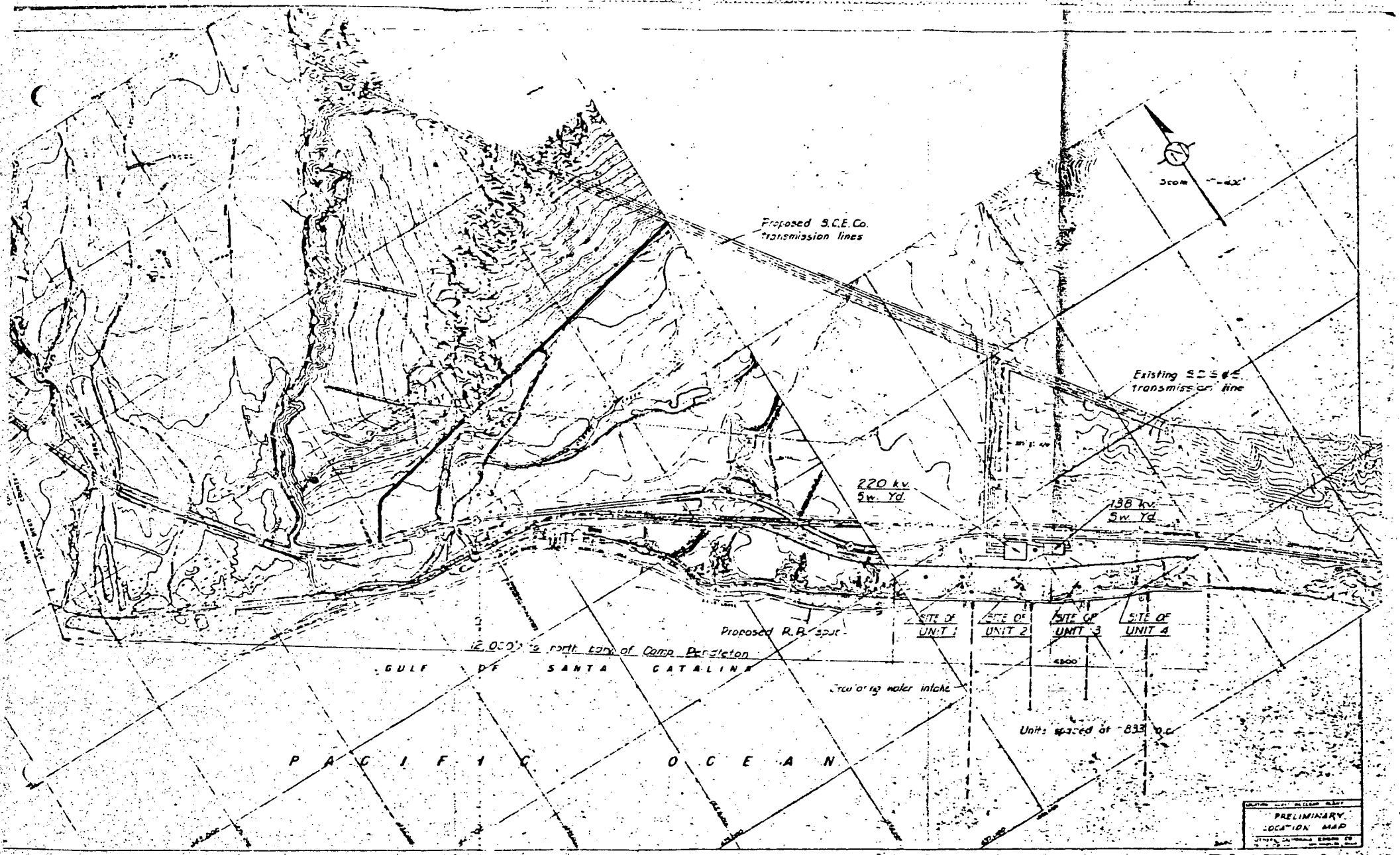
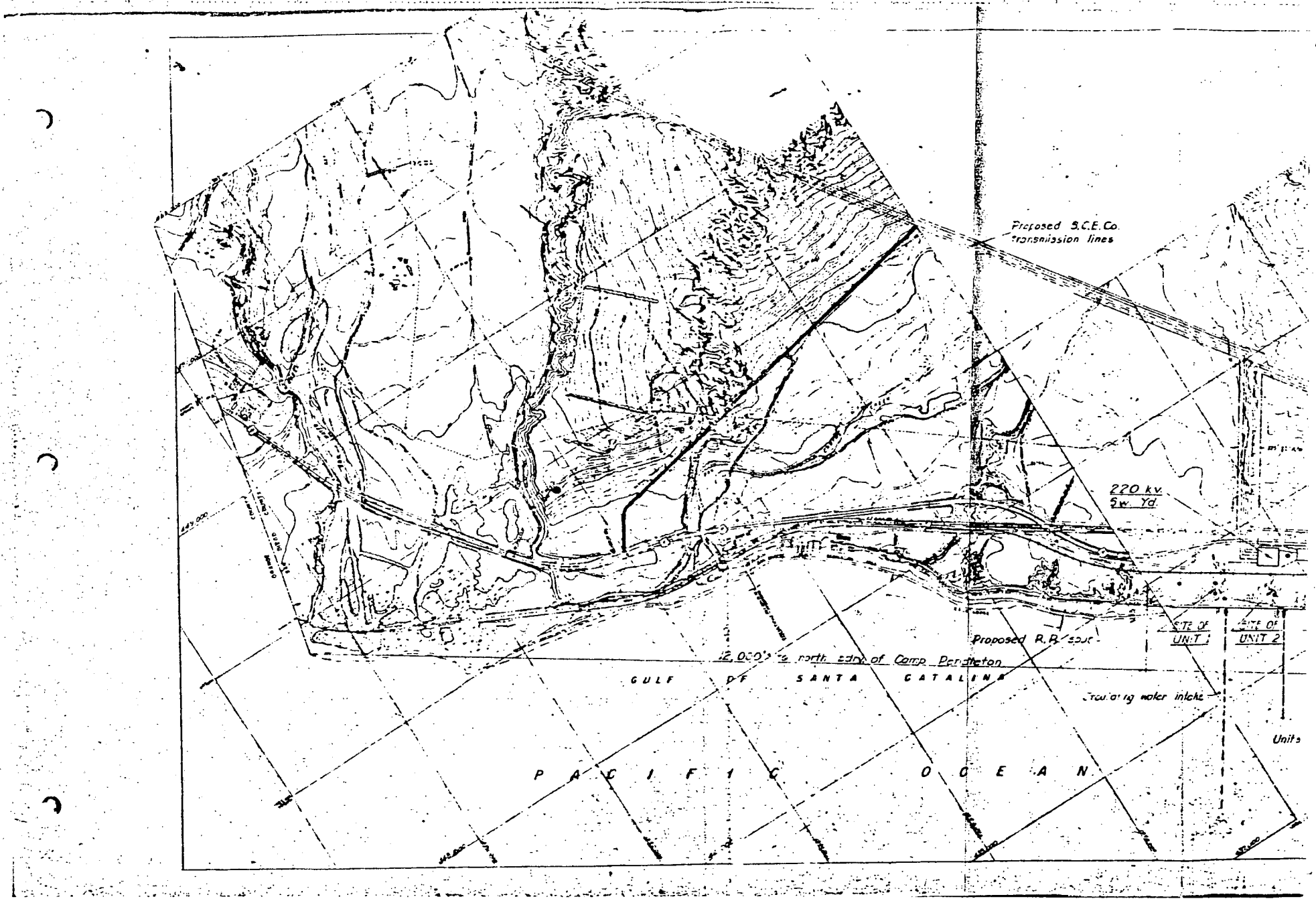
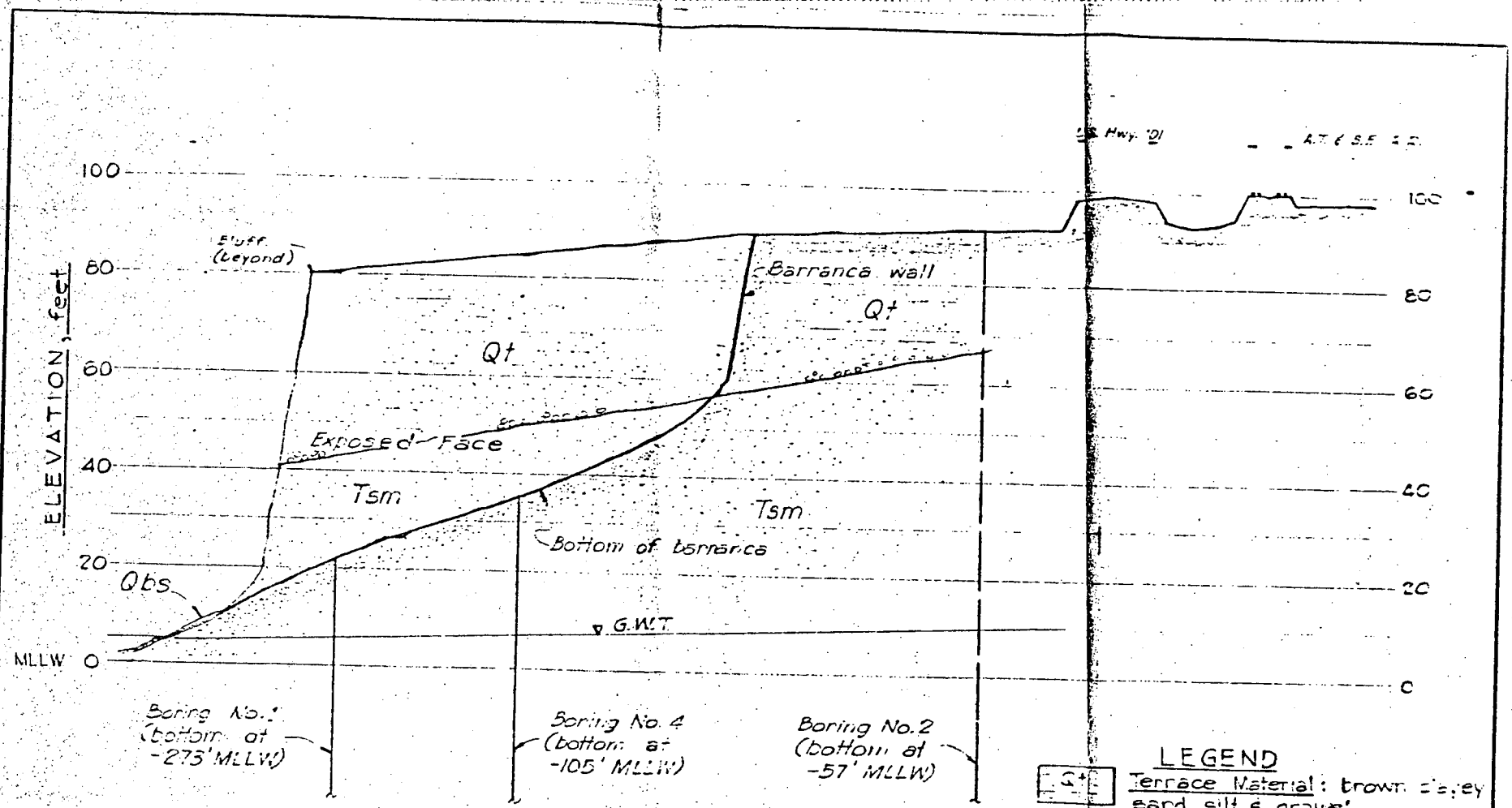

Proposed S.C.E.Co. transmission lines
Existing S.C.S.&E. transmission line
220 kv Sw. Yd
138 kv Sw. Yd
SITE OF UNIT 1
SITE OF UNIT 2
SITE OF UNIT 3
SITE OF UNIT 4
Proposed R.R. spur
12,000'± north easterly of Camp Pendleton
GULF OF SANTA CATALINA
Traveling water intake
Units spaced at 833' o.c.
PACIFIC OCEAN
PRELIMINARY LOCATION MAP

PLATE 1


Proposed S.C.E.Co.
transmission lines
220 kv
Sw. Yd.
SITE OF
UNIT 1
SITE OF
UNIT 2
Proposed R.R. spur
2,000's north entry of Camp Pendleton
GULF OF SANTA CATALINA
Circulating water intake
Units
PACIFIC OCEAN



LEGEND

Qt — Terrace Material: brown clayey sand, silt & gravel.

Tsm — San Mateo fm.: dense, coarse, yellow sand.

Qbs — Beach Sand: fine & medium clean sand.

Scale: Vertical 1"=20'
Horiz. 1"=100'

DRWG NO.	DESCRIPTION	NO	REVISIONS	DATE	APPROVED	O.K.	O.K.	CHECKED	DRAWN	J.O. NO	
	CROSS REFERENCES			11-7-62						EMF 4620	

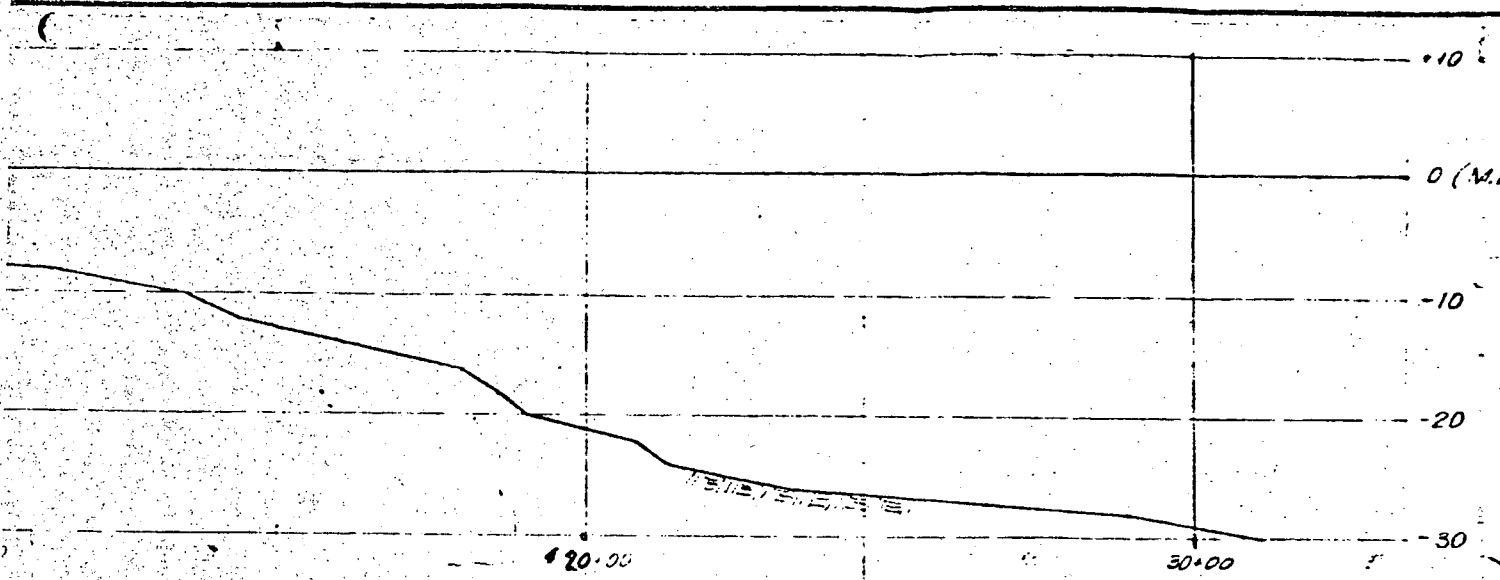
DESIGNED TRACED COMPARED

LOCATION COAST NUCLEAR STATION

Projected Geologic Cross Section At Unit No. 1

SOUTHERN CALIFORNIA EDISON COMPANY

PLATE 3



PROFILE

Scale: Vert. 1" = 20'
Horiz. 1" = 200'

Note: Plotted from survey by Pafford & Associates dated October 1962

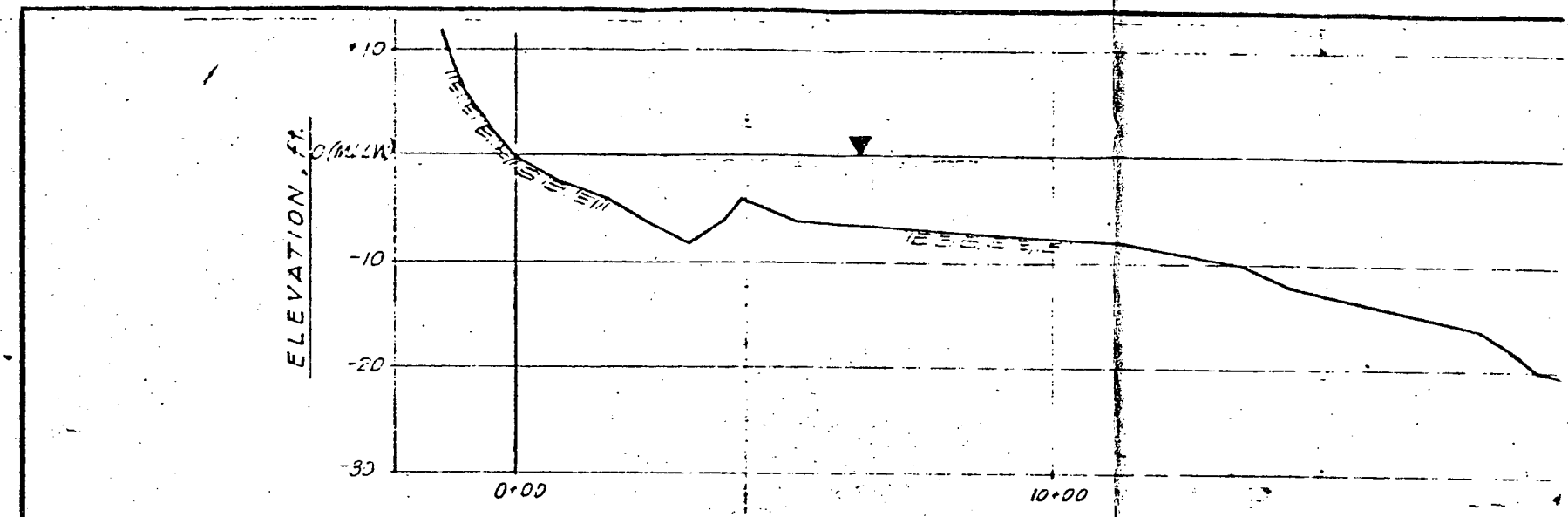
O.K.	O.K.	CHECKED	MADE	J.O.No	NO	REVISIONS	DESIGNED	TRACED	COMPARED	DATE	APPROVED	O.K.	O.K.	CHECKED	MADE	J.O.No.
														EAC	D.M.S.	4520

LOCATION COAST NUCLEAR STA.

OFFSHORE PROFILE
ALONG ℄ OF UNIT NO 1

SOUTHERN CALIFORNIA EDISON COMPANY
SCALE NOTED LOS ANGELES, CALIF.

PLATE 4



PROFILE

Scale: Vert. 1" = 2'
Horiz. 1" = 200'

DRWG. NO.	CROSS REFERENCES	NO.	REVISIONS	DATE	APPROVED	O.K.	O.K.	CHECKED	MADE	J.O.No	NO. DESIGNED

MEMORANDUM

Mr. R. W. Spencer
Manager of Engineering Department

Subject: Geologic Reconnaissance of San Onofre Beach and Vicinity--
Coast Steam Station Project, Site C

1. PURPOSE

On January 6, 1961, Mr. Cail Hunt and the writer made a geologic reconnaissance investigation of the coastal strip between the vicinity of the recreational area at San Onofre Beach and a point located 2.6 miles to the southeast.

The purpose of the investigation was to develop conclusions regarding the suitability of an area within this region for the possible location of a major steam generating station. Earlier observations there by Mr. R. W. Spencer indicated that (1) the 4.5-mile coastal strip between a point located 2.1 miles southeast of the center of San Onofre Valley and a point immediately down coast from Horno Canyon, had in most places been seriously affected by landsliding, and (2) the coastal section upcoast from the slide area appeared to lack any evidence of sliding or disruption by possible other causes.

2. FIELD INVESTIGATION

The inspection involved traversing by foot 1.8 miles in a southerly direction along the top of the sea cliffs, and 2.6 miles in a northerly direction along the beach at the base of the cliffs. Several of the largest barrancas, eroded into the bluffs, were entered from the beach, and the exposed walls were examined. An opportunity was afforded to view the landward portions of the barrancas during the traverse along the crest of the bluffs.

3. OBSERVATIONS (Refer to attached Index Map)

After traversing along the crest of the bluffs, the active slide area, previously referred to, was entered from the Pacific Coast Highway through a barranca which had been eroded headwardly to the Highway, (Point A). At a location about midway between the highway and the sea, it was observed that the Pleistocene terrace materials, which comprise the upper 30-40 feet of the San Onofre Bluffs, are directly underlaid by the Lower Unit of the Capistrano formation of Lower Pliocene age. This unit consists of grey to brown fissle shale with interbedded thin, greenish clays and poorly cemented to cemented fine sandstone.

A similar stratigraphic sequence also was noted to exist along the coastline northwesterly of the barranca over a distance of slightly in excess of 0.8 miles, (to Point B). The massive, yellow-brown sands of

the Middle Pliocene San Mateo formation are noticeably absent within this reach, however, upcoast from Point D within the coastal strip investigated (to near San Onofre Village), the terrace materials are everywhere underlaid by the San Mateo sands.

Within the slide area down coast from Point D, there are evidences of both deep-seated and shallow, active landsliding. Evidences of complex, deep-seated sliding there, include the presence in the surf zone of (1) contorted and locally sheared landward dipping Capistrano beds which vary through some 90° of strike, and which dip steeply from about 20°-30° to nearly vertical, and (2) down-dropped blocks of Pleistocene terrace materials which are now being actively bevelled seaward and spread along deep surfaces of rupture. The general hummocky nature of the surface inland from the surf zone and the presence of springs and phreatophytes are also evidences of land slide phenomena. The slide areas are also generally marked by the presence of cobbles in the surf zone. The cobbles were derived from the Pleistocene strand-line and terrace materials which have been down-dropped by slide activity, and which have been subsequently subjected to beach erosion.

Local shallow slumping of the terrace materials has eroded portions of the old slide mass, which in places extends inland from the coastline as much as 500 feet.

At Point D, the slide area, underlain by the contorted Capistrano formation shales, terminates abruptly against the stable-appearing San Mateo formation. The termination is clearly marked by the presence there of a northeasterly trending inactive fault. At the bench the fault plane strikes N 57° E and dips 72° NW. The fault plane, along which the Pliocene formations are offset, was truncated by post-faulting erosion and in turn the truncated erosional surface was covered by horizontal Pleistocene strand-line and terrace deposits. Thus it appears that the shale Capistrano formation has been up-thrusted into fault contact with the younger San Mateo formation by post-San Mateo, pre-Pleistocene normal faulting. Following or during such period of activity and prior to the time of Pleistocene terrace deposition, the up-faulted San Mateo sands down coast from the fault zone were completely removed by erosion.

Near the fault zone are several subsidiary, minor normal faults in the San Mateo sands. In the Capistrano formation are contorted, highly fractured, slickensided beds which appear to represent deep folding in the relatively incompetent shales. Such minor faulting and folding were undoubtedly associated with the interformational faulting.

Upcoast from the fault zone (Point D) to the northern end of the bluff near San Onofre Beach (Point C), and undisturbed sequence of Pleistocene terrace materials overlying massive, uniform San Mateo sands, is present. Careful inspection of the surf zone, sea cliff face, and barranca walls indicated the manifest stability of that reach since evidences of deep-seated sliding or faulting are completely absent.

CONCLUSIONS AND [illegible]

1. Southeast or down coast from Point D, surface observations indicate that the coastal strip investigated has been subjected to more or less continuous deep landsliding for many years.

2. Zones where deep sliding has occurred along that portion of the coastline are restricted to those locations where Pleistocene terrace deposits rest directly upon weak and incompetent strata within the Capistrano formation.

3. Apparently, surcharge loading of these weak materials caused by deposition of the terrace materials and subsequent erosion at the base of the sea cliffs have introduced [illegible] conducive to unfavorable slope conditions. In addition, sliding [illegible] by lubrication of the Capistrano shales caused by the [illegible] of ground water. Actual trigger action causing initiation of sliding may have been due to vibration resulting from wave action on the beach.

4. Because of the existing and potential [illegible] of deep-seated slide activity and the compressible nature of the [illegible] underlying the slide mass, such area is unfavorable for the [illegible] of a major structure.

5. Northwest or upcoast from Point D the face of the sea cliffs and the walls of barrancas [illegible] San Mateo formation sands and Pleistocene terrace [illegible] Foundation materials exposed along that [illegible] location of a major structure. Accordingly, it appears that any [illegible] selected between San Onofre Beach and the northern limit of the slide zone (Point D) would be favorable for the construction of a major [illegible] station.

It is recommended, however, that if [illegible] consideration is given to the selection of a site, preliminary foundation drilling should be accomplished to confirm the nature of the subsurface materials.

6. A favorable site located within the [illegible] approximately midway between the San Onofre recreation beach and the [illegible] boundary of the slide zone and having a [illegible]-foot beach [illegible], would have an average property depth of 900-1,000 feet between the shoreline and the Coast Highway, (see Map--Site C). The center of such site is 1.[illegible] miles from the center of San Onofre Village, 3.5 miles from the entrance to San Clemente State Park, and 5.2 miles from the center of the City of San Clemente.

7. San Onofre Beach is recognized for its excellent board surfing due to the build-up of wave-trains far offshore. Such occurrence indicates the presence there of very shallow offshore conditions. Accordingly, site location studies in the vicinity of San Onofre Beach, should at an early date, include determinations of the configuration of the offshore submarine profile and the nature of underlying materials as they may affect the location and construction of cooling-water pipelines.

[signature]
[illegible]
Engr. Geologist

[illegible]
[illegible] W. West (2)

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/18/62 — SHEET 1 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER Helton, Hize, Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES					SAMPLES		DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		100'± in from high tide line Center cat-road, bottom barranca.
							0	
							1	Rounded gravel and cobbles to 12" diameter, hard, loosely packed in coarse sand matrix. Many colors - mostly fine grained. Terrace materials washed into barranca.
							2	
							3	
							4	
							5	Coarse sand, uniform, sub-angular to sub-rounded, yellow-tan. Possibly lightly cemented. Cannot identify water table.
					Wash water sample		6	
							7	
							8	
							9	San Mateo Formation.
							10	
							11	
							12	
							13	
							14	Large cobble following down in hole. Cannot sample.
							15	
							16	
							17	
							18	
							19	

REMARKS: Using new tri-cone rock bit.

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/19/62 — SHEET 2 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES					SAMPLES				DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS		UNDIST.	BAG	JAR	*		
									20	
									21	Large cobble from above
									22	
									23	
									24	
									25	San Mateo Formation
									26	Coarse sand, with some well-graded fine to medium, sub-angular to sub-rounded, yellow-tan, dense. Scattered pebbles.
									27	
									28	
									29	
									30	
									31	
									32	Broke large cobble hole.
									33	
									34	Pitcher sampler. Cored 30" only. Sand appears dense in tube. Sample put in jar.
									35	
									36	Very dense, wet.
									37	A one-inch gravel in tube.
									38	
				20/8					39	8" penetration - bouncing

REMARKS: *Cumulative blow count for 2" cone generometer, 140 16 weight dropping 30".

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/19/62 — SHEET 3 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES: WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	SAMPLES: BAG	JAR	DEPTH FEET	FIELD DESCRIPTION
							40	
							41	
							42	Drilling time 2' per min. Heavy steam pressure - normal pump circulation.
							43	
							44	
							45	
							46	San Mateo Formation
							47	
							48	
							49	
							50	
Wash water sample							51	Coarse sand with scattered pebbles
							52	
							53	
							54	
							55	
							56	
							57	
							58	
							59	
							60	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/19/62 — SHEET 4 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							60	
							61	
							62	
							63	
							64	
							65	
							66	
							67	San Mateo Formation
							68	
							69	
							70	
Wash water sample								Coarse sand with scattered pebbles, very dense.
							71	
							72	
							73	
							74	
							75	
							76	
							77	
							78	
							79	
							80	Trace of silt.slight cohesion.

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/19/62 — SHEET 5 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary Wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES: WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	SAMPLES: UNDIST.	BAG	JAR	DEPTH FEET	FIELD DESCRIPTION
							80	
Pitcher sampler 26" sample							81	
							82	Silt gray, moist, cohesive, slightly plastic, very stiff. Contains some very fine sand.
							83	
							84	
50 blows/2 inches						50	85	
							86	
							87	
							88	
							89	
							90	Possible thin layers of fine sand, drills like cohesive soil, however stem momentarily advances faster.
							91	
							92	
							93	
							94	
							95	Very stiff
							96	Drilling time 3 min./ft.
							97	
							98	Silt squeezing in at about 85 feet. Difficult to remove drill stem.
							99	

REMARKS: Penetration resistance. See sheet 2.

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/19/62 — SHEET 6 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							100	
Split tube sampler							101	Silt with streaks of fine sand Silty fine sand**
							102	
							103	**Pieces of sand break along random planes. Shaley structure.
							104	
							105	
							106	
							107	
							108	
							109	
							110	
Pitcher sampler 24" sampler							111	San Mateo Formation
							112	Well-graded medium sand, yellow-gray, wet, very dense. Some grains appear to break down when wet and rubbed between fingers.
							113	
							114	
							115	
							116	Drills easily indicating soil is granular.
							117	
							118	
							119	
							120	

REMARKS: **Fine sand is very dense. Appears to have random fracture type structure, possibly indicating shear stress and movement. May have been distrubed during sampler driving.

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 DATE DRILLED 9/19/62 SHEET 7 OF 15

PROJECT Coast Nuclear Site C EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							120	
Pitcher sampler 30" sample							121	Medium to coarse sand, yellow, wet, very dense. Appears lightly weathered or disintegrated. High quartz content.
							122	
				1			123	
Penetration 2"						50	124	San Mateo Formation
							125	
							126	
							127	
							128	
							129	
							130	
							131	
							132	
							133	
							134	
							135	
							136	
							137	
							138	
							139	
							140	

REMARKS: *Static water level 11' below 6.5. on 9/20/62 8:30 AM - Penetration Test - 140# hammer with 30" drop on 2" cone penetrometer

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/20/62 — SHEET 8 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash bore

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION 22+ MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER C. Vize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							140	Medium to coarse sand, yellow, saturated, very dense, almost pure quartz with some dark rock fragments and some mica
							141	
							142	
							143	
							144	
							145	
							146	
							147	
							148	Same as above
							149	
							150	
							151	
							152	
							153	
							154	
							155	
							156	
Split tube							157	Sample lost
350	12	6"	110				158	Sand very dense at 158-1/2 penetration with pitcher sampler very slow.
Pitcher Sample 24"							159	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/20/62 — SHEET 9 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash bore

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES: WEIGHT POUNDS	UNDISTURBED SAMPLES: DROP INCHES	UNDISTURBED SAMPLES: INCHES DRIVEN	UNDISTURBED SAMPLES: TOTAL BLOWS	SAMPLES: UNDIST.	SAMPLES: BAG	SAMPLES: JAR	DEPTH FEET	FIELD DESCRIPTION
							160	San Mateo Sand fine to coarse grained, very dense, saturated, mostly quartz
							161	
							162	
							163	
							164	
							165	
							166	
							167	
							168	
							169	Drill rate 1 min. per foot ±
							170	
							171	
							172	
							173	Wash water sample
							174	San Mateo Sand
							175	
							176	
							177	
							178	
							179	
							180	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/20/62 — SHEET 10 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash bore

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							180	
							181	
							182	
							183	
							184	Drilling between 1 and 1-1/2 ft. per min.
							185	
							186	
							187	
							188	San Mateo Formation
							189	
							190	
							191	
							192	
							193	
							194	
							195	
							196	
							197	
							198	
							199	
							200	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/20/62 — SHEET 11 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash bore

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							200	
							201	San Mateo Sand, Light yellow, very dense, saturated, mostly medium & coarse, rounded to subangular grains almost all quartz
Pitcher Sampler 29"				I			202	
							203	
							204	Cobble at 204
							205	
							206	
							207	
							208	
							209	
							210	
							211	
							212	
							213	
							214	
							215	
							216	
							217	
							218	Probable medium to large gravel or small cobbles 218-220
							219	
							220	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/20/62 — SHEET 12 OF 15

PROJECT Coast Nuclear Site — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							220	
Wash water sample								
							221	
							222	Start large gravel or small cobble.
							223	
							224	No gravel fragments found in wash water. Still San Mateo sand.
							225	
							226	
							227	Out of cobbles or large gravel.
							228	
							229	This gravel or cobble layer easy drilling.
							230	
							231	
							232	
							233	
							234	
							235	
							236	Out of cobbles or coarse gravel
							237	Drilling 1 ft. per min.
							238	
							239	
							24	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/20/62 — SHEET 13 OF 15

PROJECT Coast Nuclear Site — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							240	Still San Mateo Sand
							241	
							242	
							243	
							244	
							245	
							246	
							247	San Mateo Formation
							248	
							249	Medium to coarse sand, yellow-tan, very dense
							250	
							251	
							252	
							253	
							254	
							255	
							256	
							257	
							258	
							259	
							260	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/21/62 — SHEET 14 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +22 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE 17' — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR C.S.H. & W.E.L.

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							260	
							261	San Mateo Sand
							262	
							263	
							264	
							265	
							266	
							267	Sand has some binder, very little mud used in the hole.
							268	
							269	
							270	
							271	
							272	
							273	
							274	
							275	
							276	
							277	
							278	
							279	
							280	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 1 — DATE DRILLED 9/21/62 — SHEET 15 OF 15

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION + 22 MLLW — CONTRACTOR J. L. Melton Co.

DEPTH TO WATER TABLE 17' — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR G.S.H. & W.E.L.

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							280	
								San Mateo Sand, well-graded fine to coarse, very dense, some binder, light yellow color, some small gravel pieces, mostly pure quartz.
							281	
							282	
							283	
							284	
							285	
							286	
							287	
							288	
							289	
							290	
							291	
							292	
							293	
							294	
							295	
								Bottom

Pitcher 24" sample

REMARKS: 100' of 2 inch diameter plastic piezometer tube with bottom 20' perforated placed in hole.

NOTE: On 10/2/62 put 500 gallons of clean water in hole at rate of about 50 gpm. Could not fill hole. Water level was raised 6" then rapidly dropped to the stable depth of 17 feet.

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 2 — DATE DRILLED 9/24/62 — SHEET 1 OF 3

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Center switchyard area — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +9' MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Hize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

Approx. 200' west of highway.

UNDISTURBED SAMPLES					SAMPLES		DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							0	Thick weed ground cover
							1	
							2	
							3	
							4	
							5	Silty or clayey, well-graded sand, gray-tan slightly plastic, moderate cohesion, moist, dense or stiff. Coarse sand to pebble size are subangular dark mineral.
							6	
							7	
						15		
						35	8	
						54		
						74	9	
							10	
							11	
							12	
						9		Compact to dense
						23	13	
						38		
						53	14	
							15	
							16	
							17	
							18	
							19	8" to 10" gravel or cobble layer
							20	

REMARKS: *Cumulative blow count using 2" cone penetrometer, 140 16 weight falling 30".

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 2 — DATE DRILLED 9/28/62 — SHEET 2 OF 8

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Center switchyard area — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +98 MLLW — CONTRACTOR J. D. Helton Co.

DEPTH TO WATER TABLE — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							20	
375	18	12	25				21	Fine to medium sand, tan, clean, damp, dense
Split tube							22	
							23	Becoming slightly cohesive. Small amount of silt in wash water.
							24	
							25	
							26	Gravel or cobbles
							27	Sand
							28	
							29	Cobbles - 3" to 4"
							30	Alternating layers of sand and gravel or cobbles.
							31	Large cobble in hole
							32	
Wash water sample							33	Subangular to subrounded gravel up to 1" size along with rock chips in wash water. Many colors - predominantly dark.
							34	
							35	
							36	
							37	
							38	Drilling smooth but in hard rock - either large, boulder or possibly San Onofre Breccia.
							39	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 2 — DATE DRILLED 9/25/62 — SHEET 3 OF 8

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Center switchyard area — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +98 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							40	Drilling smoothly in medium hard rock. Rock chips - dark minerals in wash water.
							41	
							42	
							43	Sandy
							44	
Split tube							45	Well-graded, medium to coarse sand, yellow-tan, small amount clay binder, moist, dense.
375	18	4	47 Lost				46	
Pitcher sample							47	
							48	
							49	
							50	
							51	San Mateo Formation
							52	
							53	
							54	
							55	6"-8" layer rounded gravel or small cobbles.
							56	
							57	
							58	
							59	
							60	

REMARKS: When coming in and out of hole bit catches on boulder or large gravel at depth 38 feet. Spent several minutes each time in and out reaming hole.

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 2 DATE DRILLED 9/25/62 SHEET 4 OF 8

PROJECT Coast Nuclear Site C EXPLORATION METHOD Rotary wash

LOCATION Center switchyard area SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +98 MLLW CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							60	
							61	
							62	
							63	
							64	Medium to coarse sand, yellow-tan, very dense
							65	
							66	
							67	San Mateo Formation
							68	
							69	
							70	
							71	
							72	
							73	
							74	
							75	
							76	Split tube sampler caught in hole - wedged in by cobbles or boulder from above. Recovered after 2 hours working.
							77	
							78	
							79	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 2 — DATE DRILLED 10/25/62 — SHEET 5 OF 8

PROJECT Coast Site C — EXPLORATION METHOD Rotary wash

LOCATION Switchyard area — SIZE OF HOLE 8" diameter

GROUND ELEVATION +98 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							80	Undisturbed sampling discontinued because of cobbles from layer at top of San Mateo formation. Sampling may cause loss of sampler.
							81	
							82	
							83	
							84	
							85	
							86	
							87	
							88	
							89	
							90	90'-100' wash water sample San Mateo formation: Well-graded, fine to coarse sand, very dense, yellow, some binder.
							91	
							92	
							93	
							94	
							95	
							96	
							97	
							98	
							99	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 2 — DATE DRILLED 10/26/62 — SHEET 6 OF 8

PROJECT Coast Site C — EXPLORATION METHOD Rotary wash

LOCATION Switchyard area — SIZE OF HOLE 8" diameter

GROUND ELEVATION +98 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							100	
							101	
							102	
							103	
							104	
							105	San Mateo Formation
							106	
							107	
							108	
							109	
							110	
							111	
							112	
							113	Drilling rate, 1-1/2 ft./min.
							114	
							115	
							116	
							117	
							118	
							119	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 2 — DATE DRILLED 10/26/62 — SHEET 7 OF 8

PROJECT Coast Site C — EXPLORATION METHOD Rotary wash

LOCATION Switchyard area — SIZE OF HOLE 8" diameter

GROUND ELEVATION +98 MLLW — CONTRACTOR J. L. Melton Co.

DEPTH TO WATER TABLE - — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							120	
							121	
							122	San Mateo Formation. Well-graded fine to coarse sand, yellow, saturated, very dense, easy drilling, some binding.
							123	
							124	
							125	Only 1 sack of mud used in this hole.
							126	
							127	
							128	
							129	
							130	
							131	
							132	
							133	
							134	
							135	
							136	
							137	
							138	
							139	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 2 — DATE DRILLED 10/25/62 — SHEET 8 OF 8

PROJECT Coast Site C — EXPLORATION METHOD Rotary wash

LOCATION Switchyard area — SIZE OF HOLE 8" diameter

GROUND ELEVATION +98 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE -- — DRILLER G. Mize

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Hunt

UNDISTURBED SAMPLES: WEIGHT POUNDS	UNDISTURBED SAMPLES: DROP INCHES	UNDISTURBED SAMPLES: INCHES DRIVEN	UNDISTURBED SAMPLES: TOTAL BLOWS	SAMPLES: UNDIST.	SAMPLES: BAG	SAMPLES: JAR	DEPTH FEET	FIELD DESCRIPTION
							140	
							141	San Mateo Formation.
							142	
							143	
							144	
140-150 Washed sample							145	
							146	
							147	
							148	
							149	
							150	
							151	
							152	
							153	
							154	Very dense.
							155	
								Bottom
								100 feet of 2 inch diameter plastic tubing with the bottom 20' perforated were placed in the hole.

REMARKS: Water level 33' below top of ground surface 1 hour after completion.

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 — DATE DRILLED 2/27/62 — SHEET 1 OF 10

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION + 97 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE — DRILLER Mize & workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	*	FEET	
								0	Heavy weed cover
								1	
								2	
								3	
								4	
								5	Sandy silt, gray-tan to brown, slightly plasti moderate cohesion, moist, stiff. Sands are well-graded fine to coarse with scattered pebbles
								6	
								7	
								8	
								9	
								10	
								11	
								12	
			25						Stiff to very stiff.
			53					13	
			78						
			99					14	
								15	
									Probable thin layers of sand.
								16	
								17	
								18	
								19	Becoming granular
								20	

REMARKS: *Cumulative blow-count using 2" diameter cone penetrometer, 140 lb. weight falling 30".

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 — DATE DRILLED 9/27/62 — SHEET 2 OF 10

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION ____ +97 MLLW — CONTRACTOR J. L. Helton Company

DEPTH TO WATER TABLE ____ ---- — DRILLER Mize & workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES: WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	SAMPLES: UNDIST.	BAG	JAR	DEPTH FEET	FIELD DESCRIPTION
							20	
								Scattered small gravel
							21	
							22	Fine to medium sand, tan, damp, dense.
Split tube lost							23	
							24	
							25	
							26	
								Slight cohesion
							27	
							28	
						50		
							29	
							30	Medium to coarse sand, yellow-tan, very dense. Occasional pebble layers, Very dense.
							31	
							32	
							33	
							34	
							35	Cobbles, probably gravel to small boulders. Appears to be densely packed.
							36	
							37	Medium to coarse sand, yellow, very dense.
							38	
							39	
								San Mateo Sand Formation

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 — DATE DRILLED 9/27/62 — SHEET 3 OF 10

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +97 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES: WEIGHT POUNDS	UNDISTURBED SAMPLES: DROP INCHES	UNDISTURBED SAMPLES: INCHES DRIVEN	UNDISTURBED SAMPLES: TOTAL BLOWS	SAMPLES: UNDIST.	SAMPLES: BAG	SAMPLES: JAR	DEPTH FEET	FIELD DESCRIPTION
							40	
							42	
							44	
							46	
							48	San Mateo Sand Formation Well-Graded Sand, yellow, very dense. Appears to grade in and out of fine to medium and medium to coarse sands with scattered pebbles. Little gravel.
							50	
							52	
							54	
							56	
							58	
							60	
							62	
							64	Average drilling rate: 1 min/ft.
							66	
							68	
							70	
							72	
							74	
							76	
							78	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 — DATE DRILLED 9/27/62 — SHEET 4 OF 10

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +97 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE — DRILLER Mize & workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	MOIST.	BAG	JAR	FEET	
							80	
							82	
							84	
							86	
							88	
							90	
							92	San Mateo Sand Formation Predominantly medium to coarse sand with occasional pebbly layers, yellow, very dense.
							94	
							96	
							98	
							100	
							102	
							104	
							106	
							108	
							110	
							112	
							114	
							116	
							118	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 — DATE DRILLED 9/28/62 — SHEET 5 OF 10

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +97 MLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE — DRILLER Mize & workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES: WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	SAMPLES: UNDIST.	BAG	JAR	DEPTH FEET	FIELD DESCRIPTION
							120	
							122	
							124	
							126	
							128	
							130	San Mateo Sand Formation Well-graded sands, with occasional pebbly layers, yellow, very dense.
							132	
							134	
							136	
							138	
							140	
							142	
							144	
							146	
							148	
							150	
							152	
							154	
							156	Typical San Mateo sand.
							158	

REMARKS:

Pitcher sample

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 — DATE DRILLED 9/28/62 — SHEET 6 OF 10

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +97 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							160	
							162	
							164	
							166	
							168	
							170	San Mateo Sand Formation Well-graded sands with occasional pebbly layers, yellow, very dense.
							172	
							174	
							176	
							178	
							180	
							182	Average drilling rate: 1 min/ft.
							184	
							186	
							188	
							190	
							192	
							194	
							196	
							198	
							200	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 — DATE DRILLED 9/28/62 — SHEET 7 OF 10

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere — SIZE OF HOLE 6-inch diameter

GROUND ELEVATION +97 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							200	
Wash water sample						↕	202	Several 1" to 3" layers of silty sand, tan, moist, very dense, depth 209' to 215'. Slight cohesion.
							204	
							206	
							208	
							210	
							212	
							214	San Mateo Sand Formation Predominantly medium to coarse sand, yellow, very dense. High in quartz.
							216	
							218	
							220	
							222	
							224	
							226	
							228	
							230	
							232	
							234	
							236	
							238	
							240	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 DATE DRILLED 10/1/62 SHEET 8 OF 10

PROJECT Coast Nuclear Site C EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +97 MLLW CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - DRILLER Mize & workman

DEPTH TO TOP OF SOLID ROCK Not encountered INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							240	
							242	
							244	
							246	
							248	San Mateo Sand Formation
							250	
							252	
							254	
							256	
							258	
							260	Several thin streaks of silty sand, tan, stiff, 263'-290'.
							262	
Split tube							264	Very dense
375	18	6	100				266	
Lost							268	
							270	
							272	
							274	
							276	
							278	
							280	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 — DATE DRILLED 10/1/62 — SHEET 9 OF 10

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +97 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES					SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS		UNDIST.	BAG	JAR		
								280	
								282	
								284	
								286	San Mateo Sand Formation
								288	
								290	
								292	
								294	
								296	Occasional thin layers of pebbly to small gravelly sand, 295' to 305'.
								298	
								300	
								302	
								304	
								306	Medium to coarse sand in wash water. Very dense, however drills easily with heavy wash pipe load and normal pump pressure.
								308	
								310	
								312	
								314	
								316	
								318	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 3 — DATE DRILLED 10/1/62 — SHEET 10 OF 10

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 4 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION ____ +97 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE ____ - — DRILLER Mize & workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							320	
							322	San Mateo Sand Formation Well-graded medium to coarse sand, yellow, very dense.
							324	
							326	
							328	
							330	
							332	
							334	Average drilling rate: 1 min./ft.
							336	
							338	
							340	Bottom

NOTE: Installed 100' of 2" PVC plastic pipe with lower 20' perforated after flushing hole with approximately 200 gallons of clean water.

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 4 — DATE DRILLED 10/2/62 — SHEET 1 OF 7

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +35 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							0	Approx. 150' inland from Hole 1 Center cat-road, bottom barranca
							1	Few cobbles in hole - probably from surface.
							2	
							3	
							4	
							5	
							6	
							7	San Mateo Sand Formation Well-graded fine through coarse sand, predominantly coarse, yellow-tan, dense, moist. Scattered pebbles. Sand grains and pebbles are sub-angular to sub-rounded. High in quartz.
							8	
							9	
							10	
							11	
							12	
							13	
							14	
							15	
							16	
							17	
							18	
							19	

REMARKS: Hole 4 was drilled to determine the lateral extent of the silt layer encountered in Hole 1 at elevation -60 to -80. The silt layer was not encountered in Hole 4.

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 4 — DATE DRILLED 10/2/62 — SHEET 2 OF 7

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +35 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							20	
							21	
							22	
							23	
							24	
							25	San Mateo Sand Formation very dense
							26	
							27	
							28	
							29	Drilling time 1 min./ft.
							30	
							31	
							32	
							33	
							34	Grades in and out of fine and coarse pebbly sands.
							35	
							36	
							37	
							38	
							39	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 4 — DATE DRILLED 10/2/62 — SHEET 3 OF 7

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +35 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							40	
							41	
							42	
							43	
							44	
							45	
							46	San Mateo Formation well-graded sand, yellow, very dense.
							47	
							48	
							49	
							50	
							51	
							52	
							53	
							54	
							55	
							56	
							57	
							58	
							59	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 4 — DATE DRILLED 10/3/62 — SHEET 4 OF 7

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION -35' MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH FEET	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR		
							60	
							61	
							62	
							63	
							64	San Mateo Sand Formation
							65	
							66	
							67	
							68	
							69	
							70	
							71	
350	18	6	50			1	72	Silty, fine to medium sand, gray, grades to clean fine sand to yellow San Mateo.
							73	
							74	
							75	San Mateo Sand Formation
							76	
							77	
							78	
							79	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 4 — DATE DRILLED 10/3/62 — SHEET 5 OF 7

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +35 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							80	
							81	
							82	
							83	
							84	
							85	
							86	San Mateo Sand Formation
							87	
							88	
							89	
							90	
							91	
							92	
							93	Drilling time 1 min./ft.
							94	
							95	
							96	
							97	
							98	
							99	
							100	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 4 — DATE DRILLED 10/3/62 — SHEET 6 OF 7

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +35 MLLW — CONTRACTOR J. L. Holton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							100	Possible thin streaks of gray silty sand at 100'-106'.
							101	
							102	
							103	
							104	
							105	
							106	San Mateo Sand Formation Very dense, well-graded medium to coarse sand.
							107	
							108	
							109	
							110	
							111	Drills easily with heavy stem pressure and normal pump circulation.
							112	
							113	
							114	
							115	
							116	
							117	
							118	
							119	
							120	

REMARKS:

LOG OF BORING

SOUTHERN CALIFORNIA EDISON COMPANY — ENGINEERING DEPARTMENT

HOLE NO. 4 — DATE DRILLED 10/3/62 — SHEET 7 OF 7

PROJECT Coast Nuclear Site C — EXPLORATION METHOD Rotary wash

LOCATION Unit 1 sphere — SIZE OF HOLE 8-inch diameter

GROUND ELEVATION +35 MLLW — CONTRACTOR J. L. Helton Co.

DEPTH TO WATER TABLE - — DRILLER Mize & Workman

DEPTH TO TOP OF SOLID ROCK Not encountered — INSPECTOR Chandler

UNDISTURBED SAMPLES				SAMPLES			DEPTH	FIELD DESCRIPTION
WEIGHT POUNDS	DROP INCHES	INCHES DRIVEN	TOTAL BLOWS	UNDIST.	BAG	JAR	FEET	
							120	
							121	
							122	
							123	
							124	
							125	San Mateo Sand Formation
							126	Well-graded, medium to coarse sand, yellow, very dense.
							127	
							128	
							129	
							130	
							131	
							132	
							133	
							134	Average drilling rate 1-1/2 ft/min.
							135	
							136	
							137	
							138	
							139	

REMARKS:

Bottom

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 5
SHEET 1 OF 2
(Formerly T.R. 2)

PROJECT San Onofre Nuclear Gen. Sta. LOCATION E 1,601,028 - N 440,373.5
GROUND ELEVATION 88.2' MLLW BEGUN May 8, 1963 COMPLETED May 13, 1963
DEPTH TO WATER TABLE not determined DEPTH TO BEDROCK 39' San Mateo TOTAL DEPTH 125'
SIZE OF HOLE 6" DRILL TYPE Failing 750
CONTRACTOR J. H. Pitcher DRILLER Reed-Varner INSPECTOR G. S. Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 AT °F	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
Penetration tests made using 140# weight falling 30 inches on a standard 1-3/8" I.D., 2" O.D., split tube penetrometer. Blow counts are cumulative for 6" increments.					0			Terrace deposits: brown, damp, compact, silty fine to medium sand, mostly silt and fine sand, some sandy silt layers.
Using about 1-2 gpm water in cobbles.					5		4 15 25	Penetration test 7'-8-1/2', cumulative totals for 6 inch increments. (4/15/25.)
Used between 200 and 300 gal. water for top 20 feet.					10			Cobbles start
					15			Very difficult drilling in cobble and boulder zones, hole caves.
								end of day. 5/8/63.
					25			
					30			end of day 5/9/63.
					35			Hole cased to 38'.
					40		40	San Mateo formation Pitcher core 40' - 42-1/2', 3" core recovery. Tube bent because of rocks falling in from above.
					45		61	Penetration test 42-1/2 to 43, 61 blows first 6", 75 blows cumulative total for 7". Test stopped at 75 blows.
					50		50	end of day 44'. 5/10/63.
					55			Penetration test at 52-1/2, 50 blows per 3".

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 5
SHEET 1 OF 1
(Formerly T.E. 2)

PROJECT San Onofre Nuclear Gen. Sta. LOCATION E 1,601,023 - N 440,373.5
GROUND ELEVATION 33.2' MLLW BEGUN May 8, 1963 COMPLETED May 13, 1963
DEPTH TO WATER TABLE not determined DEPTH TO BEDROCK 39 (San Mateo) TOTAL DEPTH 125'
SIZE OF HOLE 6" DRILL TYPE Failing 750
CONTRACTOR J. H. Pitcher DRILLER Reed Varner INSPECTOR Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 AT °F	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
					60			San Mateo Formation fine to coarse sand and fine gravel yellow and very dense.
					65		65	Pitcher core 65' - 66-1/2' penetration test - 50 blows for 1 inch.
					70			
					75			
					80			Pitcher core tube bent and sample lost because of gravel fragment from above. Some fine and medium sand in tube. Penetration test at 81-1/2' - 50 blows for 1 inch.
					85			
					90			
					95		95	Penetration test at 96-1/2, 50 blows per 3 inches. Fine and medium sand in penetrometer shoe.
					100			
					105			Pitcher core 105' - 105', sample lost. Penetration test - 50 blows for 1-1/2 inches at 105'.
					110			
					115			
					120			Pitcher core 123' - 125'

HOLE NO.

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 6 (Piez.)
SHEET 1 OF 2
(Formerly T.H. 3)

PROJECT San Onofre Nuclear Generating Station LOCATION E 1,600,599.5 N 446,610.5
GROUND ELEVATION 88.7' MLLW BEGUN 5/8/63 COMPLETED 5/13/63
DEPTH TO WATER TABLE 83.9' DEPTH TO BEDROCK 46'(San Mateo) TOTAL DEPTH 126'
SIZE OF HOLE 5-7/8" DRILL TYPE Failing CFD-I
CONTRACTOR J. N. Pitcher Co. DRILLER Word-Duncon INSPECTOR Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 AT	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
								Terrace deposits: brown damp, compact, silty fine to medium sand, mostly silt and fine sand, cohesive and slight plastic.
Used 500 gal. water in top 35'.					5			
					10			
Placed 125 feet of 2" plastic pipe into TH6. Gravel packed T.H. to 48 feet from ground surface and placed bentonite, sand and cement plug. Perforated bottom 50 feet with 3/16" holes every 3 inches with alternate rounds at 90°. Hole flushed and developed for about 1-1/2 hours. Produced about 1 gpm of clear water after 1/2 hr.					15			Top of cobble layer. Terrace deposits: silty fine to coarse sand with round gravel and cobbles to 6" + diameter. Very hard drilling, cobbles cave in on top of bit.
					20			
					25			Cobbles to 12".
					30			
					35			End of day - May 8. Hole crooked, no sampling done because pitcher barrel could not be taken through the cobbles without reaming.
					40			
High mud and water loss overnight on 5/9/63.					45			End of day 5/9/63 at 46'.
					50			San Mateo formation: Silty fine to coarse sand with small gravel, yellow, and very dense, sub-rounded to sucangular grains, high quartz content.
					55			
					60			

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 6 (Piez.)
SHEET 2 OF 2
(Formerly T.H. 3)

PROJECT San Onofre Nuclear Generating Station LOCATION E 1,600,599.5 N 440,610.5
GROUND ELEVATION 88.7' MLLW BEGUN 5/8/63 COMPLETED 5/13/63
DEPTH TO WATER TABLE 83.9' DEPTH TO BEDROCK 46' (San Mateo) TOTAL DEPTH 126'
SIZE OF HOLE 5-7/8" DRILL TYPE Failing CFD-1
CONTRACTOR J. H. Pitcher Co. DRILLER Word - Duncon INSPECTOR G. S. Hunt

NOTES: WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	TEMP. °F	COND. EC x 10^6 AT °F	VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
					60			
High water and mud loss overnight 5/9/63.							66	Pitcher, cores (66' - 67', 67' - 68'). Cored 66' - 67' could not penetrate more than 1 foot.
							67	
					70		68	Cored 67' - 68', could only penetrate 1 foot because of friction between tube and sample.
					80			
					90		90	Pitcher core 90' - 92-1/2'. Cored 2-1/2', recovered 1-1/2'.
								End of day 92-1/2' 5/10/63.
					100			Pitcher core 100' - 101' tube badly bent only small amount in tube, sample placed in jar. Some rounded to subangular gravel to 1" diameter noted in core.
					105			
					110			
					115		115	Pitcher core 115' - 116-1/2'
								San Mateo Formation: Very dense fine to coarse sand and fine gravel, subangular to subrounded grains high in quartz.
					120			
					125			Bottom of Hole 126'.

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 7
SHEET 1 OF 1
(Formerly T.P. 4)

PROJECT San Onofre Nuclear Generating Sta. LOCATION N 440,192 E 1,600,871
GROUND ELEVATION + 12± BEGUN 5/13/63 COMPLETED 5/13/63
DEPTH TO WATER TABLE not determined DEPTH TO BEDROCK 5' (San Mateo) TOTAL DEPTH 55'
SIZE OF HOLE 4-3/4" DRILL TYPE Failing 750
CONTRACTOR J. H. Pitcher DRILLER Reed INSPECTOR Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 AT °F	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
Penetration tests made using 140# weight falling 30 inches on a standard 1-3/3" I.D., 2" O.D. split tube penetrometer. Blow counts are cumulative for 6 inch increments.					5 10 15 20 25 30 35 40 45 50 55		6 21 23 52	Terrace Material: fill placed on cat road. Beach sand: fine and medium, loose San Mateo formation: Pitcher core sample 6'-7-1/2'. Fine to coarse sand, dense, yellow, with some small gravel. Penetration test at 7-1/2', 50 blows per 3 inches. About 6 inches of fine sand and silt at 19'. Pitcher core 21' - 23'. Cored 2 ft., recovered about 1-1/2' of sample. Penetration test at 23', 50 blows per 5 inches. Pitcher core 36' - 38' fine to coarse, dense yellow sand and fine gravel. Cored 3' at 52', recovered 1-1/2' sample. Bottom of hole 55'.

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 8 (Mez.)
SHEET 1 OF 2
(Formerly T. H. 5)

PROJECT San Onofre Nuclear Generating Station LOCATION N 440,533.0 E 1,500,695.0
GROUND ELEVATION 91.7' MLLW BEGUN 5/15/63 COMPLETED 5/16/63
DEPTH TO WATER TABLE 87' DEPTH TO BEDROCK 45' (San Mateo) TOTAL DEPTH 125'
SIZE OF HOLE 5-7/8 DRILL TYPE Failing CFD-1
CONTRACTOR J. H. Pitcher Co. DRILLER Word INSPECTOR G. S. Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 °F AT	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
Placed 125' of 2 inch Kreyloy plastic pipe into test hole and washed through the perforations. Bottom 40 feet was perforated with 3 inch spacing, alternate rounds at 90°. Upper 10' perforated 1 round every 6 inches in line. Hole was pumped with compressed air for about 1 hour. T.H.5 produced about 1/3 gpm flow. Well was pumped until return water was clear.					0 5 10 15 20 25 30 35 40 45 50 55 60		15 47 75	Terrace deposits: silty fine and medium sand, brown, damp, dense. Pitcher core 8' - 9-1/2'. Penetration test 9-1/2' - 11', cumulative total for 6 inch increments 15 - 47 - 75. Start of cobbles. Cobbles caving into hole to 45' could not sample below top of cobbles because of caving. Cobbles are probably not continuous from 25' - 45' San Mateo Formation: Attempted to core at 47', sample lost due to washing. Pitcher core 49-1/2' - 52-1/2' about 2' recovery. 62' end of day.
Penetration tests made using 140# weight falling 30" on a standard 1-3/8" I.D., 2" O.D. split tube penetrometer. Blow counts are cumulative for 6" increments.								

SOUTHERN CALIFORNIA EDISON COMPANY

HOLE NO. 8 (Piez.)

LOG OF BORING

SHEET 2 OF 2
(Formerly T.H. 5)

PROJECT San Onofre Nuclear Generating Station LOCATION N 440,833.0 E 1,600,695.0

GROUND ELEVATION 91.7' MLLW BEGUN 5/15/63 COMPLETED 5/15/63

DEPTH TO WATER TABLE 87' DEPTH TO BEDROCK 45' (San Mateo) TOTAL DEPTH 125'

SIZE OF HOLE 5-7/8 DRILL TYPE Failing CFD- 1

CONTRACTOR J. N. Pitcher Co. DRILLER Word - Duncon INSPECTOR G. S. Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 AT °F	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
					60			San Mateo Formation: fine to coarse sand and fine gravel, yellow, very dense high quartz content.
					65			
					70			
					80			
					90			
					100			
					110			
					120			
								Bottom of Hole 125'.

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 9 (Piez.)
SHEET 1 OF 2
(Formerly T.H. 6)

PROJECT San Onofre Nuclear Generating Station LOCATION E 1,601,712.5 N 440,485.5
GROUND ELEVATION 98.9' MLLW BEGUN 5/17/63 COMPLETED 5/20/63
DEPTH TO WATER TABLE 93.0' DEPTH TO BEDROCK 45' (San Mateo) TOTAL DEPTH 125
SIZE OF HOLE 5-7/8 DRILL TYPE Failing 750
CONTRACTOR J. H. Pitcher Co. DRILLER Earl Reed INSPECTOR G. S. Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 AT °F	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
Placed 122 feet of 2" diameter pipe into hole and perforated bottom 50' with 3/16" holes. T.H. was gravel packed, plugged and flushed but was not developed with compressed air.					0			Terrace deposits: silty fine and medium sand, brown, damp, dense, some clayey silt layers, slight plastic and cohesive.
Penetration tests made using 140# weight falling 30 inches on a standard 1-3/8" I.D. 2" O.D. split tube penetrometer. Blow counts are cumulative for 6" increments.					5			
					10			Pitcher core 12-1/2' - 14 penetration test 14-1/2' - 16' cumulative totals for 6" increments 15, 46, 86.
					15	15 46 86		Start of cobbles 16' very difficult drilling.
					20			End of day 5/16/63.
					25			Very slow drilling due to cobbles, gravel and boulders.
					30			
					35			Thin gravelly clay layer at 36'.
					40			
					45			San Mateo Formation:
					50			
					55			
					60			

SOUTHERN CALIFORNIA EDISON COMPANY

HOLE NO. 9 (Plan.)

LOG OF BORING

SHEET 2 OF 2

(Formerly T.H. 6)

PROJECT San Onofre Nuclear Generating Station LOCATION E 1,501,718.5 N 440,438.5

GROUND ELEVATION 98.9' MLLW BEGUN 5/17/63 COMPLETED 5/20/63

DEPTH TO WATER TABLE 93.0' DEPTH TO BEDROCK 45' (San Mateo) TOTAL DEPTH 125'

SIZE OF HOLE 5-7/8 DRILL TYPE Failing 750

CONTRACTOR J. H. Pitcher Co. DRILLER Reed-Varner INSPECTOR G. S Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	TEMP. °F	COND. EC x 10^6 °F AT	VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
					65			San Mateo Formation: Fine to coarse sand and fine gravel, yellow, very dense with occasional gravel to 1" diameter.
					70			
					75			
					80			
					85			
					90			
					95			
					100			
					105			
					110			
					120			
					125			Bottom of Hole 125'

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 30 (Piez.)
SHEET 1 OF 2
(Formerly T.H. 7)

PROJECT San Onofre Nuclear Generating Station LOCATION E 1,501,651.5 N 439,93[illegible].5
GROUND ELEVATION 82.2' MLW BEGUN 5/15/63 COMPLETED 5/16/63
DEPTH TO WATER TABLE 83.0' DEPTH TO BEDROCK 51' (San Mateo) TOTAL DEPTH 125'
SIZE OF HOLE 5-7/8 DRILL TYPE Failing "750"
CONTRACTOR J. H. Pitcher DRILLER Reed - Varner INSPECTOR G. S. Hunt

NOTES

WATER LEVELS,
WATER RETURN,
PIEZOMETER
DEVELOPMENT, ETC.

Penetration tests made using 140# weight falling 30 inches on a standard 1-3/8" I.D., 2" O.D. split-tube penetrometer.
Blow counts are cumulative for 6" increments.

125' of 2" Krayloy plastic pipe with bottom 50' perforated as shown in specifications E-4744 placed into hole. Test hole was gravel packed to top of San Mateo formation, flushed with water and plugged with sand, bentonite and cement mixture. This hole was not developed with compressed air.

MUD TESTS						
DENSITY lb/	TEMP. °F	COND. EC x 10^6 AT °F	VISCOSITY	DEPTH	LOG	TEST SAMPLES

FIELD DESCRIPTION AND CLASSIFICATION

Terrace Deposits: silty fine and medium sand, brown, damp, dense, slight cohesive.

Pitcher core 5' - 7-1/2' penetrated 7-1/2' to 9'.
15, 49, 93 cumulative total blows for 6 inch increments.

Pitcher core 10' - 12-1/2' penetrated 12-1/2' - 14' cumulative blow count for six inch increments 18 - 54 - 94.

Pitcher core 15 - 17-1/2 silty fine sand and clayey silt, brown, damp, dense, medium plastic and cohesive. Penetrated 17-1/2 - 19.
cumulative total blow count 15 -47-89

Coarse sand and fine gravel.

Pitcher, core 30-32-1/2 obtained 1-1/2' sample of medium and coarse sand, brown, damp and dense.

6" layer of gravel to 1/2" at 40'.

Cobbles and coarse gravel at 42'.
Large rocks 42-1/2' - 51'.

Slow drilling

San Mateo Formation:

HOLE NO. 30 (Piez.)

SOUTHERN CALIFORNIA EDISON COMPANY

HOLE NO. 10 (Rev.)

SHEET 2 OF 2

(Formerly T.H. 7)

LOG OF BORING

PROJECT San Onofre Nuclear Generating Station LOCATION E 1,901,651.5 N 435,936.5

GROUND ELEVATION 83.2' MSL BEGUN 5/15/63 COMPLETED 5/16/63

DEPTH TO WATER TABLE 63.0' DEPTH TO BEDROCK 51' (San Mateo) TOTAL DEPTH 125

SIZE OF HOLE 5-7/8 DRILL TYPE Failing "750"

CONTRACTOR J. F. Pitcher DRILLER Earl Reed INSPECTOR G. S. Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 °F AT	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
					60			San Mateo Formation: Fine to coarse sand and fine gravel, yellow, very dense, high quartz content, subrounded to subangular grains with some thin fine sand and silt layers.
					65			
					75			
					85			
					95			
					105			
					115			
					125			Bottom of Hole 125'.

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 11 (Piez.)
SHEET 1 OF 1
(Formerly P-1)

PROJECT San Onofre Nuclear Generating Sta. LOCATION N 440, 236.5 E 1,600,814.5
GROUND ELEVATION 15.2' MLLW BEGUN 5/14/63 COMPLETED 5/14/63
DEPTH TO WATER TABLE 11'± DEPTH TO BEDROCK 9' (San Mateo) TOTAL DEPTH 50'
SIZE OF HOLE 5-7/8 DRILL TYPE Failing 1000
CONTRACTOR J. N. Pitcher Co. DRILLER Reed - Varner INSPECTOR G. S. Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP °F	MUD TESTS: COND EC x 10^6 AT °F	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
Set 49' of 1-1/2 inch plastic pipe. Pipe was perforated with 3/16" holes on lower 40'. T.H. was gravel packed to 4' of surface and flushed with water. Placed cement plug on gravel at the surface. Well pumped with compressed air for about 1 hour until water was clear. Piezometer produced estimated 3-5 gallons per minute.					5			Terrace Deposits: Stream bed deposits and beach sand top 3 feet is fill constructed by cat during leveling.
					10			San Mateo Formation: Fine to coarse sand with some gravel to 1" yellow and very dense.
					15			
					20			Pitcher core 20 - 22'. Lost sample and tube bent.
					25			
					30			
					35		38	
					40		40	Cored 38' - 40' obtained about 8" to 9" sample.
							47	Clayey lense, mostly silty fine sand with some cohesive clayey material.
					50			Bottom of Hole 50'
					55			

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 12 (Piez.)
SHEET 1 OF 1
(Formerly P-2)

PROJECT San Onofre Nuclear Generating Sta. LOCATION N 440, 290.0, E 1,600,757.5
GROUND ELEVATION 14.8' MLLW BEGUN 5/14/63 COMPLETED 5/14/63
DEPTH TO WATER TABLE 11'± DEPTH TO BEDROCK 5' (San Mateo) TOTAL DEPTH 50'
SIZE OF HOLE 6" DRILL TYPE Failing CFD-I
CONTRACTOR J. H. Pitcher DRILLER Word - Duncon INSPECTOR G. S. Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 AT °F	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
Set 48' of 1-1/2" plastic pipe and perforated bottom 40'. Gravel packed to surface and flushed with water. Developed piezometer for about 1 hour, until water was clear. Well produced 3-5 gpm flow. Cement plug placed on gravel at the surface. P-1 and P-2 perforated with 1 round per 1-1/2", alternate rounds at 90°.					0			Terrace and stream bed deposits: With cobbles and boulders mostly sand and gravel.
					5			
					10			San Mateo Formation: Fine to coarse sand and fine gravel with occasional gravel to 1" diameter, yellow and very dense.
					15		15	Cored 15' - 16.5', recovered about 6" core with some gravel to 1/2".
					20			
					25			
					30			
							33	6" recovery, cored 2 feet.
					35		35	
					40			
					45			
					50			Bottom of Hole 50'.

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO. 13 (Piez.)
SHEET 1 OF 1
(Formerly P-3)

PROJECT San Onofre Nuclear Gen. Sta. LOCATION N 440, 277.0, E 1,600,815.0
GROUND ELEVATION 16.7' MLLW BEGUN 5/14/63 COMPLETED 5/15/63
DEPTH TO WATER TABLE 11' ± DEPTH TO BEDROCK 3' (San Mateo) TOTAL DEPTH 49'
SIZE OF HOLE 5-7/8 DRILL TYPE Failing 750
CONTRACTOR J. N. Pitcher Co. DRILLER Reed INSPECTOR G. S. Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	TEMP. °F	COND. EC x 10^6 AT °F	VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
Placed 49' of 1-1/2" plastic pipe perforated for bottom 40'. Gravel packed to surface and flushed with water. Perforated 1 round every 3" alt. rounds at 90° with 3/16 drill. Developed well for about 1 hour until water produced was clear. Well produced 3-5 gpm. Water sample taken for analysis. Cement plug placed on surface.					0 5 10 15 20 25 30 35 40 45 50			Fill, stream bed deposits and terrace deposits placed by cat. San Mateo Formation: Fine to coarse sand and fine gravel, yellow and very dense. Pitcher core 20' - 22'. Good 2' core. Pitcher core 40' - 42' good core, silty fine sand on bottom of sample. Silty, fine sand lense 48' - 49'. Bottom of Hole 49'.

SOUTHERN CALIFORNIA EDISON COMPANY

LOG OF BORING

HOLE NO 14 (Piez.)
SHEET 1 OF 1
(Formerly P-4)

PROJECT San Onofre Nuclear Generating Sta. LOCATION N 440,351.5, E 1,660,831.0
GROUND ELEVATION 22.7' MLLW BEGUN 5/14/63 COMPLETED 5/15/63
DEPTH TO WATER TABLE 17.4 ± DEPTH TO BEDROCK 9' (San Mateo) TOTAL DEPTH 50'
SIZE OF HOLE 6" DRILL TYPE Failing CFD - I
CONTRACTOR J. H. Pitcher Co. DRILLER Word INSPECTOR G. S. Hunt

NOTES WATER LEVELS, WATER RETURN, PIEZOMETER DEVELOPMENT, ETC.	MUD TESTS: DENSITY lb/	MUD TESTS: TEMP. °F	MUD TESTS: COND. EC x 10^6 AT °F	MUD TESTS: VISCOSITY	DEPTH	LOG	TEST SAMPLES	FIELD DESCRIPTION AND CLASSIFICATION
Placed 50' of 1-1/2" plastic pipe and perforated lower 40'. Lower 20' perforated with alt. rounds at 1.5" spacing at 90°. Upper 20' perforated with 3/16 holes alternate rounds at 90° with 3" spacing. Hole was gravel packed to surface and a cement plug placed on the top. T.H. was developed for about 1 hour with air line.					5 10 15 20 25 30 35 40 45 50			Stream Deposits: Gravel, sand, cobbles and boulders, loose, very difficult drilling. San Mateo Formation: Fine to coarse sand and fine gravel with occasional gravel to 1" diameter, yellow and very dense. Bottom of hole 50'

APPENDIX C

TABLE OF CONTENTS

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

SOIL CLASSIFICATION TESTS

PROJECT San Onofre Nuclear Gen. Sta. | TESTED BY G.S. Hunt | DATE 6-18-63

% GRAVEL	24
% SAND	70
% SILT	6
% CLAY	
DEPTH ft.	115'-116.5'
HOLE NO.	6
SAMPLE NO.	San Mateo Fm.

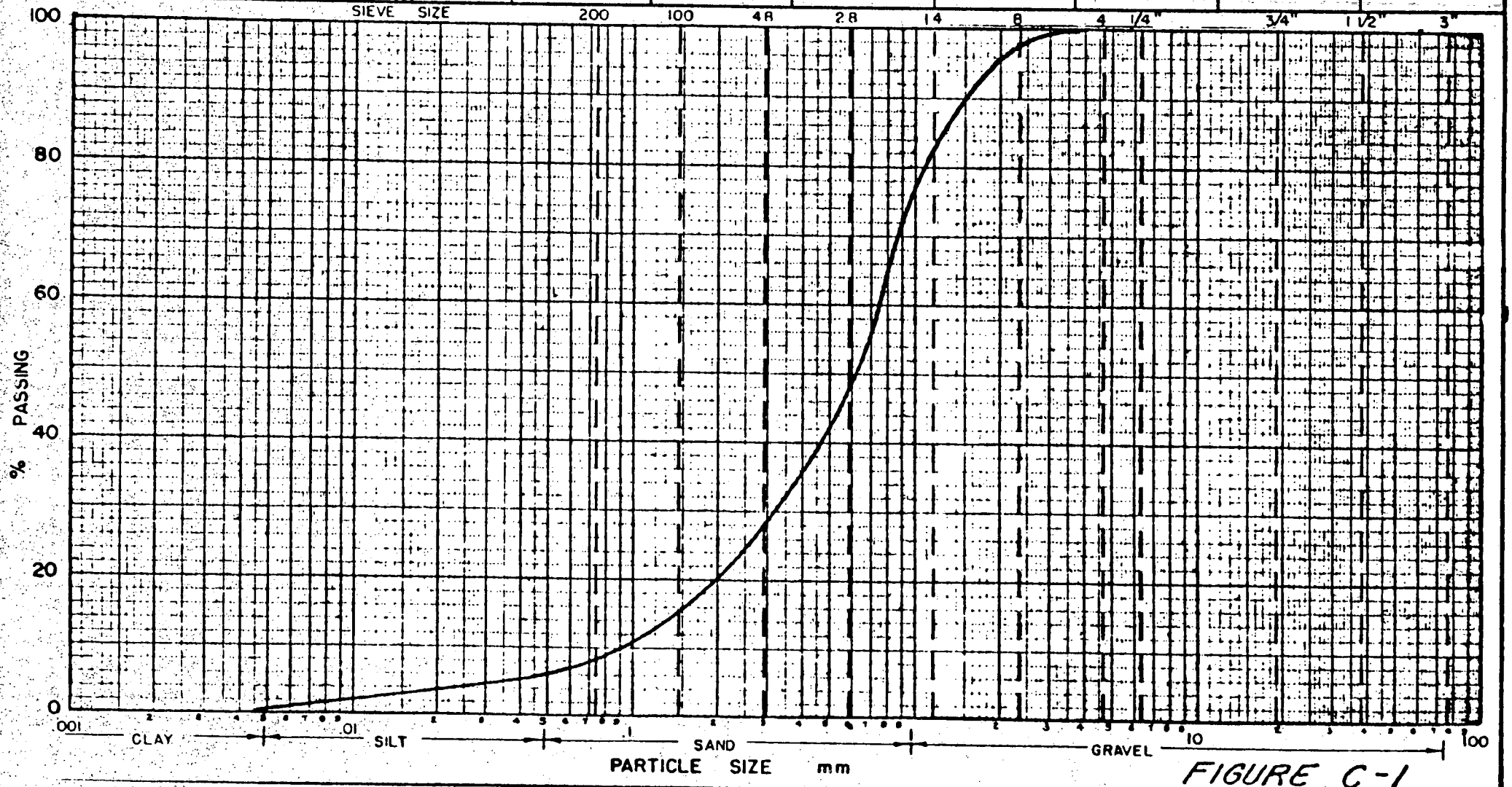


FIGURE C-1

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

SOIL CLASSIFICATION TESTS

PROJECT San Onofre Nuclear Gen. Sta. | TESTED BY G. S. Hunt | DATE 6-17-63

% GRAVEL	35								
% SAND	60								
% SILT	5								
% CLAY	0								
DEPTH ft.	6'-7½'								
HOLE NO.	7								
SAMPLE NO.	San Mateo								

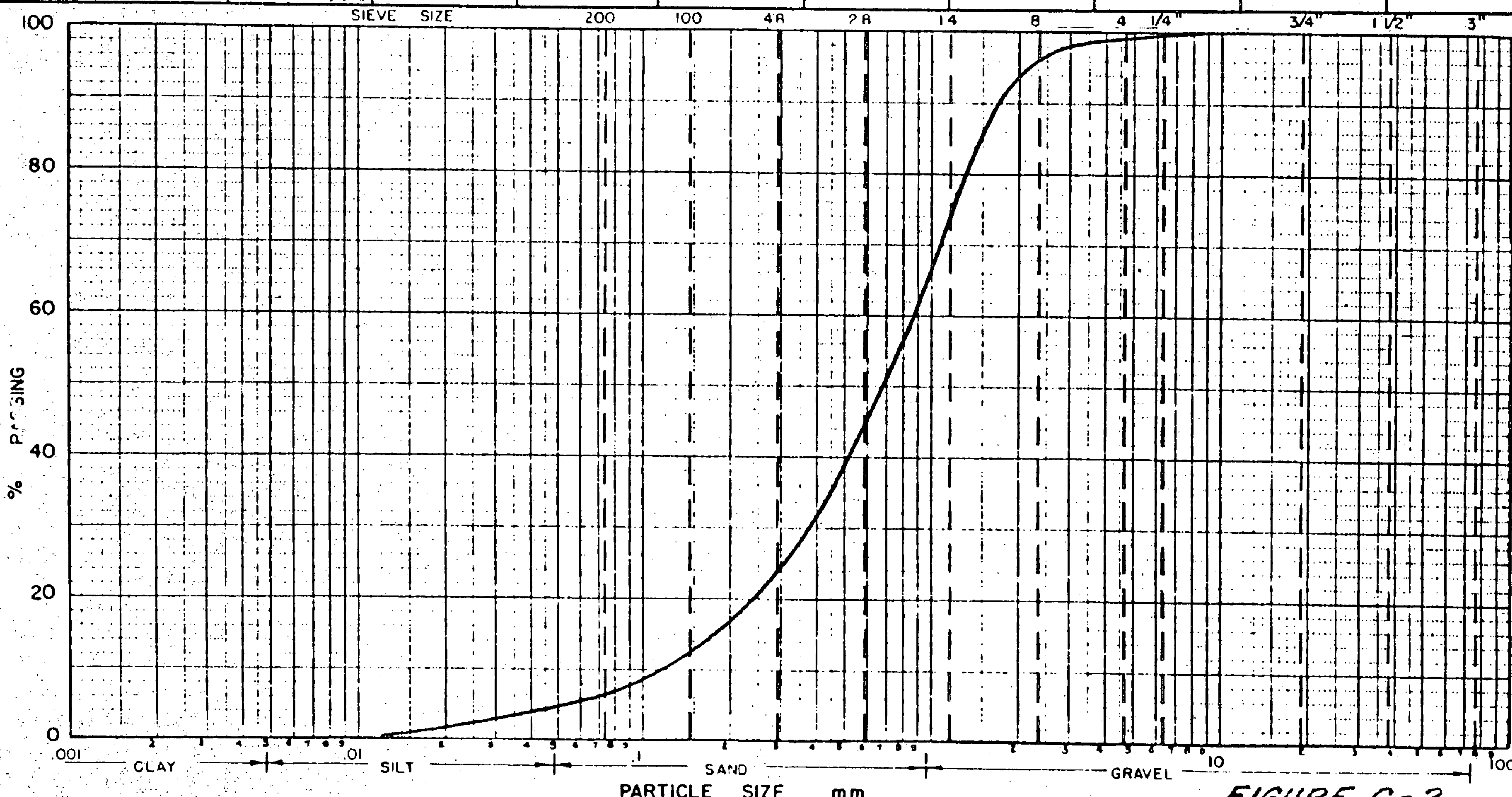


FIGURE C-2

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

SOIL CLASSIFICATION TESTS

PROJECT San Onofre Nuclear Gen. Sta. TESTED BY C.W.M. - G.S.H. DATE 6-6-63

% GRAVEL	0		34		3				
% SAND	60		61		43				
% SILT	20		5		26				
% CLAY	20		0		30				
DEPTH ft.	81'-84'		66'-67'		12.5'-14'				
HOLE NO.	1		6		9				
SAMPLE NO.	26		24		7				

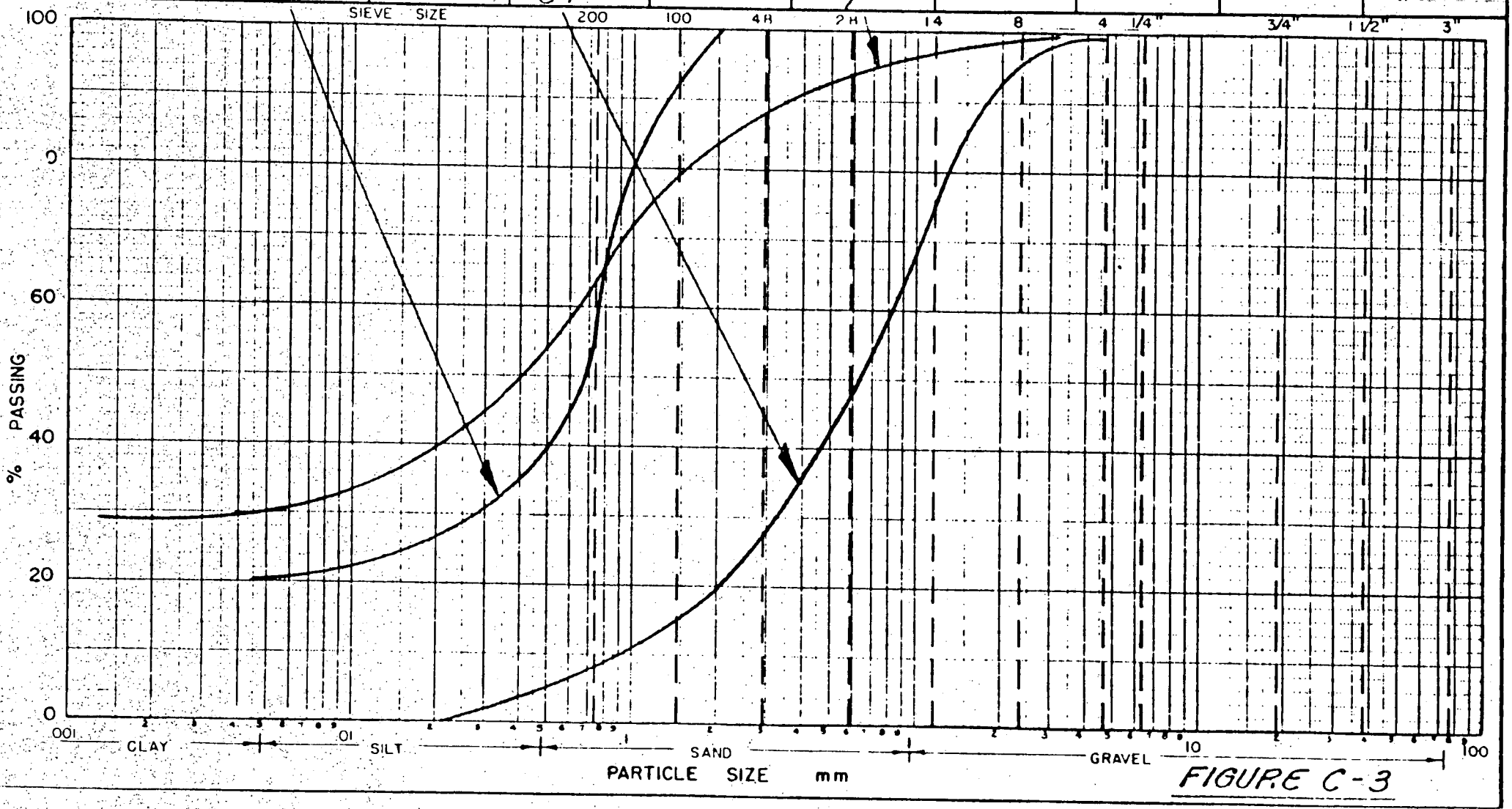
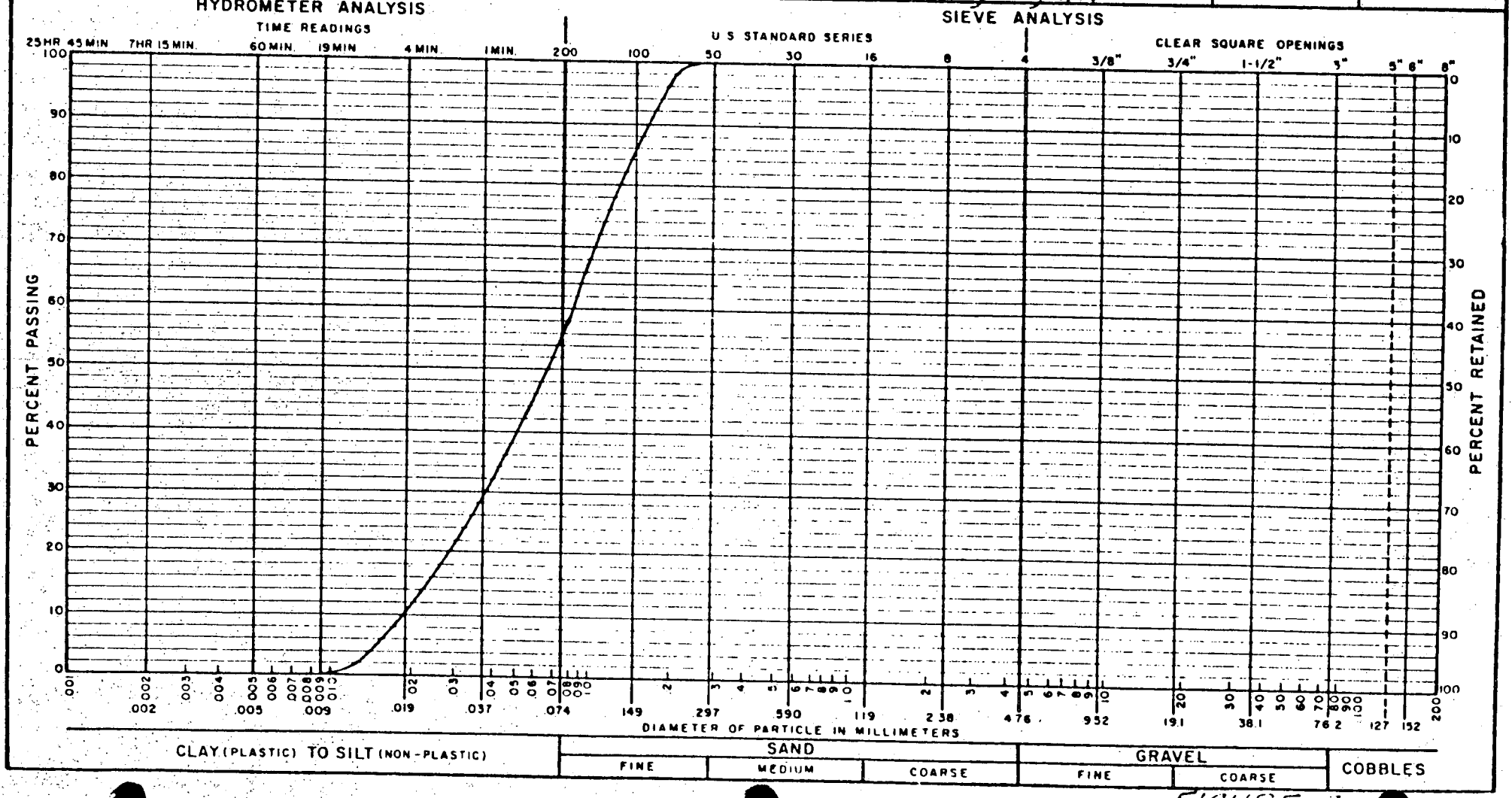


FIGURE C-3

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

GRADATION TESTS

PROJECT	San Onofre Nuclear Gen Sta.			TESTED BY	G. S. Hunt					DATE	7-25-63
% GRAVEL											
% SAND											
% SILT & CLAY											
DEPTH FT.	5'-7½'										
HOLE NO.	5		Terrace Material								
SAMPLE NO.			Sea Water - No Deflocculating Agent								



SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

GRADATION TESTS

PROJECT	San Onofre Nuclear Gen. Stn.			TESTED BY	G. S. H.				DATE	7-22-63
% GRAVEL										
% SAND										
% SILT & CLAY										
DEPTH FT.	15'-17½'									
HOLE NO.	10		Terrace Material							
SAMPLE NO.			Sea Water - No Deflocculating Agent							

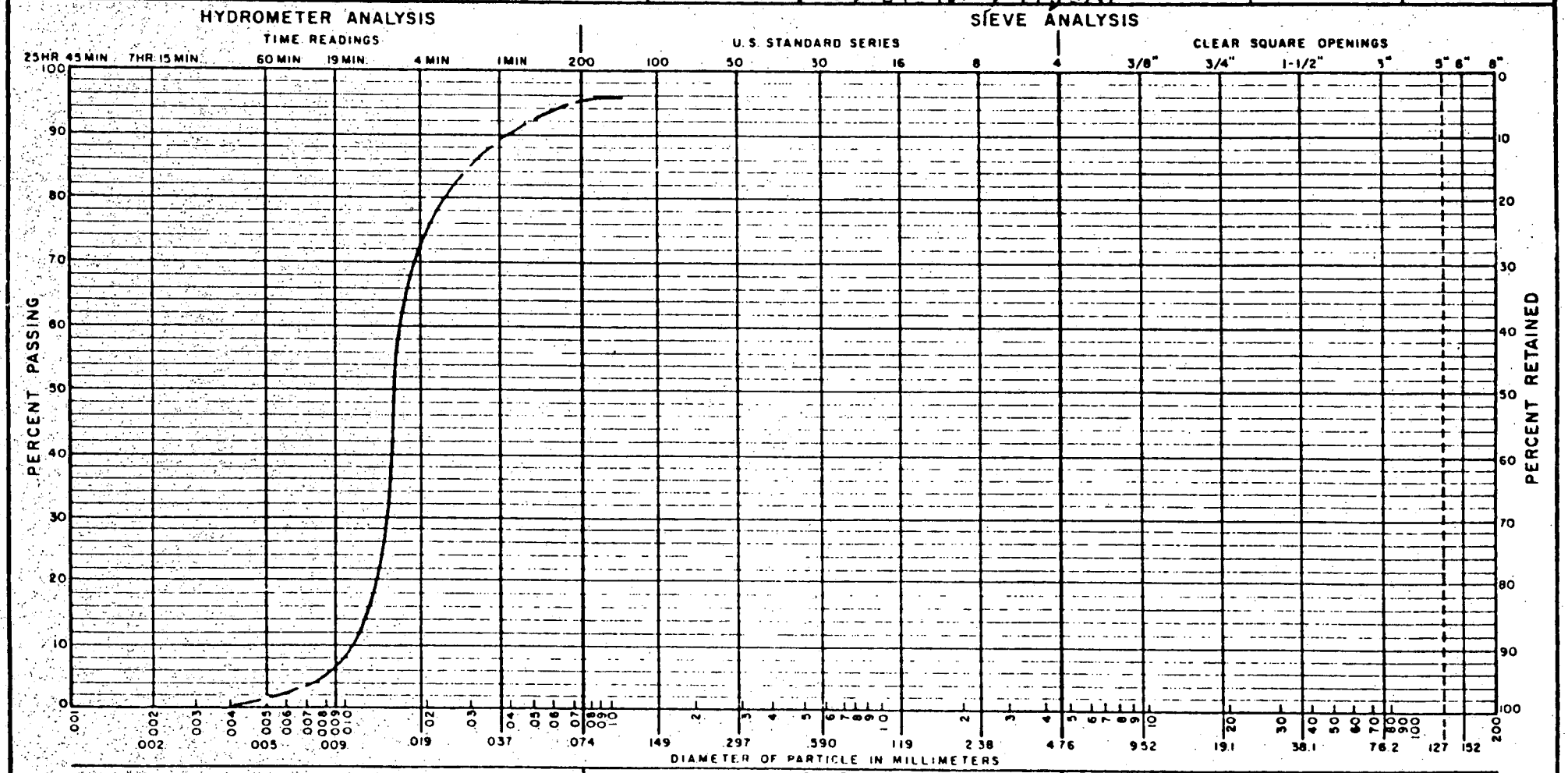
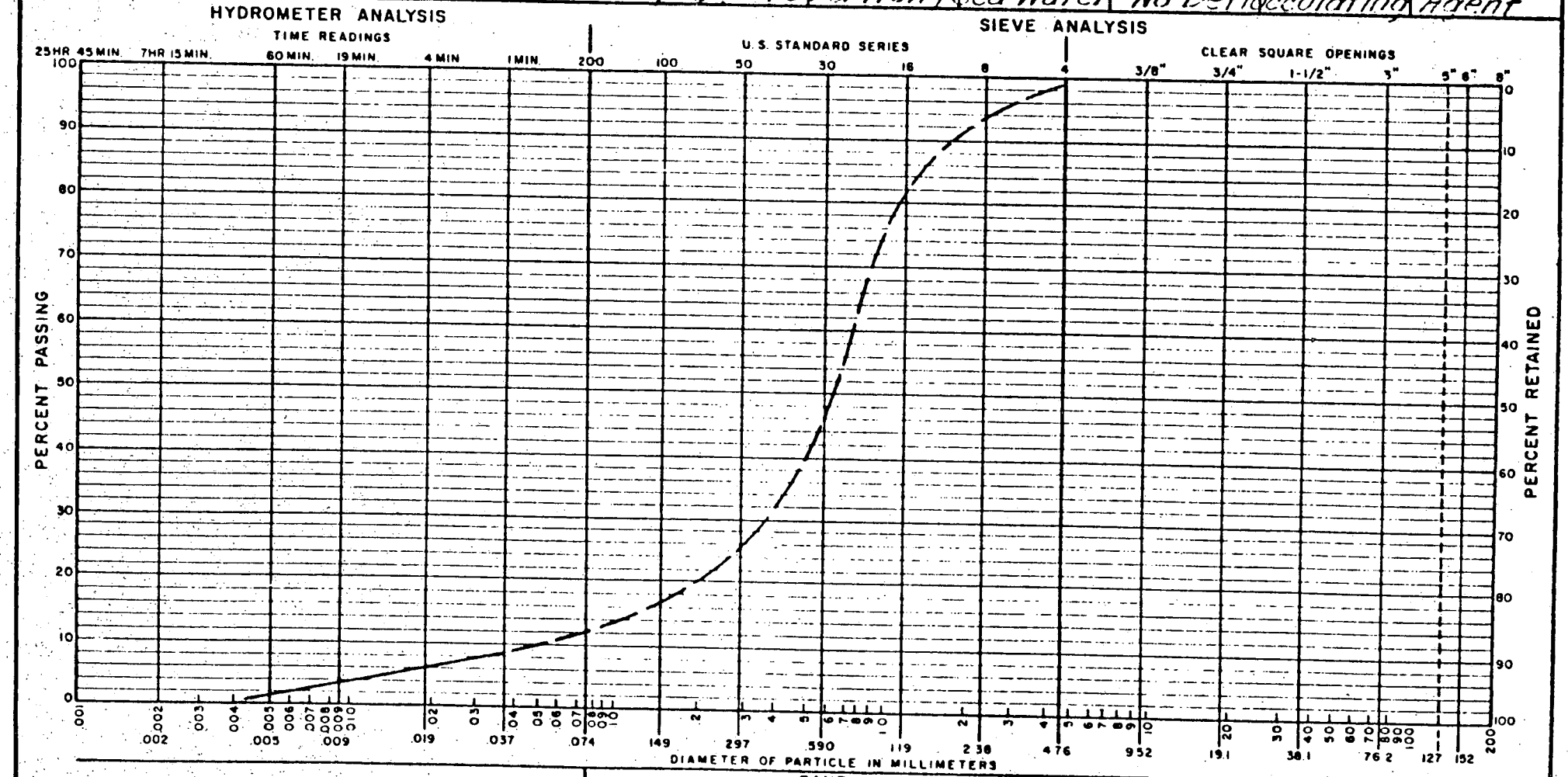


FIGURE C-5

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

GRADATION TESTS

PROJECT	San Onofre Nuclear Gen. Sta.			TESTED BY	G. S. Hunt			DATE	
% GRAVEL									
% SAND									
% SILT & CLAY									
DEPTH FT.									
HOLE NO.									
SAMPLE NO.	Composite - San Mateo Sample (#48 Portion) Sea Water - No Deflocculating Agent								



FIGURE

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

SOIL COMPACTION TEST ASTM D1557-58T

PROJECT San Onofre Nuc. Gen. Sta.
HOLE NO. —
DEPTH ft. 0'-3' Terrace Mat
SAMPLE NO. Bag Sample

OPTIMUM MOISTURE CONTENT % 10.0
OPTIMUM DRY DENSITY p c f 123
TESTED BY G.S.H.
DATE TESTED 7-24-63

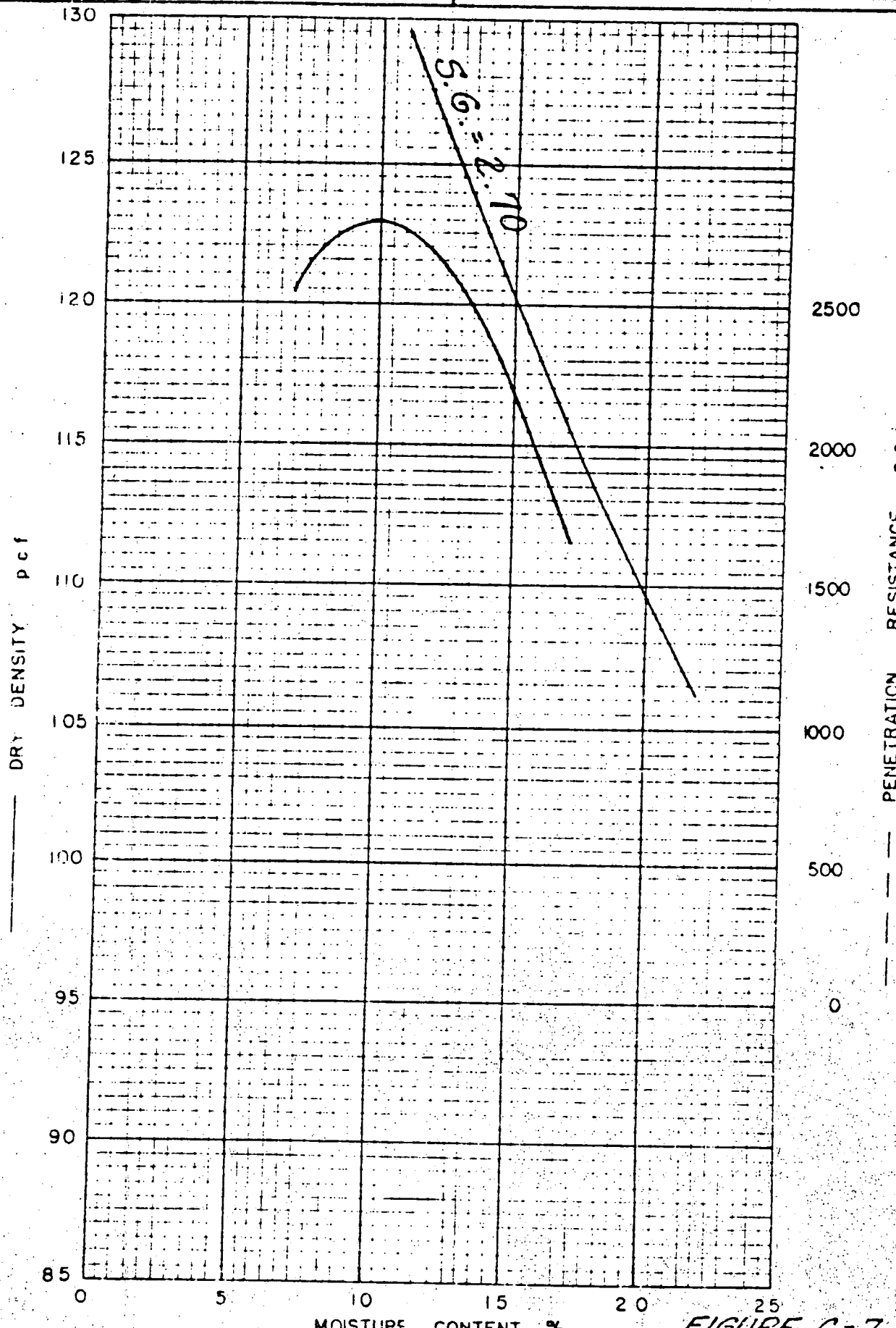
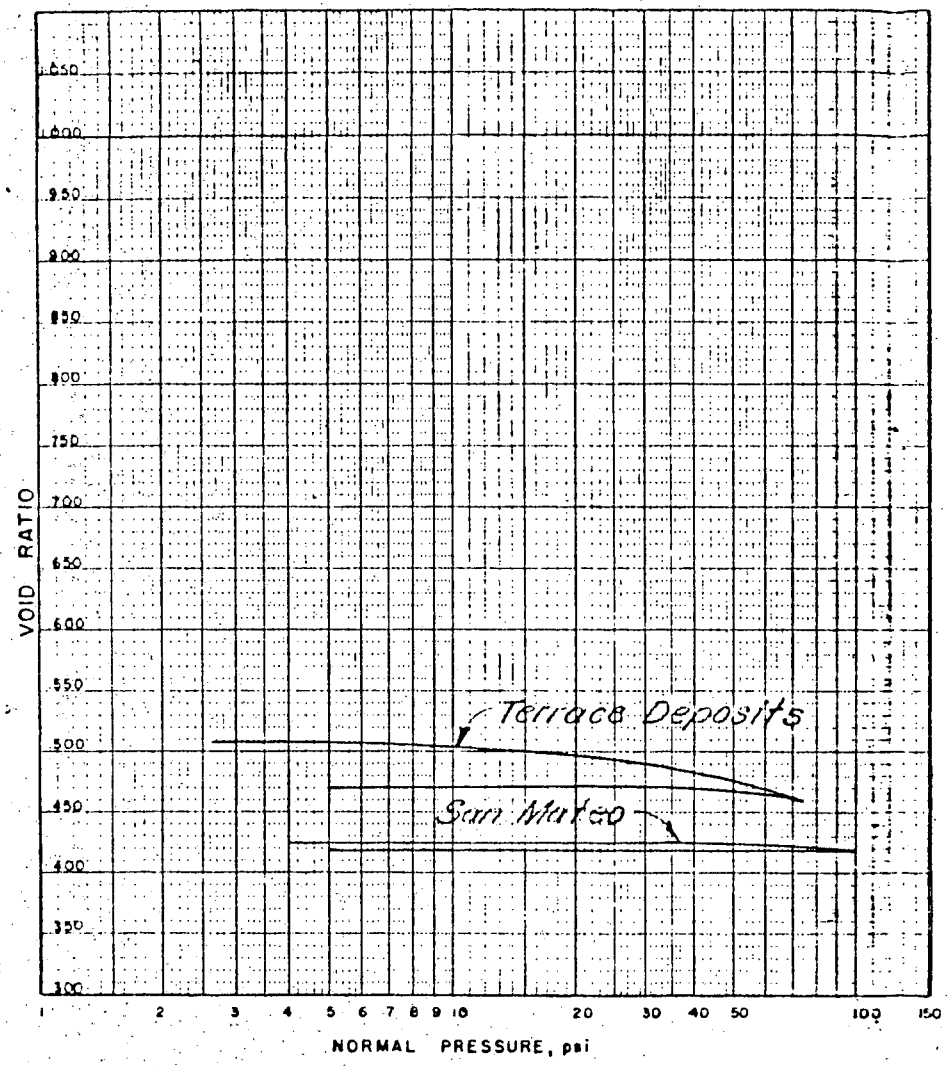


FIGURE C-7

SOUTHERN CALIFORNIA EDISON CO ENGINEERING DEPT LLL-58



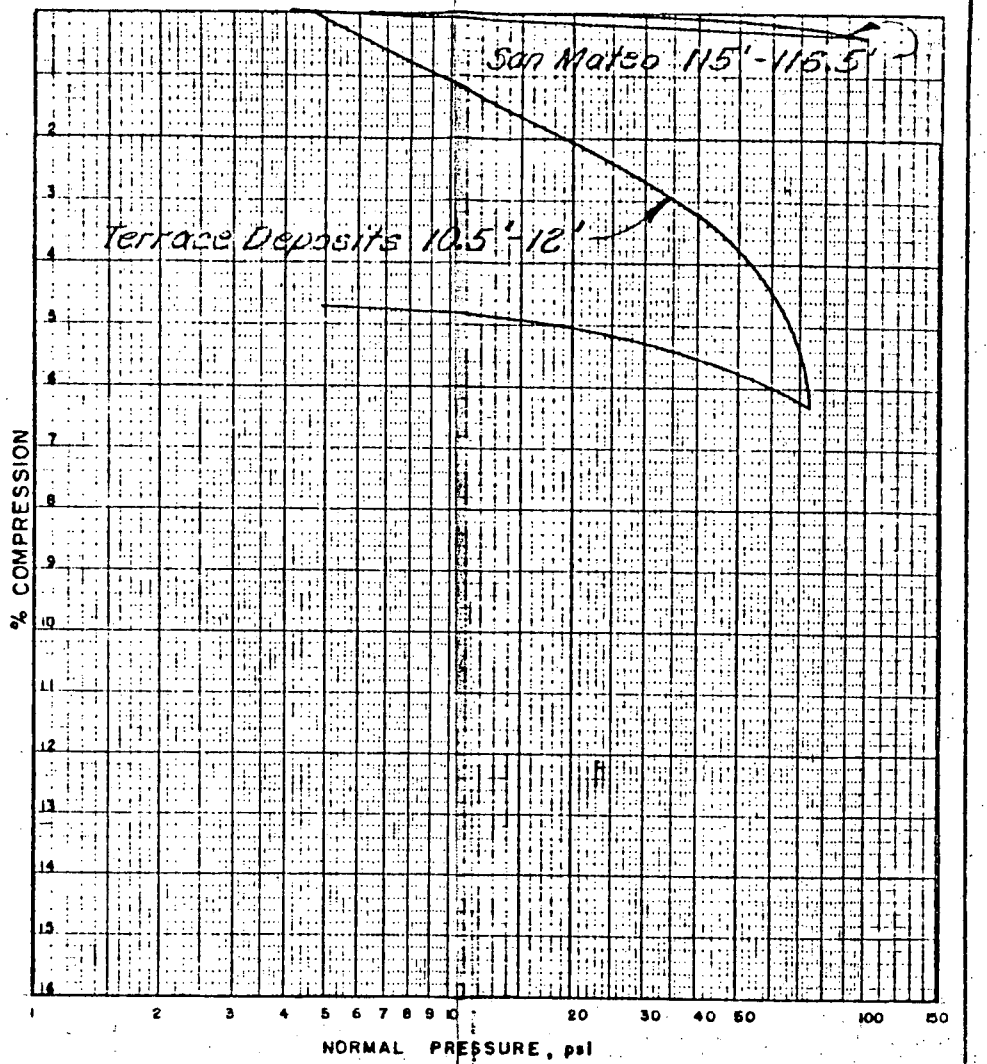


FIGURE C-8

SAMPLE NO. T.H. 6	DEPTH, ft. 115'-116.5'
FIELD DRY DENSITY, pcf 114.5	FIELD VERTICAL PRESSURE, psi
FIELD MOISTURE CONTENT %	SPECIFIC GRAVITY 2.65
SAMPLE NO. T - T.H. 9	DEPTH, ft. 10.5'-12'
FIELD DRY DENSITY, pcf	FIELD VERTICAL PRESSURE, psi
FIELD MOISTURE CONTENT %	SPECIFIC GRAVITY 2.70

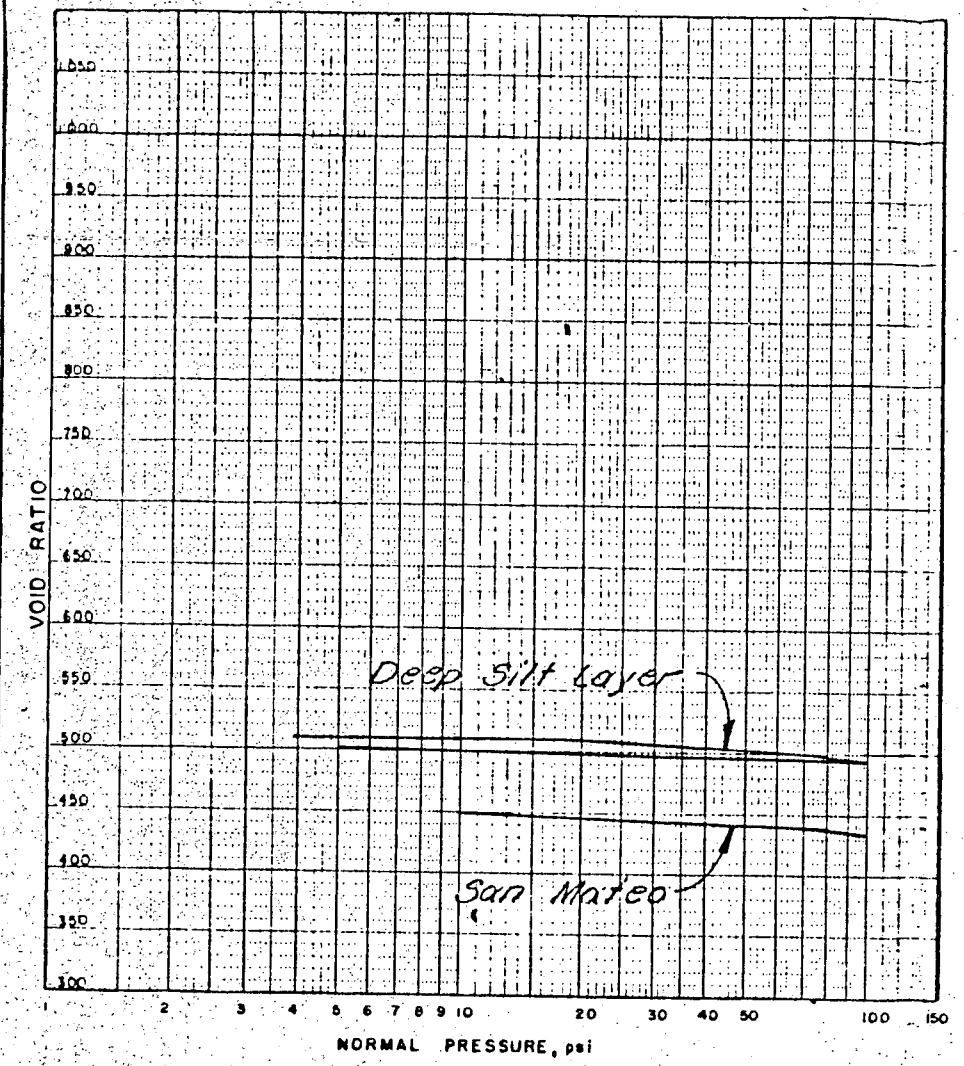
VERTICAL PRESSURE, psi	1	2.5	5	10	20	40	75	100	5 Reb
VOID RATIO			.444	.444	.446	.444	.439	.437	.441
COMPRESSION %			0	0	0	0	.2	.35	.13
VERTICAL PRESSURE, psi	1	2.5	5	10	20	40	75	100	5 Reb
VOID RATIO		.516	.513		.493	.467	.430		.444
COMPRESSION %		0	.13		2.1	3.2	6.3		4.7

SOIL CONSOLIDATION TESTS

PROJECT San Onofre HOLE NO 6+9

TESTED BY G.S.H. DATE 7-1-63

SOUTHERN CALIFORNIA EDISON CO. - ENGINEERING DEPT. 11-54



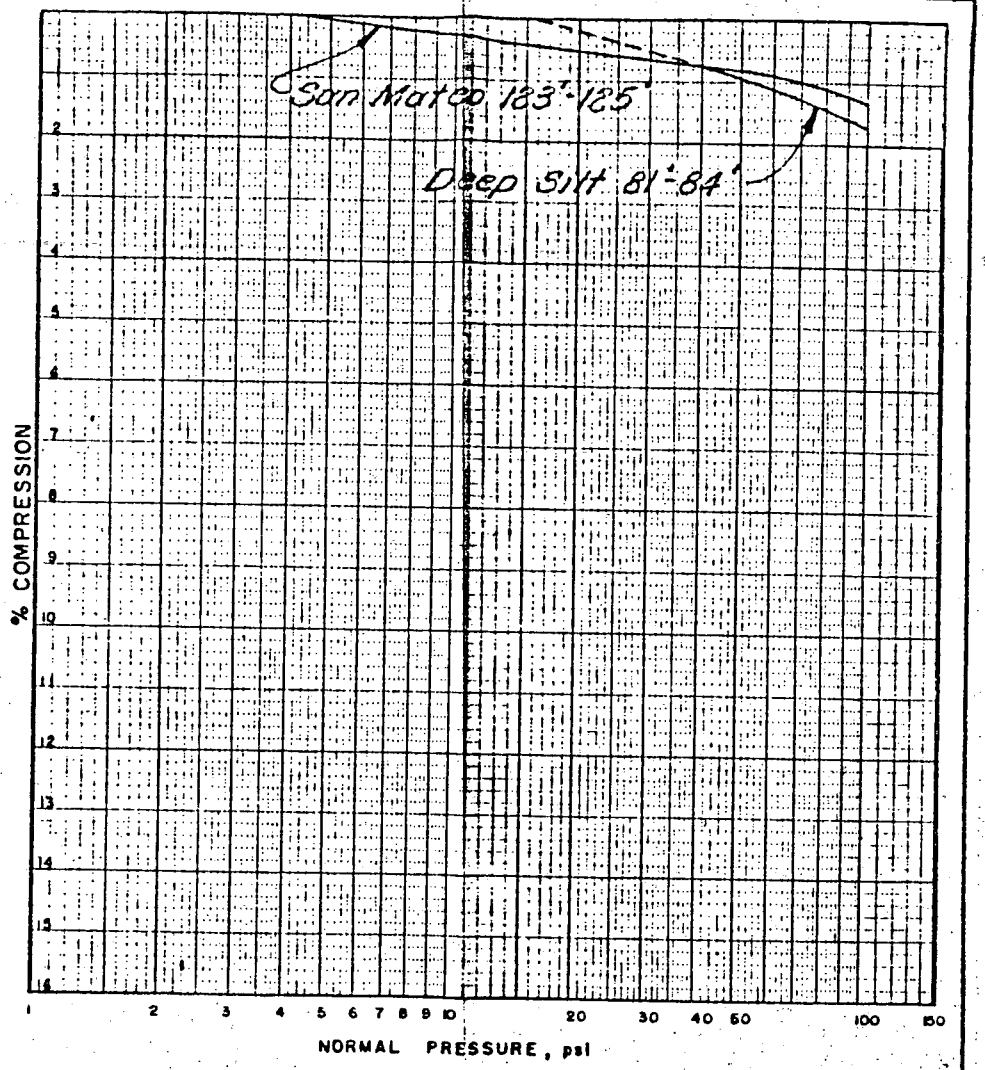


FIGURE C-9

SAMPLE NO. 26 T.H. Pre. 1 DEPTH, ft. 81'-84' Deep Silt layer
FIELD DRY DENSITY, pcf ____ FIELD VERTICAL PRESSURE, psi ____
FIELD MOISTURE CONTENT % ____ SPECIFIC GRAVITY 2.75

SAMPLE NO. T.H. 2 DEPTH, ft. 123'-125'
FIELD DRY DENSITY, pcf ____ FIELD VERTICAL PRESSURE, psi ____
FIELD MOISTURE CONTENT % ____ SPECIFIC GRAVITY 2.65

VERTICAL PRESSURE, psi	1	2.5	5	10	20	40	75	100	5 Reb
VOID RATIO				.519	.520	.507	.459	.493	.512
COMPRESSION %						.77	1.34	1.7	.18
VERTICAL PRESSURE, psi	1	2.5	5	10	20	40	75	100	5 Reb
VOID RATIO			.453	.449	.436	.442	.437	.454	.432
COMPRESSION %			103.4	100.6	100.8	101.1	101.5	101.8	101.3

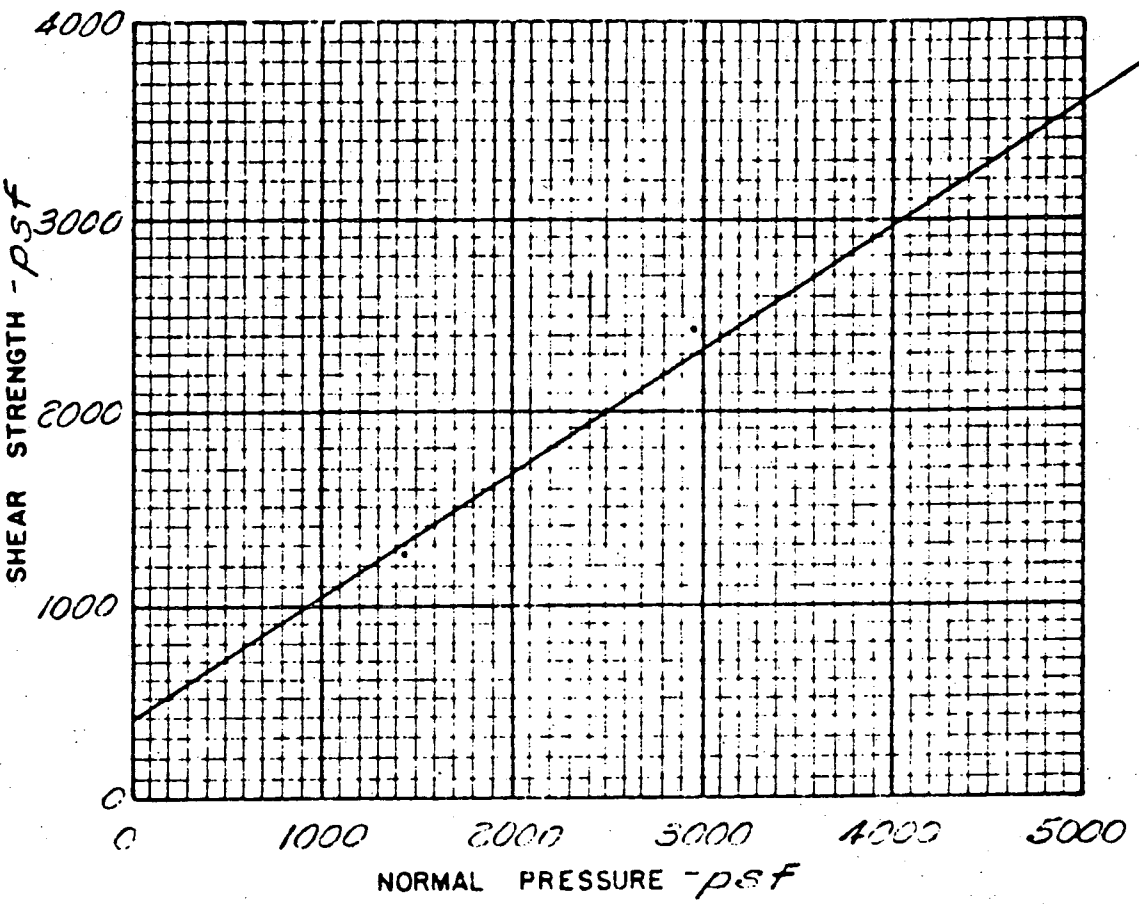
SOIL CONSOLIDATION TESTS

PROJECT San Onofre HOLE NO 1 + 2
TESTED BY G.S.H. DATE 7-3-63

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON *Undisturbed* SOIL SAMPLE

PROJECT *San Onofre Nuc. Gen. Sta.*	DRY DENSITY pcf *94-97*
HOLE NO. *10*	COHESIVE STRENGTH *400*
DEPTH ft. *30'-32.5'*	SOIL COEFF. OF FRICTION *.64*
SAMPLE NO. *7*	FRICTION ANGLE *32.5*
TESTED BY *G.S.H.*	INITIAL MOISTURE CONTENT % *8-13*



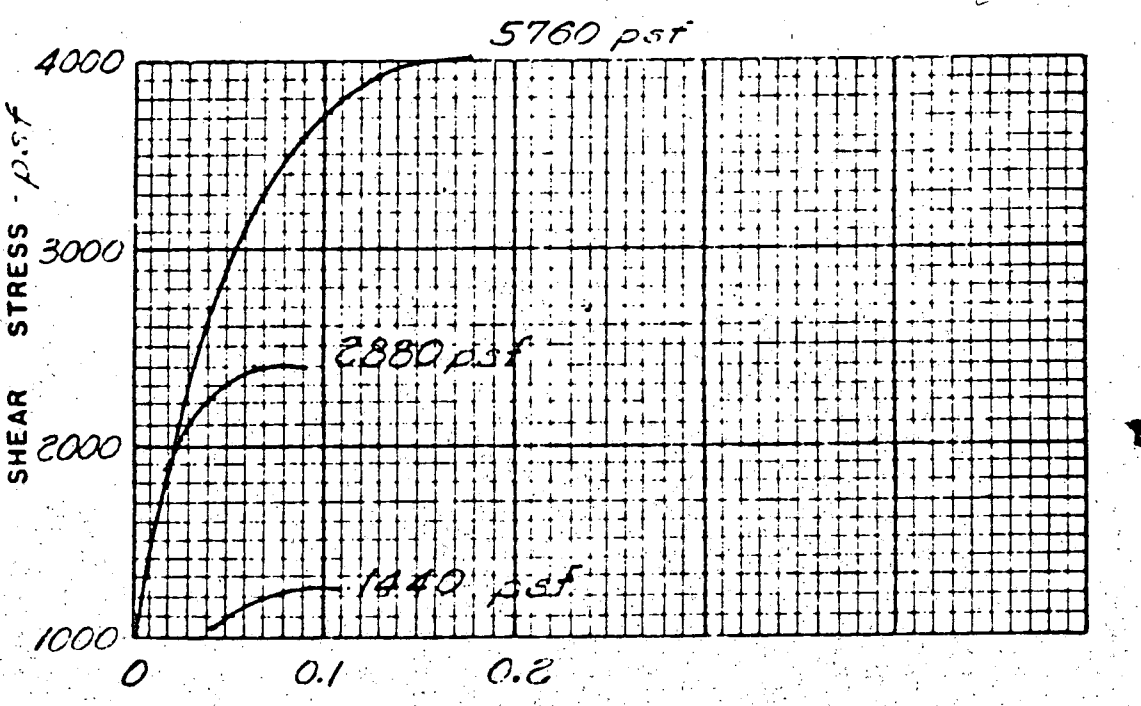


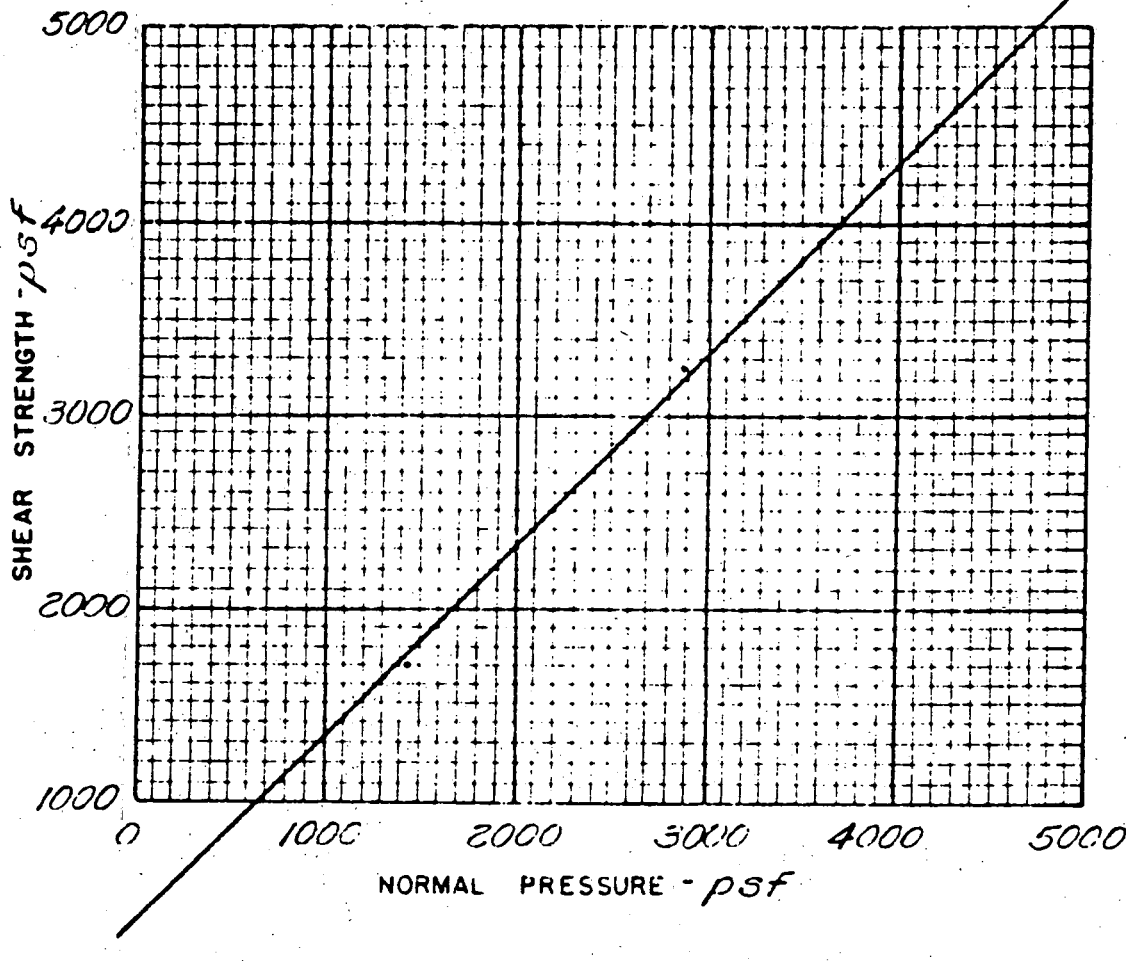
FIGURE C-10

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON *Undisturbed* SOIL SAMPLE

PROJECT *San Onofre Nuc. Gen. Sta.*
HOLE NO. *4*
DEPTH ft. *6'-7.5'*
SAMPLE NO. *L3 San Mateo Fm.*
TESTED BY *G.S.H.*

DRY DENSITY pcf *112*
COHESIVE STRENGTH psf *400*
SOIL COEFF. OF FRICTION *1*
FRICTION ANGLE *45°*
INITIAL MOISTURE CONTENT % *12.6*



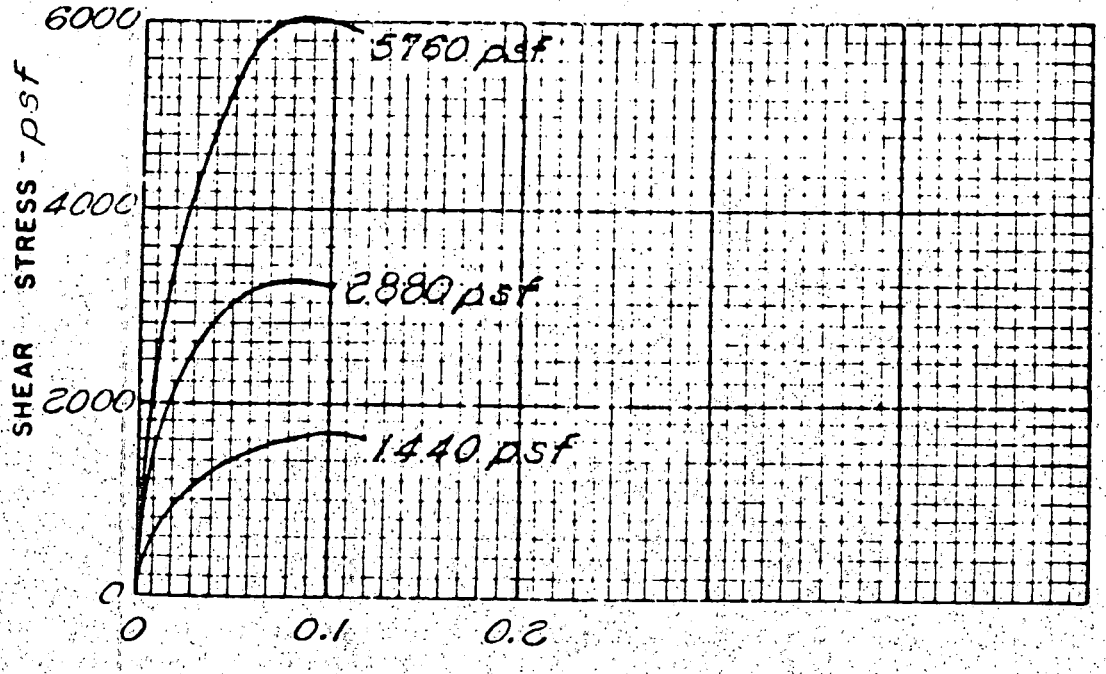


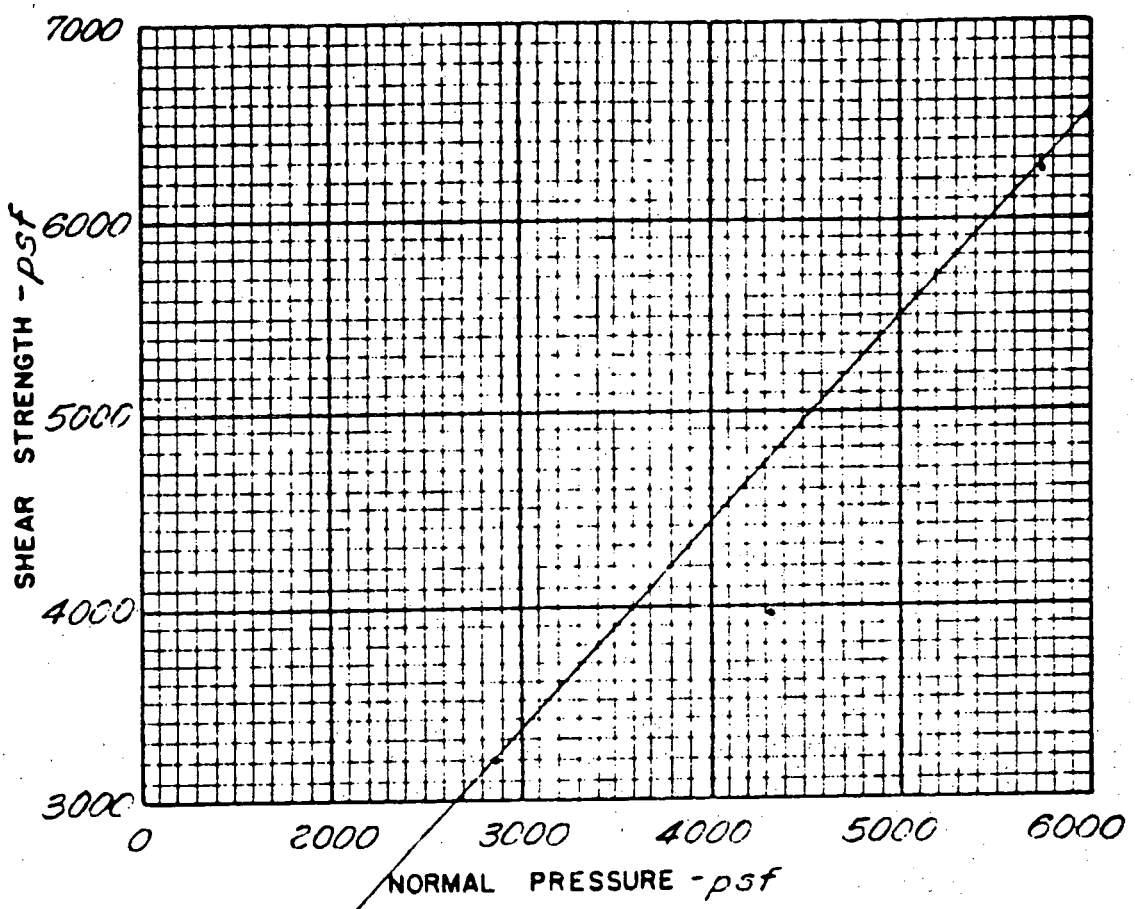
FIGURE C-11

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON Undisturbed SOIL SAMPLE

PROJECT San Onofre Nuc. Gen. Sta.
HOLE NO. 5
DEPTH ft. 123'-125'
SAMPLE NO. 6 San Mateo Fm.
TESTED BY G.S.H.

DRY DENSITY p c f 120
COHESIVE STRENGTH 220
SOIL COEFF. OF FRICTION 1
FRICTION ANGLE 45°
INITIAL MOISTURE CONTENT % est. 12%



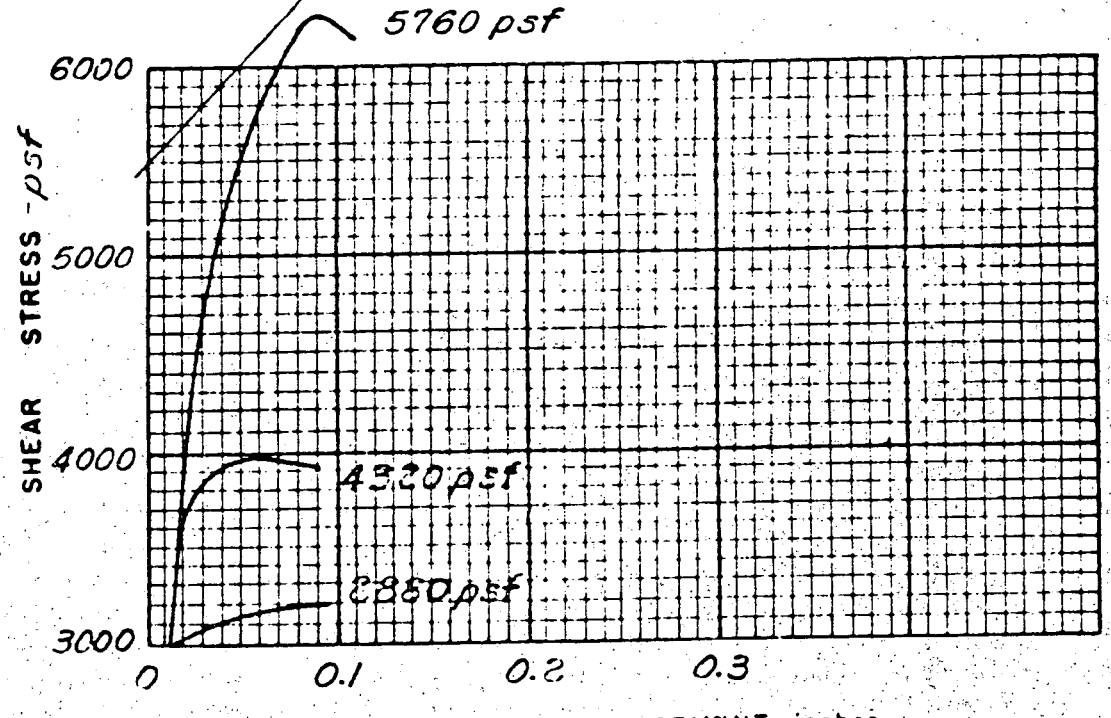
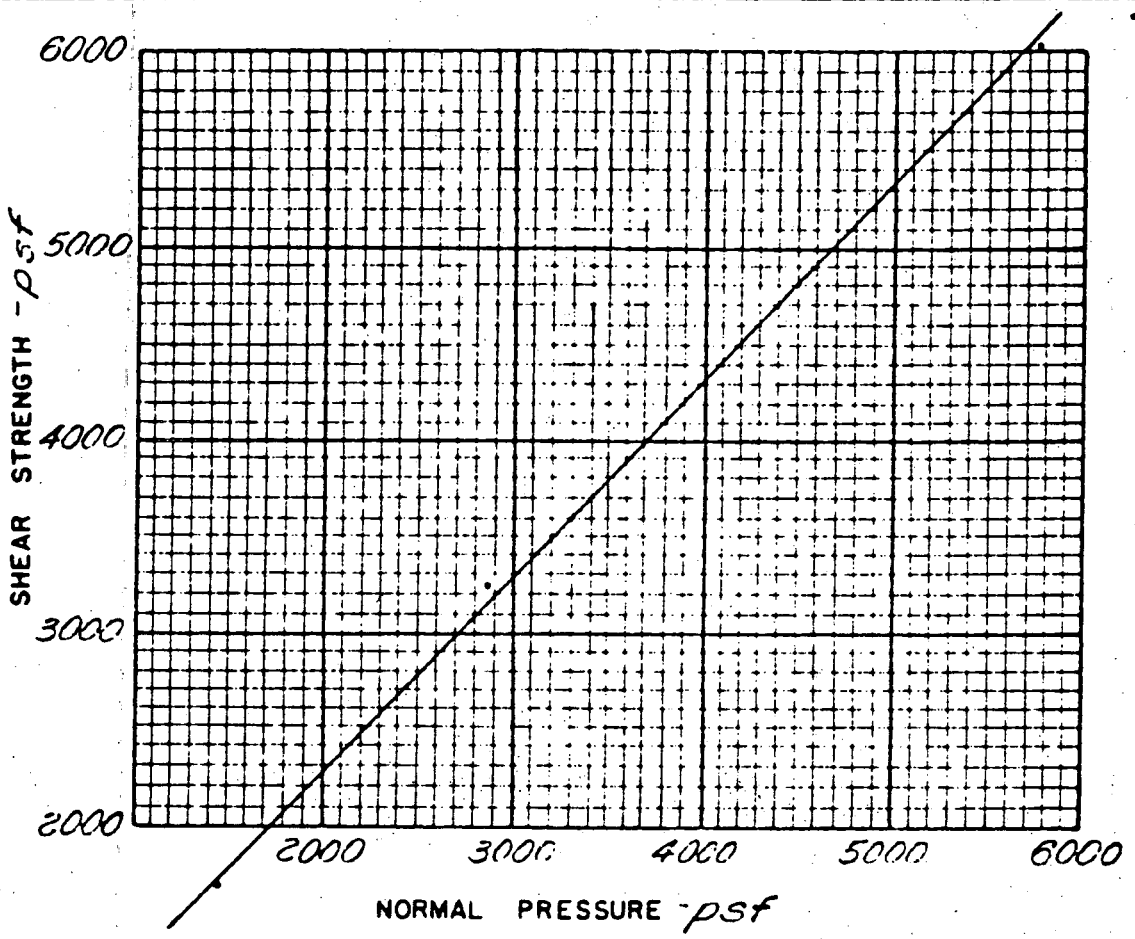


FIGURE C-12

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON *Undisturbed* SOIL SAMPLE

PROJECT *San Onofre Nuc. Gen. Sta.*	DRY DENSITY pcf *111' - 115'*
HOLE NO. *7*	COHESIVE STRENGTH psf *250*
DEPTH ft. *6' - 7⅓'*	SOIL COEFF. OF FRICTION *1*
SAMPLE NO. *13 San Mateo Fm.*	FRICTION ANGLE *45°*
TESTED BY *G.S.H.*	INITIAL MOISTURE CONTENT % *12.6*



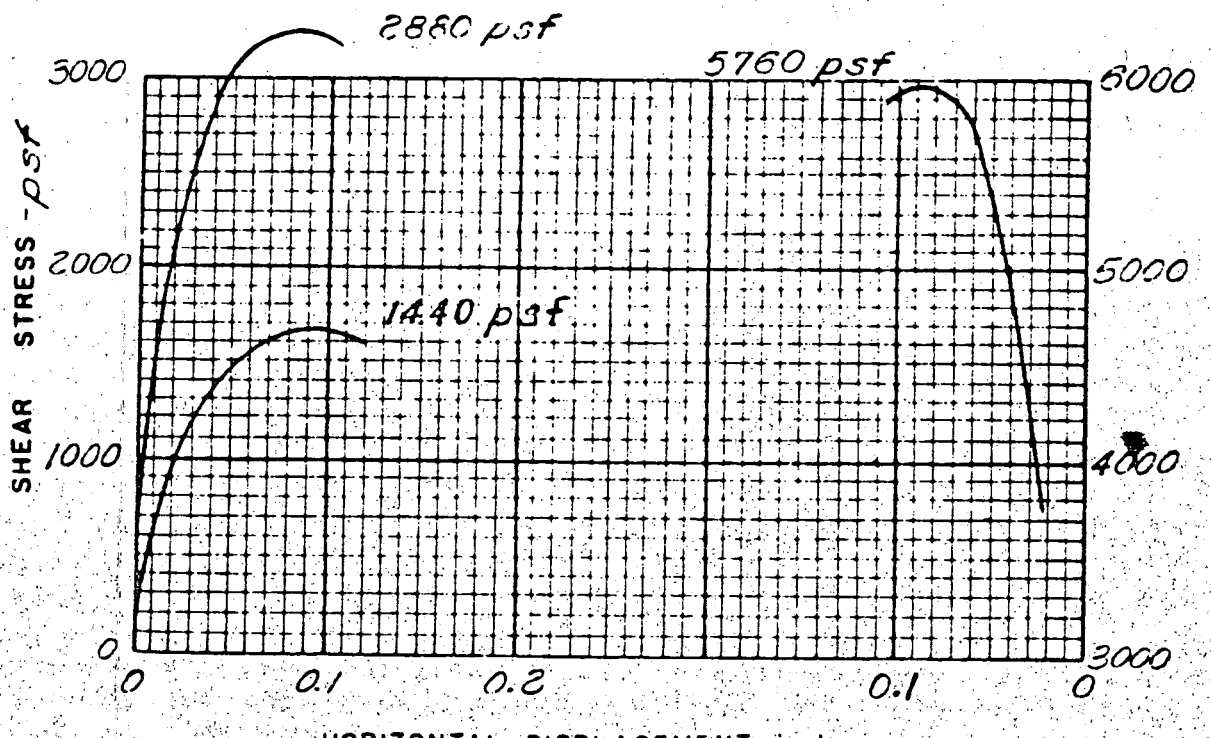
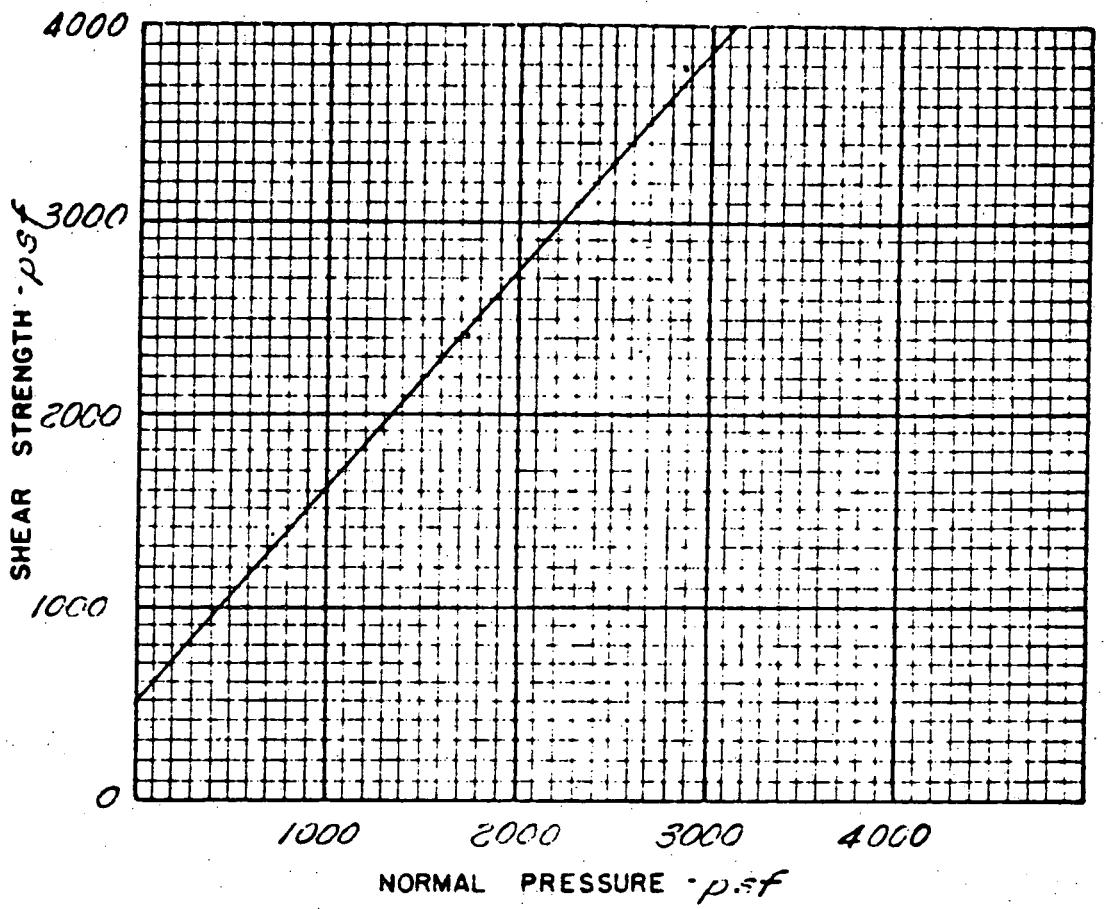


FIGURE 5-13

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON Remolded SOIL SAMPLE

PROJECT San Onofre Nuc. Gen. Stn.	DRY DENSITY p c f 116
HOLE NO.	COHESIVE STRENGTH 500
DEPTH ft. 0'-3'	SOIL COEFF. OF FRICTION 1.1
SAMPLE NO. Terrace bag sample	FRICTION ANGLE 48.5
TESTED BY G.S.H.	INITIAL MOISTURE CONTENT % 14



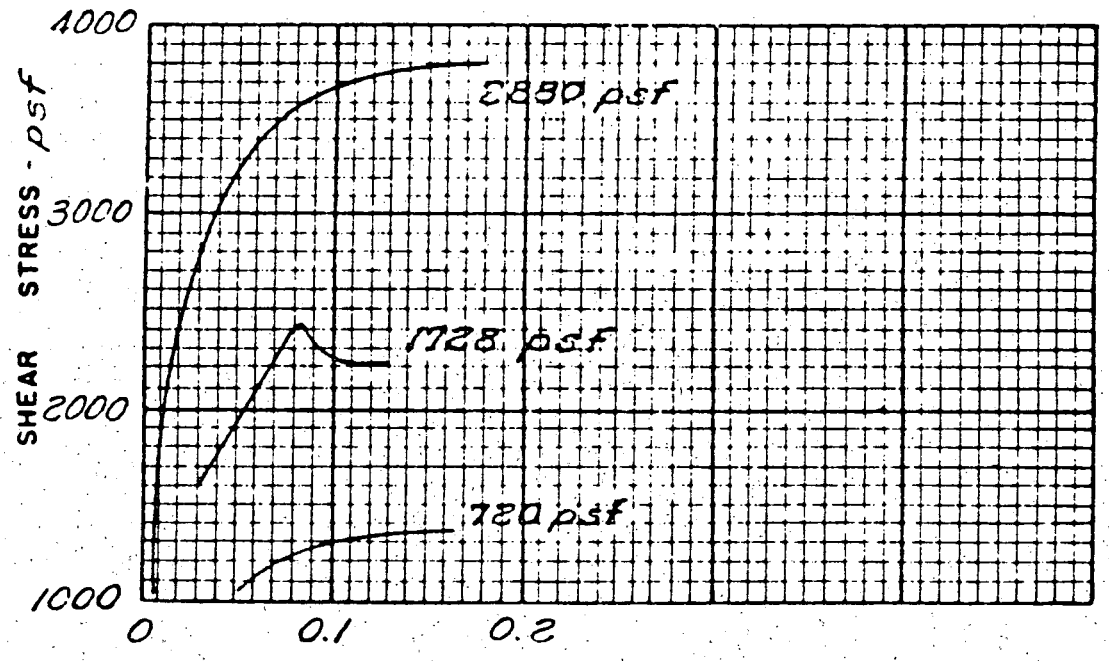


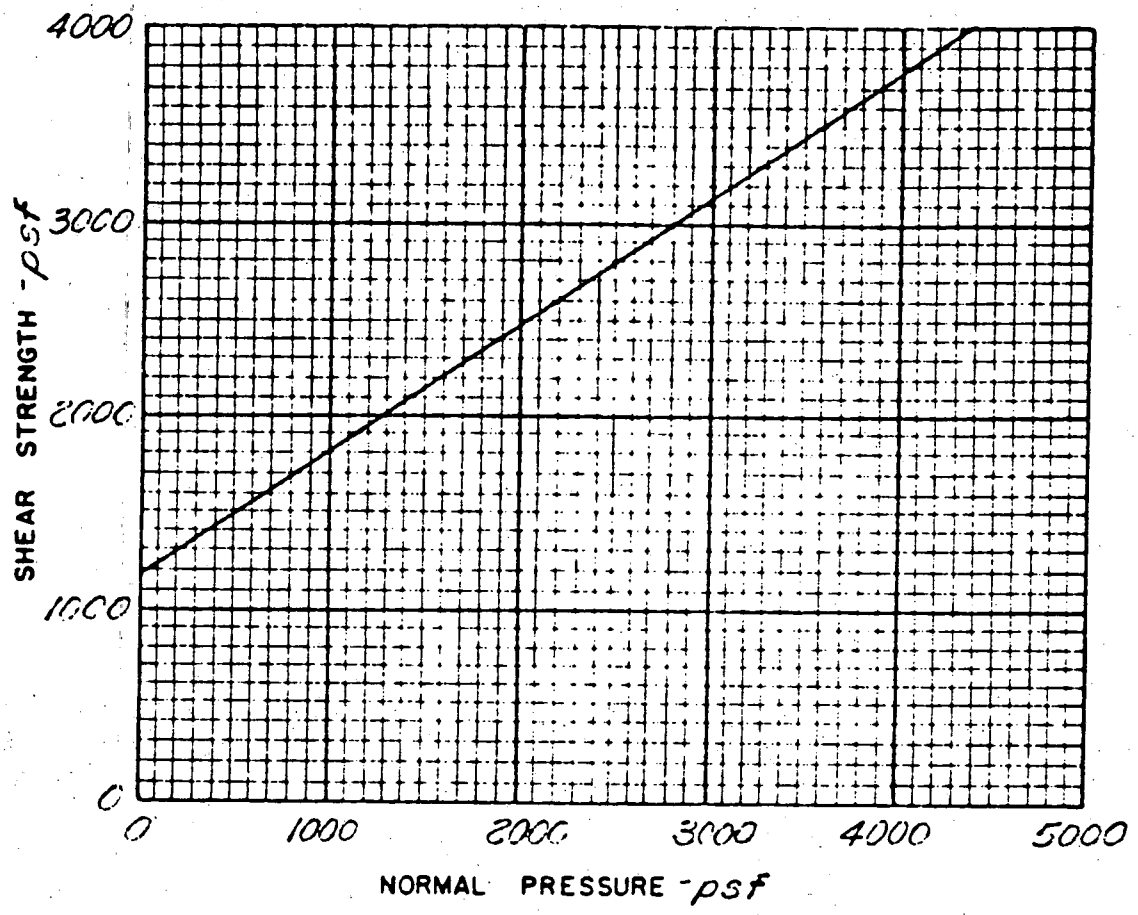
FIGURE C-14

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON *Undisturbed* SOIL SAMPLE

PROJECT *San Onofre Nuc. Gen Sta.*
HOLE NO. *6*
DEPTH ft. *66' - 67'*
SAMPLE NO. *24 San Mateo Fm.*
TESTED BY *E.S.H.*

DRY DENSITY pcf *110 - 116*
COHESIVE STRENGTH psf *1170*
SOIL COEFF. OF FRICTION *.66*
FRICTION ANGLE *33.5*
INITIAL MOISTURE CONTENT % *7.3*



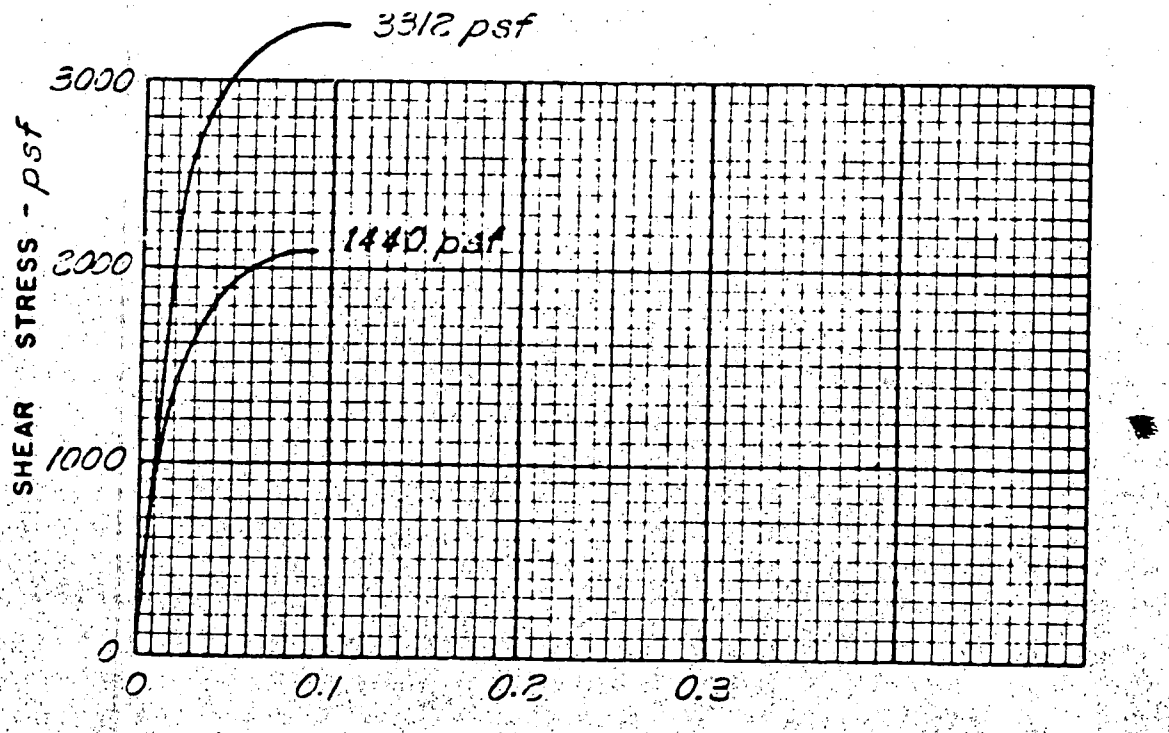
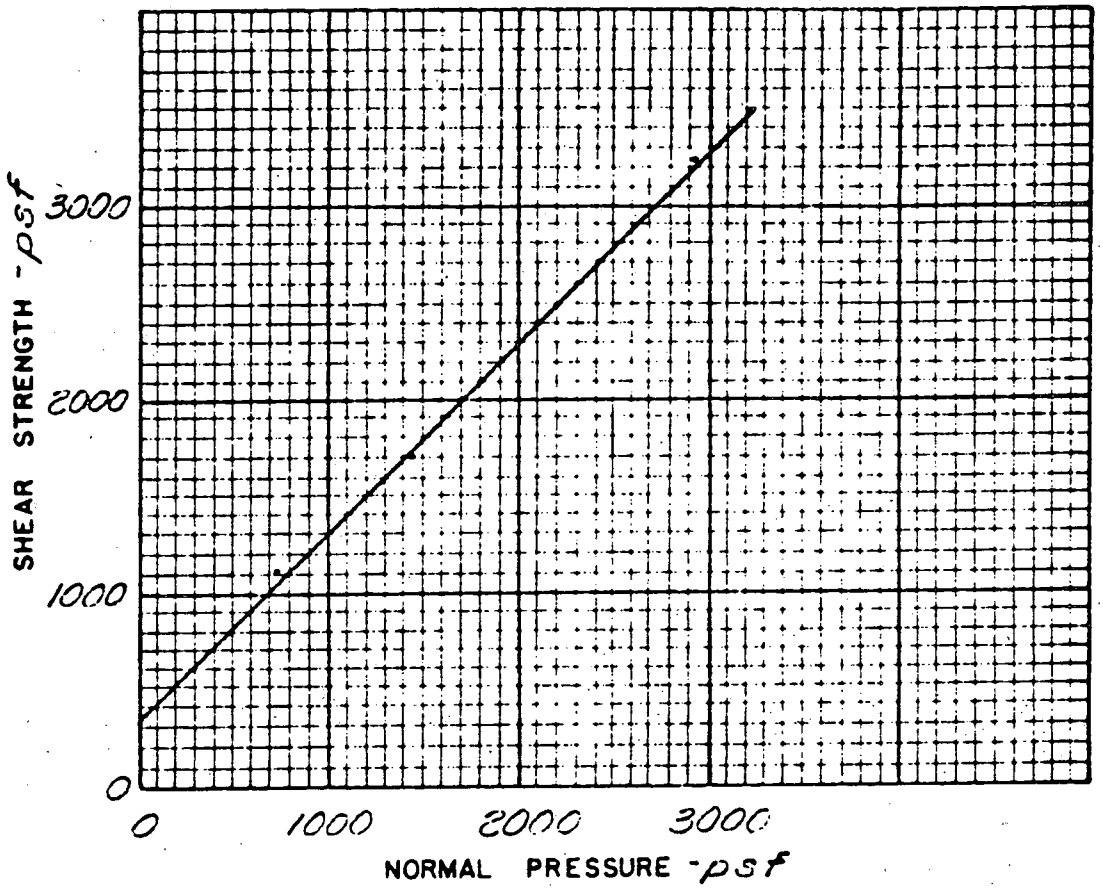


FIGURE C-15

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON *Undisturbed* SOIL SAMPLE

PROJECT *San Onofre Nuc. Gen. Sta.*	DRY DENSITY p c f *114 - 120*
HOLE NO. *6*	COHESIVE STRENGTH *300*
DEPTH ft. *115' - 116.5'*	SOIL COEFF. OF FRICTION *.965*
SAMPLE NO. *San Mateo Fm.*	FRICTION ANGLE *44°*
TESTED BY *G.S.H.*	INITIAL MOISTURE CONTENT % *12.3*



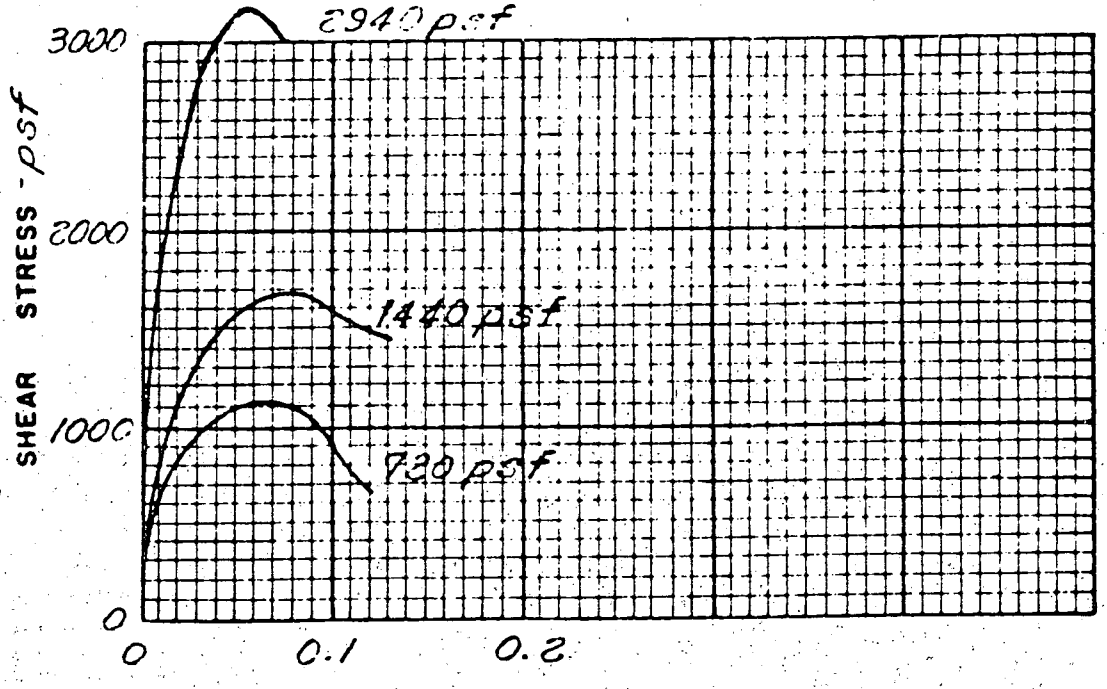


FIGURE C-16

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON Undisturbed SOIL SAMPLE

PROJECT San Onofre Nuc. Gen. Sta.
HOLE NO. 1
DEPTH ft. 81' - 84'
SAMPLE NO.
TESTED BY G.S.H.

DRY DENSITY pcf 115
COHESIVE STRENGTH 1700
SOIL COEFF. OF FRICTION 0.7
FRICTION ANGLE 35
INITIAL MOISTURE CONTENT % 16

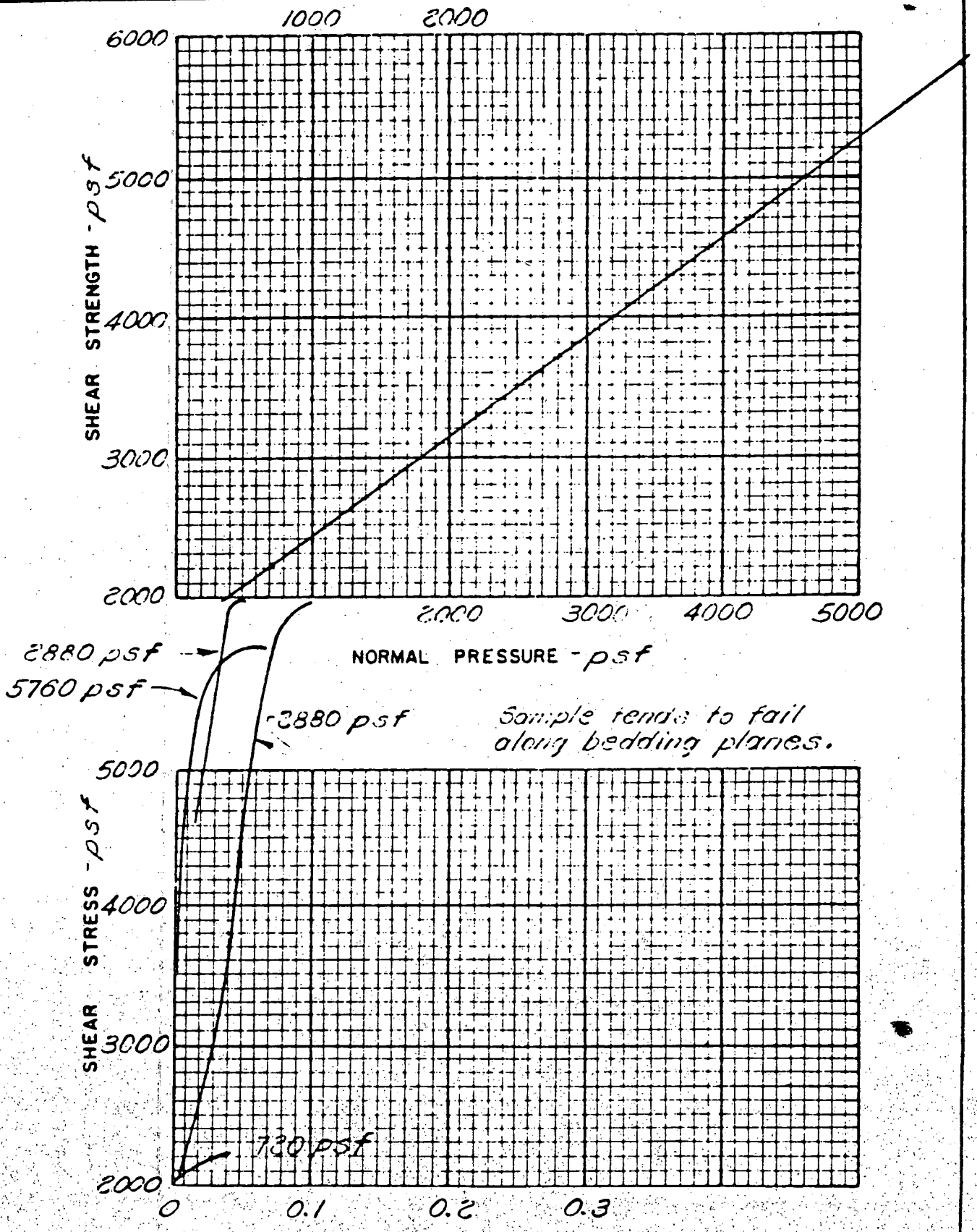


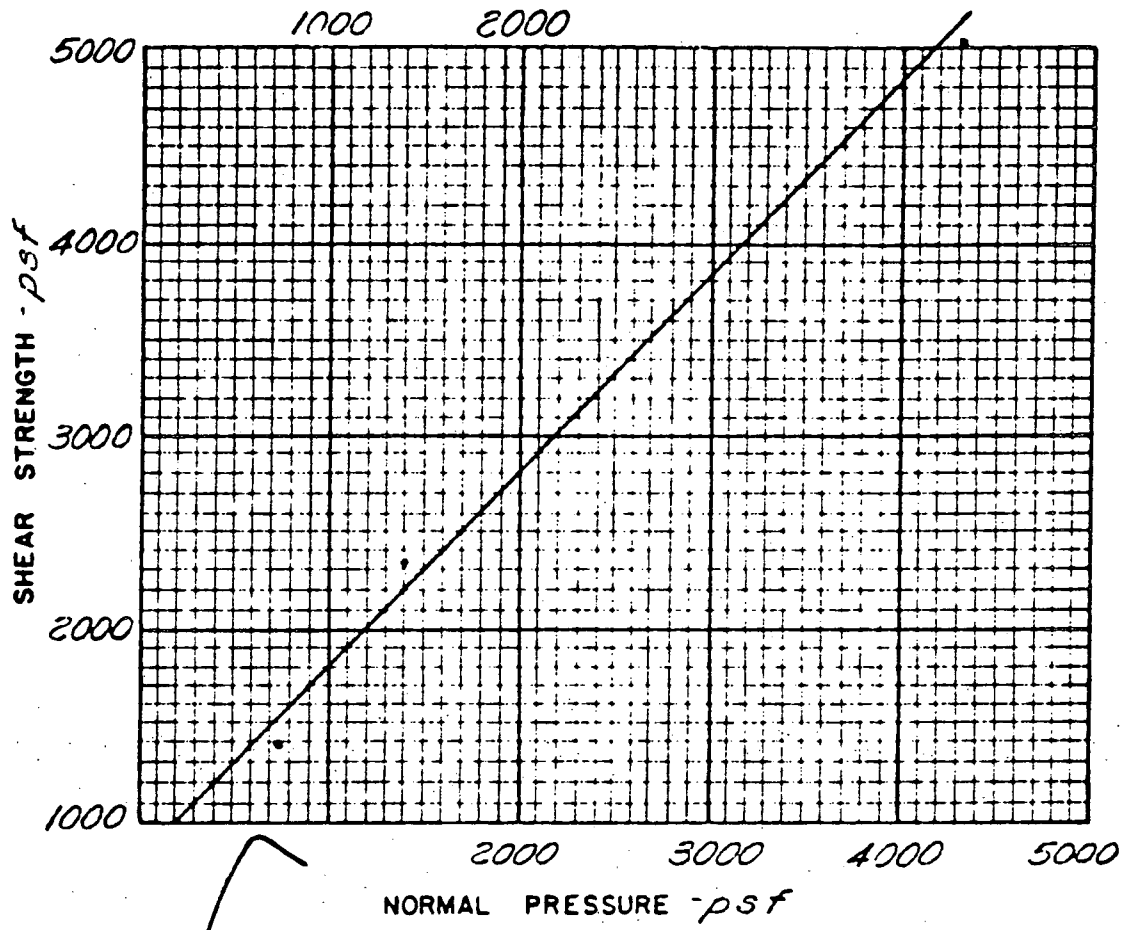
FIGURE C-17

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON Undisturbed SOIL SAMPLE

PROJECT San Onofre Nuc. Gen. Sta.
HOLE NO. 1
DEPTH ft. 120' - 123'
SAMPLE NO.
TESTED BY G.S.H.

DRY DENSITY pcf 113 - 116
COHESIVE STRENGTH 780
SOIL COEFF. OF FRICTION 1.1
FRICTION ANGLE 47.5
INITIAL MOISTURE CONTENT % 9.5



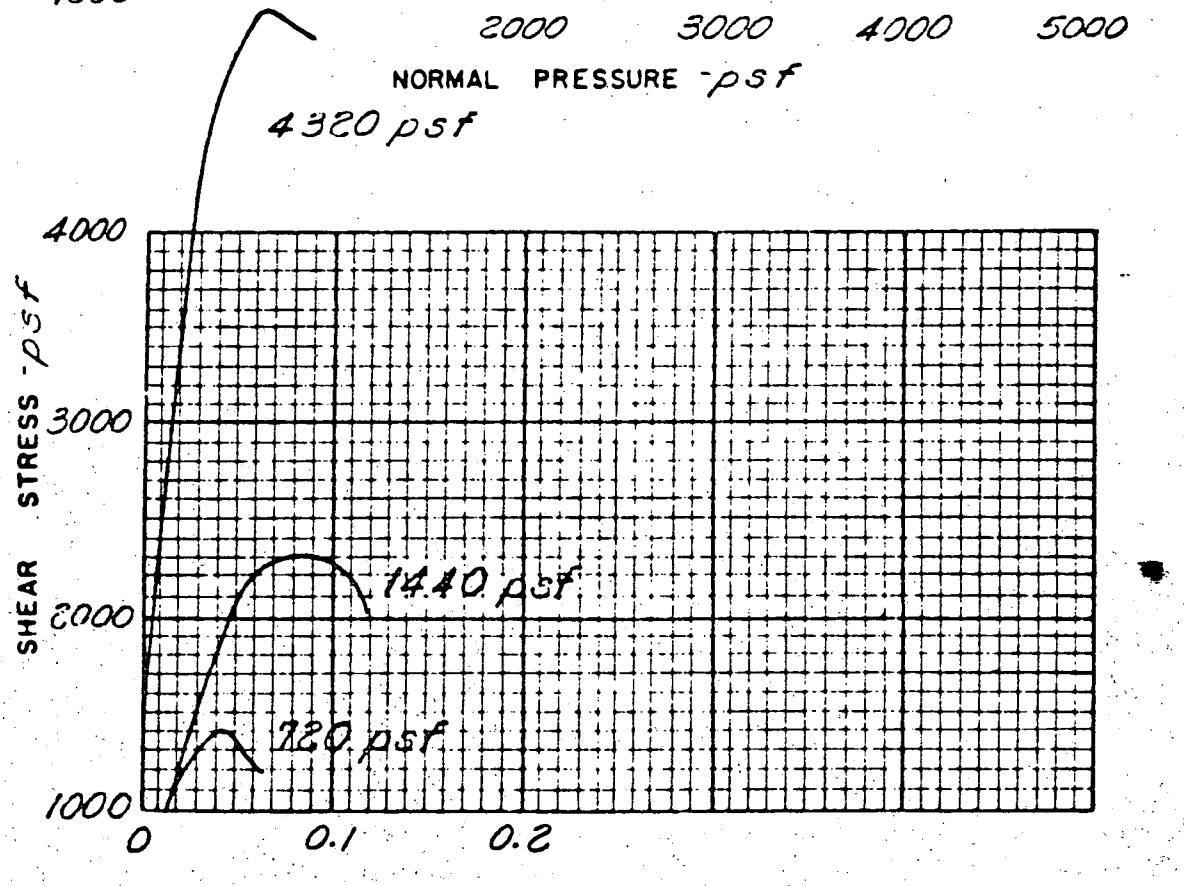


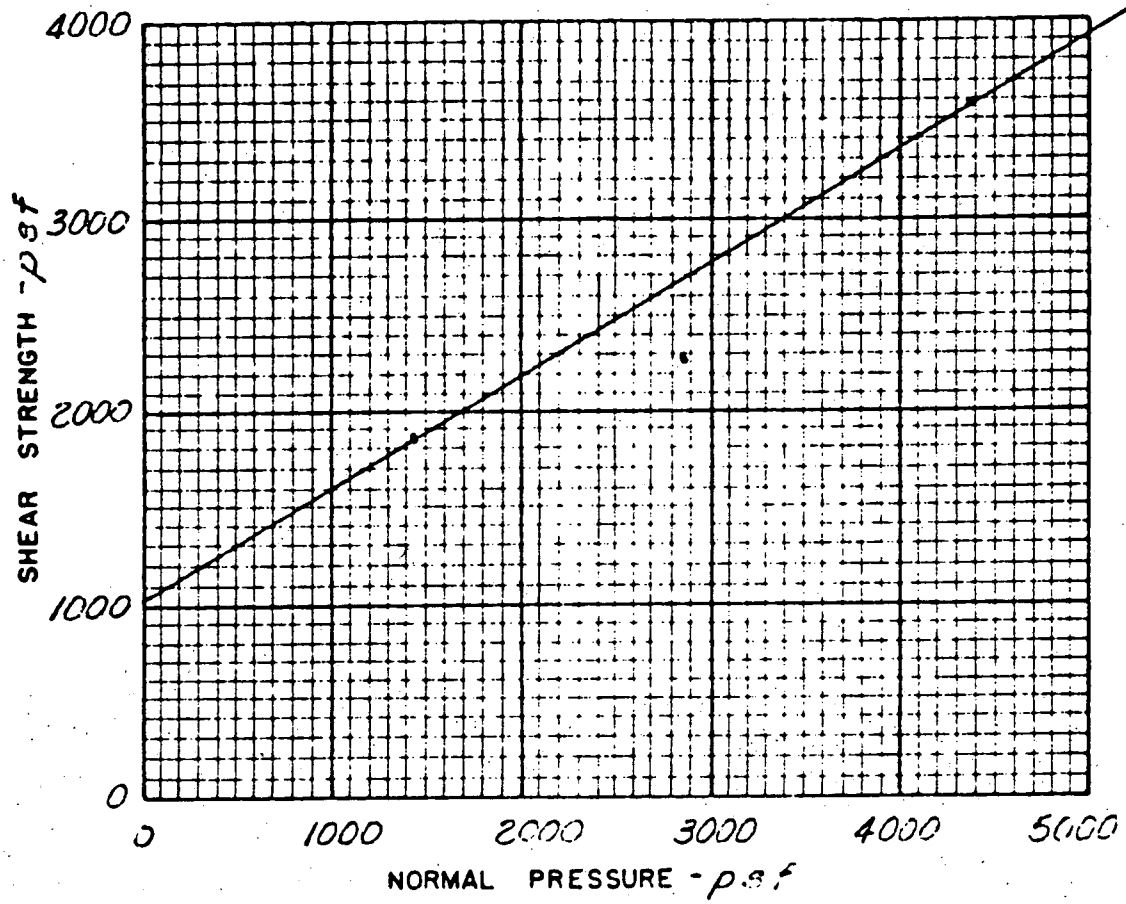
FIGURE C-12

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON Undisturbed SOIL SAMPLE

PROJECT San Onofre Nuc. Gen. Sta.
HOLE NO. 9
DEPTH ft. 12.5' - 14'
SAMPLE NO. 7 Terrace Deposits
TESTED BY G.S.H.

DRY DENSITY p c f 119
COHESIVE STRENGTH psf 1020
SOIL COEFF. OF FRICTION .58
FRICTION ANGLE 30°
INITIAL MOISTURE CONTENT % 14.5



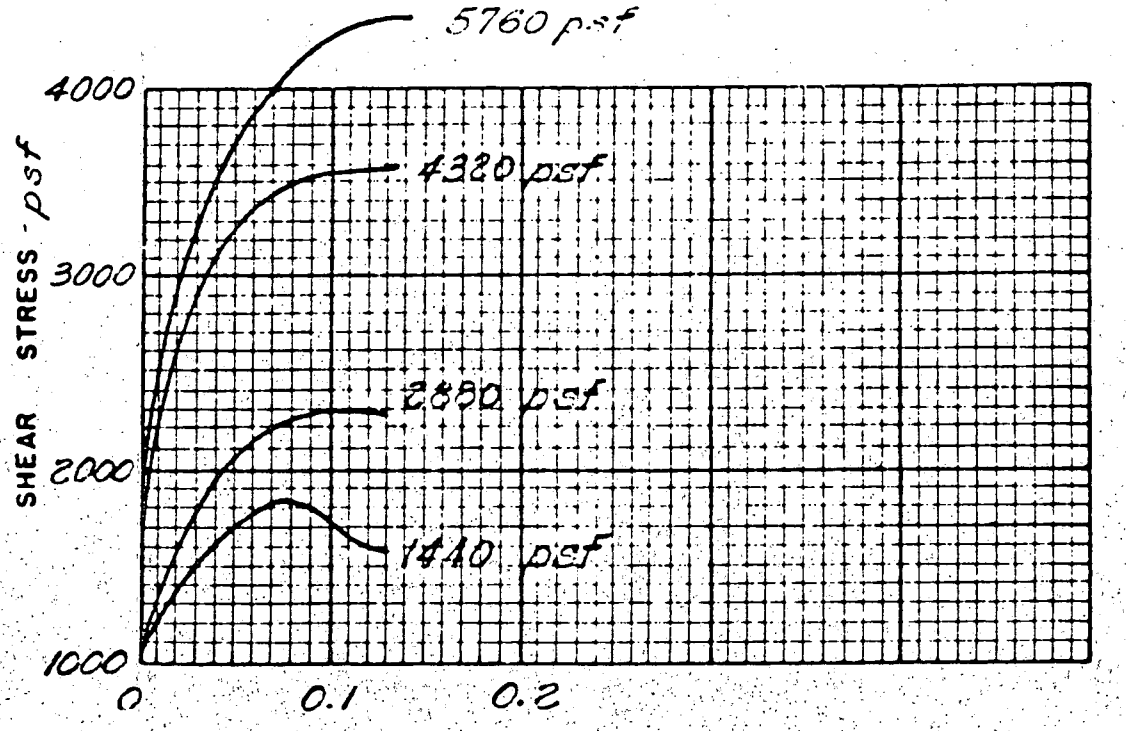
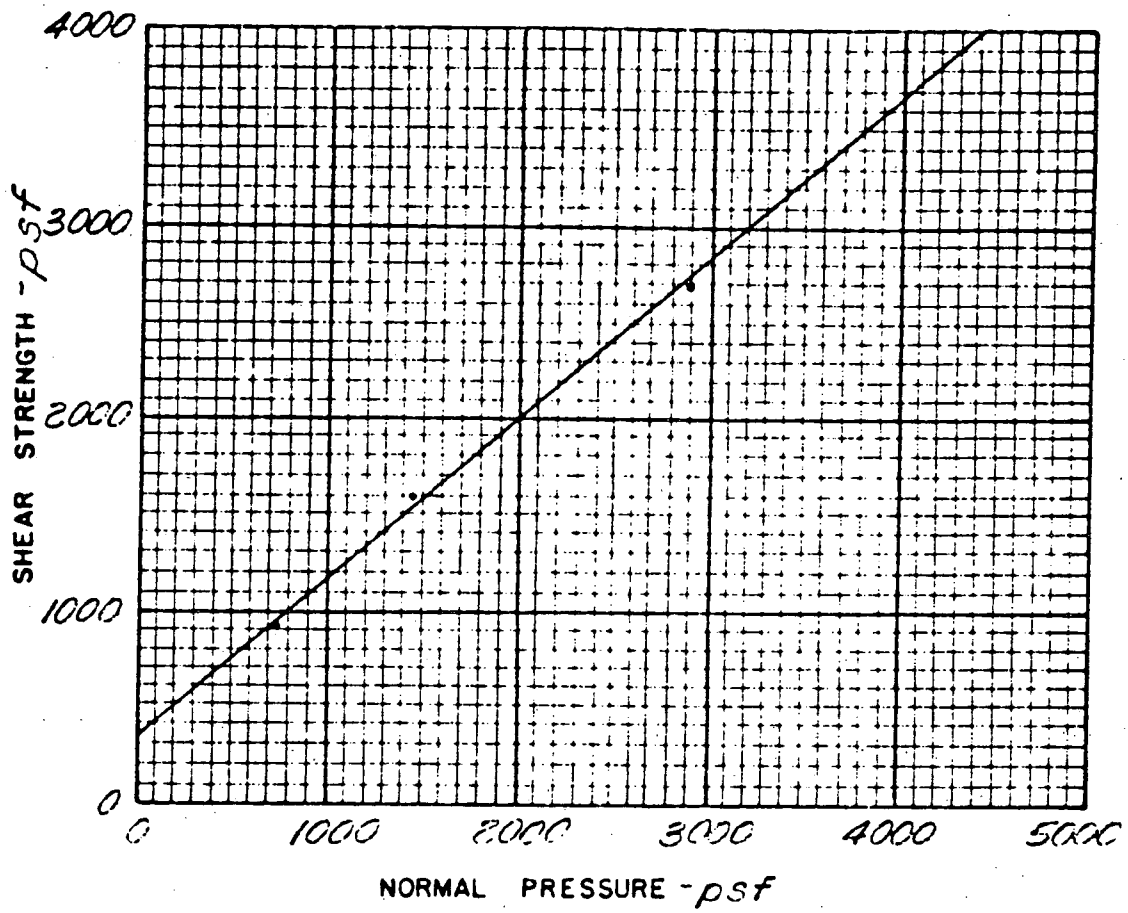


FIGURE C-10

SOUTHERN CALIFORNIA EDISON CO. ENGINEERING DEPARTMENT

DIRECT SHEAR TESTS ON *Undisturbed* SOIL SAMPLE

PROJECT *San Onofre Nuc. Gen. Sta.*	DRY DENSITY p c f *97 - 101*
HOLE NO. *10*	COHESIVE STRENGTH *350*
DEPTH ft. *15' - 17.5'*	SOIL COEFF. OF FRICTION *.824*
SAMPLE NO. *8 Terrace Deposits*	FRICTION ANGLE *39.5*
TESTED BY *G. S. H.*	INITIAL MOISTURE CONTENT % *20.5*



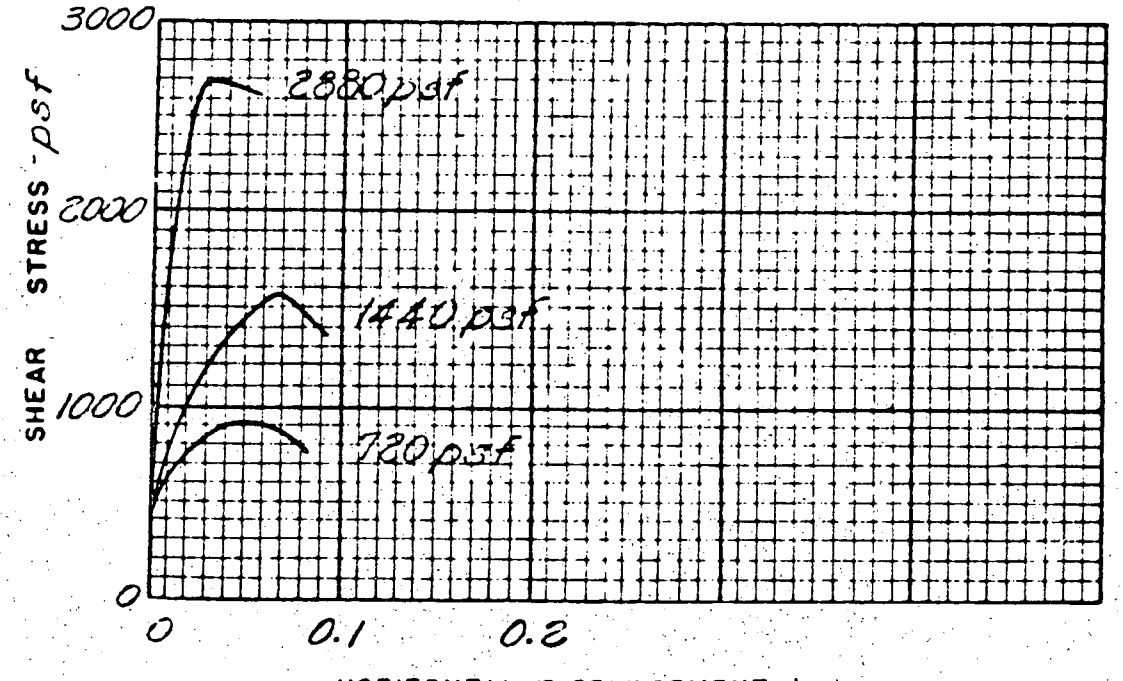


FIGURE C-20

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - BACTERIOLOGISTS - ENGINEERS

4101 N. FIGUEROA STREET
LOS ANGELES 65
CAPITOL 5-4148

CLIENT: Southern California Edison Company
P.O. Box 351
Los Angeles 53, California Attn: Gale Hunt

DATE: July 12, 1963
RECEIVED: June 26, 1963
LABORATORY NO. 61885

SAMPLE: 2 - Jars of sand, 1-tube of sand, and 1 - tube of clay.
Marked: As shown

INVESTIGATION

Identification and analysis of cementitious matter in sand.

RESULTS

Qualitative analysis of the cementitious matter in the sand samples indicated the presence of clay. No organic matter was detected. The clay was separated from the sand by decantation of aqueous suspensions of the samples after allowing all of the sand particles to settle.

Quantitative analysis for the amount of clay in the samples gave the following results:

	Clay, % of dry sand
Hole 1 157' - 159 1/2', 9/20/62	0.68
Hole 1 201' - 203 1/2', 9/20/62	0.65

Spectrographic analyses were made on the clay from the sand samples and on the clay from the tube marked: TH6 10'-12 1/2'. The results of these, shown below, indicate that the clay removed from the sand marked: Hole 1 157'-159 1/2' is very similar in composition to the clay from the tube.

---Continued---

Southern California Edison Company

Laboratory No. 61835

SPECTROGRAPHIC ANALYSIS

	Clay	157 1/2' - 159 1/2'	201' - 203 1/2'
Silicon-	24. %	25. %	35.
Aluminum-	13.	13.	8.3
Iron-	8.1	6.3	3.5
Calcium-	0.16	0.48	0.62
Magnesium-	1.9	1.1	0.93
Titanium-	1.1	0.45	0.18
Lead-	nil	trace	nil
Barium-	trace	trace	trace
Boron-	0.0022	trace	0.0016
Chromium-	0.025	0.011	0.0072
Tin-	nil	0.010	nil
Manganese-	0.064	0.026	0.040
Gallium-	0.0077	0.0076	0.0044
Vanadium-	0.017	0.0096	0.0059
Copper-	0.016	0.010	0.0078
Sodium-	1.1	1.9	1.3
Silver-	0.00042	0.00052	0.00075
Nickel-	0.013	0.0036'	0.0042
Zirconium-	0.0095	0.0084	0.0085
Cobalt-	0.0023	trace	trace
Potassium-	trace	trace	trace
Strontium-	trace	0.015	0.019
Other elements-	nil	nil	nil

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Roger W. Truesdail

Roger W. Truesdail, Ph. D.
President

SEDIMENTATION CHARACTERISTICS OF [illegible] SOILS AT [illegible]

The special hydrometer tests described below were carried out for the purpose of determining the sedimentation characteristics of the soils to be excavated and possibly disposed of in the adjacent [illegible].

Soil Types

The soils at the site consist primarily of two major types:

1. Terrace deposits within the upper 45 feet and ranging from find sands and silts to boulders.

2. San Mateo sands which extend to at least several hundred feet in depth. Since cuts approximately 90 feet in height are contemplated, both soil types will be involved in excavation operations.

The two samples of terrace material are considered to be typical of the finer material. Since the gravelly to boulder portion of this material obviously have much higher settling rates, the tested samples can be considered to be conservative representations of the settling rate for the material as a whole. The San Mateo sands have a higher degree of uniformity and the one tested is considered to be representative of the whole deposit.

Test Description

The hydrometer test is essentially a sedimentation process in which rate of movement is used as an index of particle diameter. It is used for determining the grain-size distribution of soils too fine to be screened and is based on the law that grains of different sizes fall through a liquid at different velocities.

The conventional procedure is to periodically observe with a hydrometer the specific gravity of a soil-distilled water suspension as the soil particles gradually settle to the bottom of a tall cylinder. To insure against the formation of flocs during this sedimentation process, a deflocculant is normally used to alter the electrical charges on the particles. However, because the emphasis in this case is primarily on rate of settlement (and not on grain size distribution per se) it is necessary to introduce certain deviations from the normal procedure in order to simulate more reasonably the conditions in the field. Accordingly, bay water instead of distilled water was employed without the addition of any deflocculant.

Test Results

Test results are plotted in the form of grain size distribution curves relative to time. As shown in Figures 1, 2 and 3, over 90 per cent of the soil particles settled in less than 20 minutes and only approximately two per cent of the soil particles remained in suspension after one hour. It is estimated that the percentage of colloids is less than one per cent.

APPENDIX E

TABLE OF CONTENTS

WATER LEVEL OBSERVATIONS
SAN ONOFRE NUCLEAR GENERATING STATION

	2S/7W/P1 Elev.*MP 37.38 MSl		2S/7W/13R1 Elev.*MP 52.87 MSl		2S/7W/14R3 Elev.*MP 52.87 MSl		2S/7W/24D1 Elev.*MP 37.91 MSl		2S/7W/24M1 Elev.*MP 92.37 MSl	95.01 MLLW		T.H. 6 Elev.*MP= 88.7 MLLW		T.H. 8 Elev.*MP= 91.7 MLLW		T.H. 9 Elev.*MP= 98.9 MLLW	
Date	Depth to Water	Water Elev. MSl	Depth to Water	Water Elev. MSl	Depth to Water	Water Elev. MSl	Depth to Water	Water Elev. MSl	Depth to Water	Water Elev. MSl	Water Elev. MLLW	Date	Depth to Water	Water Elev. MLLW	Depth to Water	Water Elev. MLLW	Depth to Water	Water Elev. MLLW
3/1/63	24.59	13.29	34.79	18.08	12.33	9.32	30.32	7.69	87.27	5.10	7.74	5/28/63	83.9	4.8	86.4	5.3	93.0	5.9
4/1/63	24.30	13.58	34.62	18.25	12.60	9.05	30.45	7.46	87.52	4.85	7.49	6/28/63	83.6	5.1	86.2	5.5	92.8	6.1
5/1/63	23.86	14.02	34.46	18.41	12.55	9.10	30.76	7.15	87.48	4.89	7.53	8/27/63	83.2	5.5	86.3	5.4	-	-

	T.H. 10 Elev.*MP 88.2 MLLW		T.H. 11 Elev.*MP 14.80 MLLW		T.H. 12 Elev.*MP = (14.8** MLLW (15.99		T.H. 13 Elev.*MP = (15.09 MLLW (17.55***		T.H. 14 Elev.*MP 22.55 MLLW			10" Test Well Elev.*M.P. 17.01 MLLW	
Date	Depth to Water	Water Elev.	Depth to Water	Water Elev.	Depth to Water	Water Elev.	Depth to Water	Water Elev.	Depth to Water	Water Elev.	Date	Depth to Water	Water Elev.
5/28/63	83.05	5.15	10.0	4.8	10.3	4.5	10.2	4.9	17.75	4.80	8/29/63	12.2	5.8
6/28/63	82.8	5.4	10.4	4.4	10.8	4.0	10.5	4.6	17.6	4.9			
8/19/63	-	-	9.25	5.55	10.53	5.46	11.92	5.63	16.93	5.62			

* Measuring Point = Top of casing or top of plastic pipe

** Top of pipe broken and new measuring point used after July 17

*** 17.55 = Top of water level recorder table

TABLE E-1

WATER WELL TEST ... NG PROGRAM

RECOVERY

Sheet No. 1 of 2

Start Pumping _____

Observer Hunt - Barber

End Pumping 2:56 p.m. 8/28/63

Contractor J. L. Helton - Orange County Pump Co.

PUMPING WELL

Elevation 17.01 'LLW

Q gpm	water level	drawdown	specific capacity
	9 min.		
	13.15'		
	21 min.		
	12.6'		
	29 min.		
	12.3'		
	40 min.		
	12.35'		
	49 min.		
	12.15'		
	64 min.		
	12.09'		

OBSERVATION WELLS

Depths to water below measuring point in feet.

* 11 El. 14.80	* 12 El. 15.99	* 13 El. 17.55	* 14 El. 22.55
0 min.	0 min.	0 min.	0 min.
10.3'	11.35'	13.65'	17.65'
14 min.	2 min.	1 min.	5 min.
9.95'	11.25'	13.50'	17.65'
24 min.	17 min.	2 min.	19 min.
9.90'	11.05'	13.35'	17.55'
45 min.	26 min.	3 min.	29 min.
9.85'	11.05'	13.20'	17.50'
64 min.	31 min.	4 min.	44 min.
9.75'	10.90'	13.07'	17.4'
	62 min.	5 min.	69 min.
	10.85	13.03'	17.4'
		6 min.	
		12.98'	
		7 min.	
		12.95'	
		15 min.	
		12.76'	
		27 min.	
		12.64'	

Elevation of ... point

Table E-2

WATER WELL TEST ING PROGRAM

RECOVERY

Sheet No. 2 of 2

Start Pumping

End Pumping 2:56 p.m.

Observer Hunt - Barber

Contractor J. L. Helton - Orange County Pump Co.

PUMPING WELL

Elevation 17.01 'LLW

Q gpm	water level	drawdown	specific capacity

OBSERVATION WELLS

11 El. 14.80	12 El. 15.99	13 El. 17.55	14 El. 22.55
		32 min.	
		12.61'	
		36 min.	
		12.57'	
		41 min.	
		12.56'	
		47 min.	
		12.54'	
		51 min.	
		12.52'	
		52 min.	
		12.45'	

Table E-3

WATER WELL TEST[illegible]PING PROGRAM

DRAWDOWN

Sheet No. 1 of 3

Start Pumping 11:18 a.m.

End Pumping 5:56 p.m. 8/29/63

Observer Hunt - Barber

Contractor Orange County Pump Co.

12.3 Static level = 14' on gage

PUMPING WELL — Gage located 2' higher than measuring point on top of casing

Elevation 17.01 MLLW

* El Measuring Point

OBSERVATION WELLS
Depths to water below measuring point in feet

Q gpm	water level	drawdown	specific capacity	EC x 10^6	Gallons Pumped (flowmeter)	* 11 El. 14.80	12 El. 15.99	13 El. 17.55	14 El. 22.55
	Stat. 8:10			13 min.	12,600	Stat. 8:13A	Stat. 8:21A	Stat. 11:15	Stat. 8:50A
	12.2'			1150		10.00'	11.07'	12.65'	17.35'
	Stat. 11:00			14 min.	13,300	Stat. 11:00	Stat. 11:02	15 sec.	Stat. 11:05
	14' gage			1100		10.05'	11.10'	12.7'	17.35'
Est. 97 heavy	1 min.			25 min.	14,300	3 min.	5 min.	30 sec.	9 min.
fluct. broke	35'			1125		10.35'	11.35'	12.9'	17.45'
suction at	2 min.			38 min.	15,300	8 min.	11 min.	45 sec.	14 min.
1-1/2 min. Q	30'			1100		10.40'	11.38'	13.0'	17.50'
decreased.	3 min.			1 hr. 4 min.	16,900	14 min.	17 min.	1 min.	19 min.
	33'			1100		10.47'	11.40'	13.2'	17.50'
	4 min.			1 hr 37 min.	19,300	22 min.	24 min.	1 min. 30 sec.	24 min.
	39'			1100		10.50'	11.45'	13.35'	17.55'
	6 min.			1 hr. 57 min.	20,700	29 min.	31 min.	2 min.	29 min.
97	39'			1090		10.50'	11.45'	13.30'	17.55'
32 min.	30 min.			2 hr. 57 min.	25,000	34 min.	37 min.	6 min.	34 min.
88-94	32'			1050		10.45'	11.45'	13.35'	17.57'
47 min.	45 min.			4 hr. 12 min.	30,000	42 min.	44 min.	9 min.	39 min.
88-94 fluct.	34'			1100		10.50'	11.47'	13.40'	17.56'
88 Steady	1 hour			5 hr. 17 min.	34,500	51 min.	59 min.	20 min.	44 min.
	34.5			1000		10.53'	11.50'	13.45'	17.57'

Table E-4

WATER WELL TEST [illegible]NG PROGRAM

[illegible]TION

Sheet No. 2 of 3

Start Pumping 11:18 a.m.

End Pumping 2:56 p.m. 8/29/63

Observer Hunt - Barber

Contractor Orange County Pump Co.

PUMPING WELL

Elevation 17.01 'LLW

Q gpm	water level	drawdown	specific capacity	EC x 10^6	Gallons Pumped (flowmeter)
See Sheet 3				5 hr. 48 min. 1000	36,800
				6 hr. 17 min. 1000	38,800
					End Test 39,900

* Elevation of measuring point

OBSERVATION WELLS

Depth to water below measuring point

* 11 El. 11.80	* 12 El. 15.99	13 El. 17.80	* 14 El. 22.55
1 hr. 6 min.	1 hr. 32 min.	24 min.	59 min.
10.53'	11.48'	13.5'	17.60'
1 hr. 32 min.	2 hr. 33 min.	32 min.	1 hr. 14 min.
10.55'	11.55'	13.50'	17.63'
1 hr. 52 min.	2 hr. 53 min.	47 min.	1 hr. 29 min.
10.60'	11.57'	13.55'	17.65'
2 hr. 57 min.	3 hrs.	59 min.	1 hr. 44 min.
10.50'	11.50'	13.60'	17.66'
3 hr. 42 min.	3 hr. 47 min.	1 hr. 19 min.	2 hr. 44 min.
10.38'	11.38'	13.60'	17.69'
4 hr. 12 min.	4 hr. 13 min.	1 hr. 52 min.	2 hr. 44 min.
10.30'	11.29'	13.65'	17.71'
5 hr. 7 min.	5 hr. 9 min.	3 hrs.	3 hr. 14 min.
10.10'	11.15'	13.65'	17.70'
5 hr. 42 min.	5 hr. 47 min.	3 hr. 53 min.	3 hr. 44 min.
10.00'	11.05'	13.50'	17.70'
6 hr. 7 min.	6 hr. 11 min.	4 hr. 28 min.	4 hr. 10 min.
10.00'	11.00'	13.45'	17.70'
6 hr. 27 min.	6 hr. 31 min.	5 hr. 12 min.	5 hr. 12 min.
9.95'	10.95'	13.30'	17.65'

Table E-5

WATER WELL TEST [illegible] PROGRAM

DRAWDOWN

Sheet No. 3 of 3

Start Pumping 11:18 a.m.

End Pumping 2:56 p.m. 8/29/63

Observer Hunt - Barber

Contractor Orange County Pump Co.

PUMPING WELL

Elevation 17.01 MLW

Q gpm	water level	drawdown	specific capacity
84-88	1 hr. 19 min.		
	35'		
82-84	1 hr. 52 min.		
	35'		
82-84	3 hrs.		
	36'		
82-84	3 hr. 55 min.		
	36.5		
82-84	5 hr. 12 min.		
	36.5		
82-84	5 hr. 45 min.		
	36.5		
82-84	6 hr. 35 min.		
	36.5		

OBSERVATION WELLS

11 El.	12 El.	13 El.	14 El.	Total Q
		5 hr. 38 min.	5 hr. 42 min.	
		13.30	17.65	
		5 hr. 45 min.	6 hr. 12 min.	
		13.30	17.58	
		6 hr. 11 min.	6 hr. 30 min.	
		13.22	17.55	38,600
		6 hr. 35 min.		
		13.15		

Table E-6

WATER WELL TEST [illegible]G PROGRAM

RECOVERY

Sheet No. 1 of 2

Start Pumping _____

Observer Hunt - Barber

End Pumping 5:57 p.m. 8/29/63

Contractor Orange County Pump Co.

14.5 gage = 12.5' below measuring point.

PUMPING WELL

Elevation 17.01 'LLW (measuring point)

Q gpm	water level	drawdown	specific capacity
	0 min.		
	36.5		
	1 min.		
	35.0'		
	1 min. 15 sec.		
	20.0'		
	1 min. 30 sec.		
	18.5'		
	1 min. 45 sec.		
	18.5'		
	2 min. 30 sec.		
	16.0'		
	3 min.		
	16.0'		
	4 min.		
	15.5'		
	5 min.		
	15.5'		

OBSERVATION WELLS

Depths to water below measuring point in feet.

* 11 El. 14.80	* 12 El. 15.99	* 13 El. 17.55	* 14 El. 22.55
0 min.	0 min.	0 min.	0 min.
9.95'	10.95'	13.15'	17.55'
5 min.	11 min.	15 sec.	9 min.
9.90'	10.75'	13.05'	17.60'
8 min.	16 min.	1 min.	14 min.
9.80'	10.70'	12.85'	17.50'
13 min.	23 min.	2 min.	19 min.
9.75'	10.70'	12.85'	17.47'
18 min.	33 min.	5 min.	25 min.
9.75'	10.70'	12.65'	17.40'
----	50 min.	7 min.	33 min.
9.70'	10.65'	12.60'	17.40'
33 min.		10 min.	43 min.
9.65'		12.55'	17.40'
43 min.		13 min.	57 min.
9.55'		12.50'	17.30'
		18 min.	
		12.40'	

Table E-7

* El measuring point

WATER WELL TEST PUMPING PROGRAM

RECOVERY

Sheet No. 2 of 2

Start Pumping _____

End Pumping 5:57 p.m. 8/29/53

Observer Hunt - Barber

Contractor Orange County Pump Co.

PUMPING WELL

14.5' gage = 12.5' below measuring point

Elevation 17.01 MLLW

Q gpm	water level	drawdown	specific capacity
	8 min.		
	15.0'		
	12 min.		
	14.5'		
	17 min.		
	14.5 = 12.5		
	25 min.		
	12.35 below measuring point (steel tape)		

OBSERVATION WELLS

Depths to water below measuring point in feet

* 11 El. 14.80	* 12 El. 15.99	* 13 El. 17.55	* 14 El. 22.55
		24 min.	
		12.35'	
		43 min.	
		12.30'	
		51 min.	
		12.23	

* Elevation of measuring point

Table E-8

FORM 00397 50 PADS 10-61
SOUTHERN CALIFORNIA EDISON COMPANY

SHEET OF SHEETS

ENGINEERING DEPARTMENT
CALCULATION SHEET

DRAWDOWN
8/29/55

SUBJECT: SAN ONOFRE PUMP TEST DWG. NO.

J.O. NO. MADE BY G.S.H DATE CHK. BY DATE

TEST HOLE 13
DRAWDOWN

TIME (min)	DEPTH TO WATER El MEAS. point 17.55' BELOW	ELEV. OF WATER TABLE NOT COR. FOR TIDE	TIDE EFFECT FT	DEPTH TO WATER CORRECTED FOR TIDE	DRAWDOWN Ho - H
0	12.65	4.90			0
1/4	12.7	4.85			.05
1/2	12.9	4.65			.25
3/4	13.0	4.55			.35
1	13.2	4.35			.55
1 1/2	13.35	4.20			.70
2	13.3	4.25			.65
6	13.35	4.20			.70
9	13.40	4.15			.75
20	13.50	4.10			.85
24	13.60	4.05			.90
32	13.50	4.05		13.55	.90
47	13.55	4.10	0	13.55	.90
59	13.60	3.95	.05	13.55	.95
79	13.60	3.95	.05	13.60	.95
112	13.55	3.90	.05	13.60	.95
180	13.55	3.90	0	13.60	.95
233	13.50	4.05	.1	13.60	.95
269	13.45	4.10	.2	13.60	.95
312	13.35	4.25	.3	13.65	1.00
338	13.30	4.25	.35	13.65	1.00
345	13.30	4.25	.35	13.65	1.00
372	13.20	4.33	.4	13.6	
395	13.15	4.40	.5	13.6	

FILE DWG. NO Figure E-1

DRAW DOWN
8/29/63

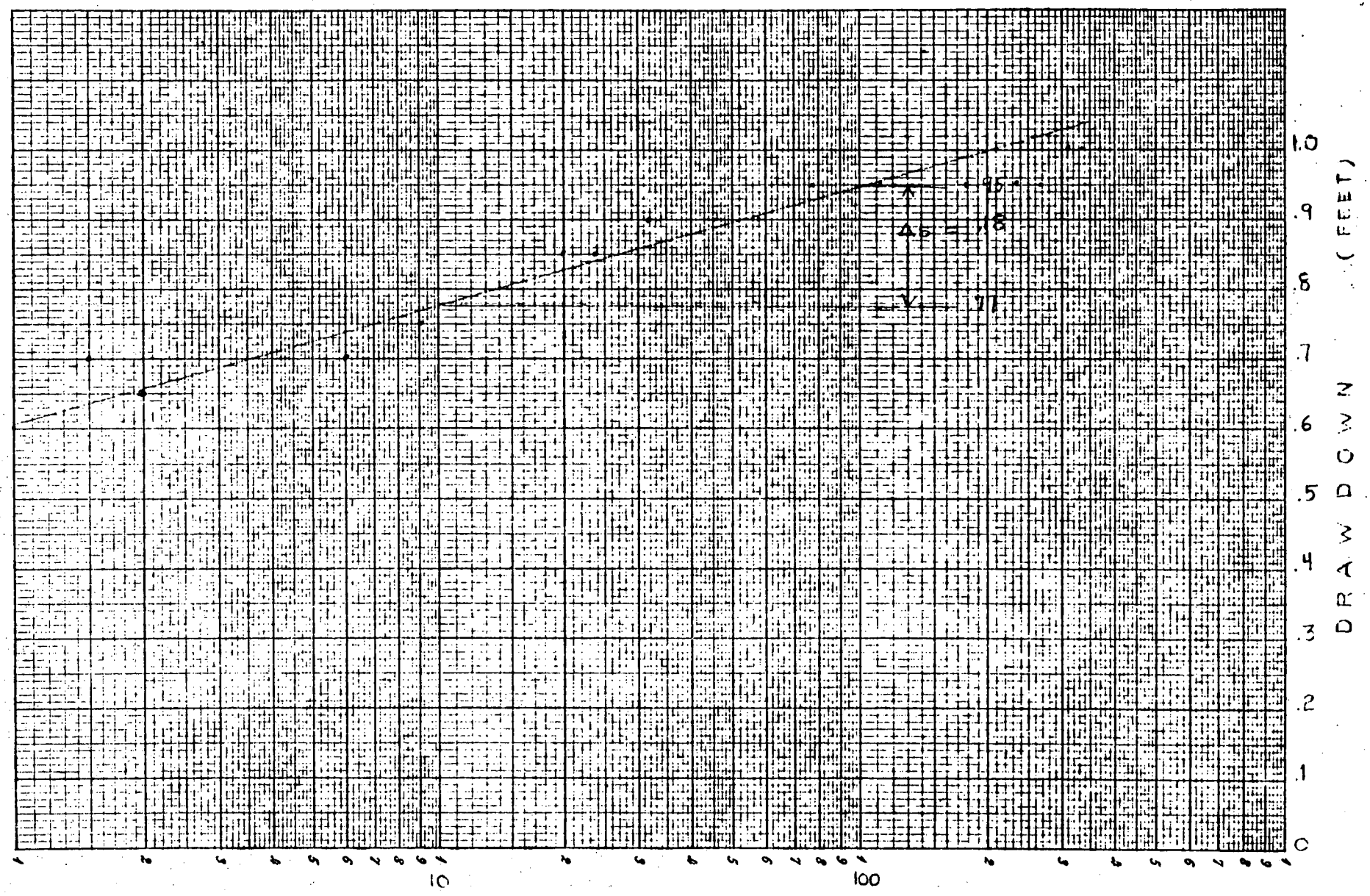


Figure E-2

SOUTHERN CALIFORNIA EDISON COMPANY

SHEET OF SHEETS

ENGINEERING DEPARTMENT

CALCULATION SHEET

RECOVERY
9/18/63

SUBJECT SAN CLEMENTE PUMP TEST DWG. NO.

J.O. NO. 5702 MADE BY GEH DATE CHK. BY DATE

TEST HOLE 13
RECOVERY

TIME MIN	DEPTH TO WATER El MEAS POINT 17.55 MLLW	El. WATER TABLE (F+) NOT CORRECTED FOR TIDE	TIDE EFFECT (F+)	DEPTH TO WATER CORRECTED FOR TIDE	RESIDUAL DRAWDOWN $h_e - h_1$	t/t' (min)
0	13.65	3.90			1.30	
1	12.50	4.05			1.15	3[illegible]
2	13.35	4.20			1.00	2[illegible]
3	13.20	4.35			.85	1[illegible]
4	13.07	4.48			.72	1[illegible]
5	13.03	4.52			.68	[illegible]
6	12.98	4.57			.63	6[illegible]
7	12.95	4.60	0		.60	5[illegible]
15	12.76	4.79	0		.41	2[illegible]
27	12.64	4.91	0		.29	16
32	12.61	4.94	- .05	12.56	.21	13
36	12.57	4.98	- .05	12.52	.17	12
41	12.56	4.99	- .05	12.51	.16	11
49	12.54	5.01	- .05	12.49	.09	9
51	12.52	5.03	- .1	12.42	.07	9
52	12.45	5.10	- .1	12.35	0	9

t = time since pump started

t' = time since pump stopped

FILE DWG NO. Figure E-3

CODEX BOOK COMPANY, INC. NORWOOD, MA
PRINTED IN U.S.A.

RECOVERY
8/28/63

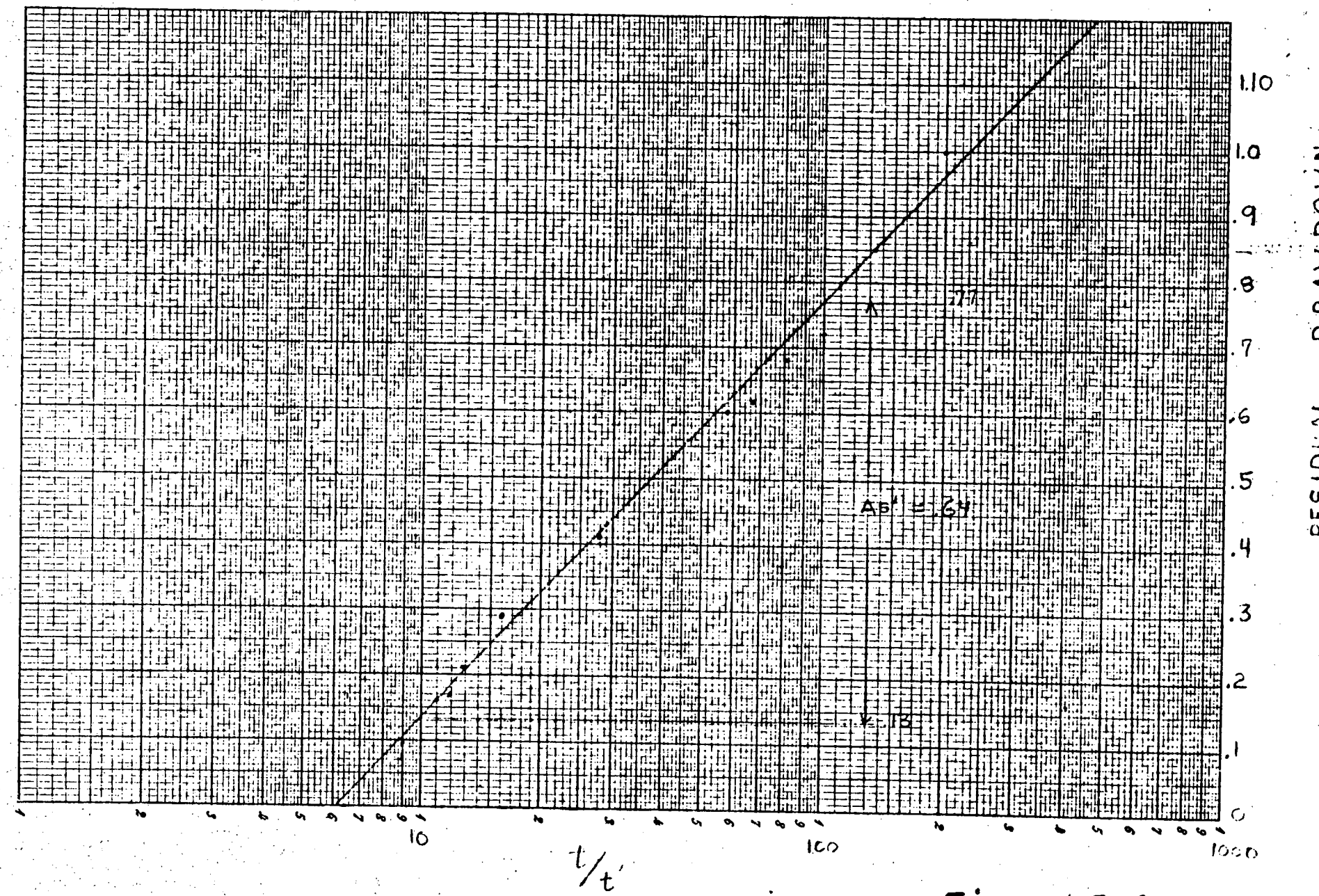


Figure E-4

FORM 30397 50 PADS 10-61

SOUTHERN CALIFORNIA EDISON COMPANY

SHEET OF SHEETS

ENGINEERING DEPARTMENT
CALCULATION SHEET

RECOVERY
8/23/62

SUBJECT: SAN ONOFRE - PUMP TEST DWG. NO.

J.O. NO. 5960 MADE BY GSH DATE 8/23/62 CHK. BY DATE

TEST HOLE 13
RECOVERY

TIME	DEPTH TO WATER	EL. WATER SURFACE	TIDE FEET	DEPTH TO WATER	EL. WATER SURFACE	RESIDUAL DRAWDOWN	t/t'
MIN	EL MEAS. POINT 17.55 MLLW	(Ft) NET CORRECTED FOR TIDE	(Ft)	CORRECTED FOR TIDE	(Ft) CORRECTED FOR TIDE	(Ft)	min
0	13.15	4.40				.82	
1/4	13.05	4.50				.72	1530
1	12.95	4.60				.62	306
2	12.85	4.70				.52	153
5	12.75	4.80				.42	61
7	12.60	4.85				.27	44
10	12.50	5.00	0			.17	31
13	12.50	5.00	0			.17	24
18	12.40	5.15	.05	12.45	5.10	.12	18
24	12.35	5.20	.05	12.40	5.15	.07	13
48	12.30	5.25	.1	12.35	5.20	.02	10
51	12.28	5.23	.1	12.33	5.18	0	9.1

t = time since pumping started

t' = time since pumping stopped

FILE DWG NO. Figure E-5

RECOVERY
9/29/03

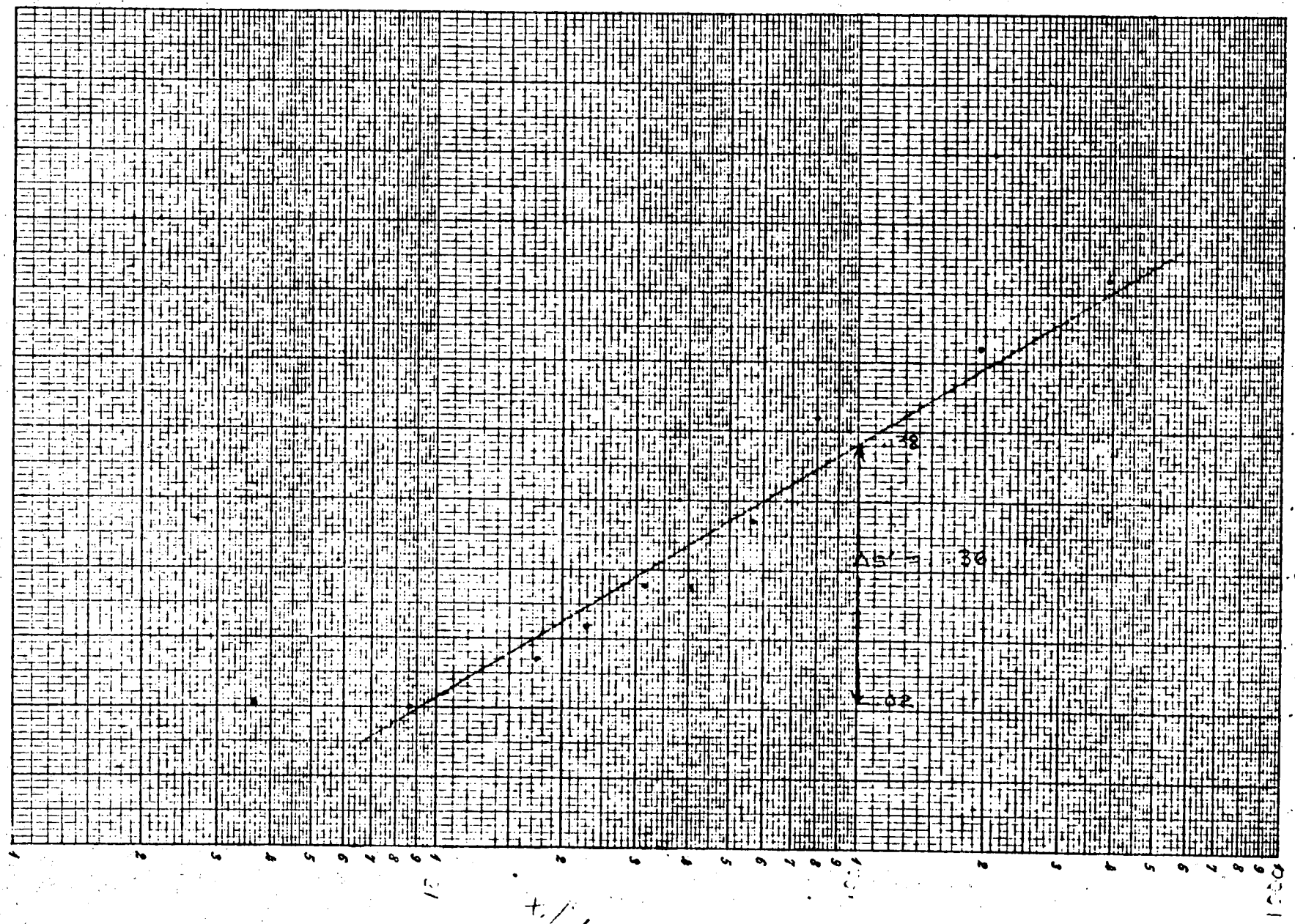


Figure E-6

FORM 00397 50 PADS 10-61
SOUTHERN CALIFORNIA EDISON COMPANY

SHEET 1 OF 2 SHEETS

ENGINEERING DEPARTMENT
CALCULATION SHEET

SUBJECT: SAN ONOFRE PUMP TEST DWG. NO.

J.O. NO. 5780 MADE BY G.S.H. DATE CHK BY DATE

T.H. 12 8/28/63 RECOVERY Transmissibility = T

$$T = \frac{264 \times 84}{.64} = 34{,}650 \text{ gal/day ft.}$$

T.H. 13 8/29/63 RECOVERY $T = \frac{264 \times 84}{.36} = 61{,}600$ gal/day ft.

T.H. 13 8/29/63 DRAWDOWN $T = \frac{264 \times 84}{.18} = 123{,}000$ gal/day.

T.H. 13 Effect of partial penetration

1. Assume maximum formation thickness of 500 ft and 450 feet of saturated, homogeneous San Mateo formation
2. Use partial penetration curves from Todd: Ground Water Hydrology Pg 108

$\frac{h_s}{2r_w} = \frac{38'}{2'} = 19$ well slimness factor

$\frac{h_s}{H} = \frac{38}{450} = .084$ penetration fraction

Discharge ratio $\frac{Q_p}{Q} = 0.1$ (Approx)

$Q_p = 84$ $Q = 840$ gpm

Q is flow which would result if the aquifer were fully penetrated

FILE DWG NO. Figure E-7

SOUTHERN CALIFORNIA EDISON COMPANY

ENGINEERING DEPARTMENT
CALCULATION SHEET

SUBJECT: SAN ONOFRE PUMP TEST DWG. NO.

J.O. NO. [illegible] MADE BY GSH DATE CHK. BY DATE

T.H. 13 5/28/63 — Recovery

$T = \frac{264 \times 840}{.64} = 346{,}500$ gal/day ft

Transmissibility = Permeability times Aquifer thickness

$P = \frac{346{,}500}{450 \text{ ft}} = 770$ gal/day ft²

$K = 770 \text{ gal/day ft}^2 \times \frac{1}{7.48 \text{ gal/ft}^3}$ = 103 ft/day

T.H. 13 5/29/63 — Recovery

$T = \frac{264 \times 840}{.36} = 616{,}000$ gal/day ft

$P = \frac{616{,}000 \text{ g/day ft}}{450 \text{ ft}} = 1370$ gal/day ft²

$K = \frac{1370 \text{ gal/day ft}^2}{7.48 \text{ ft}^3\text{/gal}} = 183$ ft/day

T.H. 13 5/29/63 — DRAWDOWN

$T = \frac{264 \times 840}{.12} = 1{,}850{,}000$ gal/day ft

$P = \frac{1{,}850{,}000}{450 \text{ ft}} = 4133$ gal/day ft²

$K = \frac{4133 \text{ gal/day ft}^2}{7.48 \text{ ft}^3\text{/gal}}$ 553 ft/day

FILE DWG. NO. Figure E-8

SOUTHERN CALIFORNIA EDISON COMPANY

EDISON BUILDING • P. O. BOX 351
LOS ANGELES 53 CALIFORNIA

GROUND WATER ANALYSES

Investigation S.O.F.G.S.
County San Diego
Near San Onofre
State No.
USGS No.
Company No. 10" Test Well
Other Nos.

Description and Location 10 inch diameter well used for pumping test
N 440, 294 E 1,660,822

Owner So. California Edison Company Address 601 W. 5th Street, L. A. 53, Calif.
Use Test Depth 50 Date Completed 10/63 Capacity (gpm) 84 SWL 12'
Drawdown 24' Perforations 20-50' Size Casing and Depth 10" diameter
Gravel Packed Yes Seal no At What Depth - Log no Water Level Record no
Surface Elev. 17.01 Datum MLLW Source of Information Report 176

Lab. Field No.		1			2			3			4		
Sampled By		G. S. Hunt			G. S. Hunt			G. S. Hunt			G. S. Hunt		
Date Collected		8/28/63			8/28/63			8/28/63			8/28/63		
Date Analyzed		9/9 - 9/30/63			9/9 - 9/30/63			9/9 - 9/30/63			9/9 - 9/30/63		
Temperature pH		7.8			8.1			7.8			7.1		
EC x 10⁶ @ 25° C		1193			1166			1044			1193		
Constituents in		epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm
Cations:	Ca	4.48		89.2	4.00		80	4.24		84.8	4.24		84.8
	Mg	2.72		33.2	2.40		29.3	2.64		32.2	2.72		33.2
	Na	4.87		112	4.70		108	4.26		98	4.26		98
	K	.06		2.4	.05		2.0	.05		2.0	.05		1.9
Total Cations		12.13			11.15			11.19			11.27		
Anions:	CO_3												
	HCO_3	3.20		195.2	3.00		183	2.96		180.6	2.92		178.1
	SO_4	3.75		180	3.54		170	3.75		180	3.64		175
	Cl	5.35		190	4.45		158	4.51		160	4.51		160
	NO_3												
	F			0.62			0.67			0.49			0.5
Total Anions		12.30			10.99			11.22			11.07		
Balance													
Boron				0.33			0.25			0.25			0.33
Silica				25			27			29			30
Iron				0.45			0.72			1.3			0.3
Total Solids - Sum		835			816			731			835		
Per Cent Sodium													
Hardness: Total NC		360			320			344			348		
Total gal. pumped when sampled		100			2,200			4,000			6,000		
Laboratory Chemist		*			*								
Copied, Date By		GSH	10/14/63										

REMARKS: 1. Samples taken during pumping test 8/28 and 8/29/63.
2. * San. Eng. Lab., Eleventh Naval District for Office of Ground Water Resources, Camp Pendleton.

Figure E-10

SOUTHERN CALIFORNIA EDISON COMPANY

EDISON BUILDING • P.O. BOX 351
LOS ANGELES 53, CALIFORNIA

GROUND WATER ANALYSES

Investigation S.O.R.G.S.
County San Diego
Near San Onofre
State No.
USGS No.
Company No. 10" Test Well
Other Nos.

Description and Location 10 inch diameter well used for pump test
N 440, 294 E 1,700,822

Owner So. California Edison Company Address 601 W. 5th Street, L. A. 53, Calif.
Use Test Depth 50' Date Completed 10/63 Capacity (gpm) 34 SWL feet
Drawdown 24' Perforations 20 - 50' Size Casing and Depth 10 inch
Gravel Packed Yes Seal no At What Depth - Log no Water Level Record no
Surface Elev. 17.01 Datum MLLW Source of Information Report 176

Lab. Field No.		1			2							
Sampled By		C. S. Hunt			C. S. Hunt							
Date Collected		8/29/63			8/29/63							
Date Analyzed		9/9 - 9/30/63			9/9 - 9/30/63							
Temperature, pH		8.3			7.9							
EC x 10^6 @ 25° C		1078			1179							
Constituents in		epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm
Cations:	Ca	4.24		84.8	3.84		76.8						
	Mg	2.56		31.2	2.49		30.3						
	Na	4.26		98	4.48		103						
	K	.05		1.8	.04		1.7						
Total Cations		11.11			10.84								
Anions:	CO_3			7.2									
	HCO_3	2.72		165.9	3.40		207.4						
	SO_4	3.65		175	3.60		173						
	Cl	4.62		164	4.17		148						
	NO_3												
	F			.48			0.4						
Total Anions		10.99			11.17								
Balance													
Boron				0.42			0.42						
Silica				31			30						
Iron				0.42			0.42						
Total Solids Sum		755			825								
Per Cent Sodium													
Hardness: Total NC		340			340								
Total cal. pumped when sampled.		12,900			30,100								
Laboratory Chemist		*			*								
Copied: Date By		CST	10/15/63		CST	10/15/63							

REMARKS: 1 - Sanitary Engineering Laboratory, Eleventh Naval District for Office of Ground Water Resources Camp Pendleton.

Figure E-11

SOUTHERN CALIFORNIA EDISON COMPANY

EDISON BUILDING • P.O. BOX 351
LOS ANGELES 53, CALIFORNIA

GROUND WATER ANALYSES

Investigation 3.0.2.3.3.
County San Diego
Near San Onofre

State No. 9S/7W/19D1
USGS No.
Company No.
Other Nos. 5-C11

Description and Location San Mateo Creek - Camp Pendleton 52

Owner ..... Address .....
Use ..... Depth ..... Date Completed ..... Capacity (gpm) ..... SWL .....
Drawdown ..... Perforations ..... Size Casing and Depth .....
Gravel Packed ..... Seal ..... At What Depth ..... Log ..... Water Level Record .....
Surface Elev. ..... Datum ..... Source of Information Office of Ground Water Resources

Lab. Field No.												
Sampled By												
Date Collected		1/3/63										
Date Analyzed		1/15-1/11/63										
Temperature pH		7.-										
EC x 10^6 @ 25° C		830										
Constituents in		epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm
Cations:	Ca	4.40		87.6									
	Mg	2.00		24.4									
	Na	4.02		92.0									
	K	.04											
Total Cations		10.61											
Anions:	CO_3												
	HCO_3	3.84		197.4									
	SO_4	2.61		125.5									
	CL	4.13		158.00									
	NO_3	.13		11.25									
	F			0.4									
Total Anions		10.48											
Balance													
Boron				0.2									
Silica				27									
Total Solids Sum		647											
Per Cent Sodium		37.4											
Hardness: Total NC		324											
Laboratory Chemist		*											
Copied Date By													

REMARKS: 1. 9S/6./19D1 - Symbols Quality 3
2. *Sanitary Engineering Laboratory, Eleventh Naval District San Diego
3.
4.

Figure E-12

SOUTHERN CALIFORNIA EDISON COMPANY

EDISON BUILDING • P.O. BOX 351
LOS ANGELES 53, CALIFORNIA

Investigation S.O.H.C.S.
County San Diego
Near San Onofre

GROUND WATER ANALYSES

State No.
USGS No.
Company No. T.H. 8
Other Nos. Formerly T.H.5

Description and Location Test Hole 8
N 440, 833.0 E 1, 600, 695.0

Owner So. California Edison Company Address 601 W. 5th Street, L. A. 53, Calif.
Use Ob. Depth 125' Date Completed 5/63 Capacity (gpm) 1/3 SWL 86.3
Drawdown - Perforations Bottom 40' Size Casing and Depth 2" plastic pipe
Gravel Packed Yes Seal - At What Depth - Log Yes Water Level Record Yes
Surface Elev. 91.7 Datum MLLW Source of Information Report 176

Lab./Field No.										
Sampled By		G. S. Hunt			G. S. Hunt					
Date Collected		5/20/63			8/28/63					
Date Analyzed		5/27-28/63			9/9-9/30/63					
Temperature pH		12.0			7.7					
EC x 10⁶ @ 25° C		1916			1078					
Constituents in		epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm
Cations:	Ca	1.92		38.4	3.60		72			
	Mg	.16		2.0	1.36		16.6			
	Na	16.96		390.0	4.48		103			
	K	.06		2.4	0.19		7.4			
Total Cations		19.10			9.63					
Anions:	CO_3	8.00		240						
	HCO_3				1.36		83			
	SO_4	2.91		140	3.13		150			
	CL	5.18		184	5.35		190			
	NO_3									
	F			1.1			0.63			
	OH	3.20		54.4						
Total Anions		19.29			9.84					
Balance										
Boron				0.1			0.42			
Silica				25			42			
Iron				.05			.04			
Total Solids Sum		* 1340			755					
Per Cent Sodium										
Hardness: Total NC		104			6-8					
Laboratory Chemist		*			*					
Copied/ Date By					10/14/63 G.S.H.					

REMARKS: 1. *San. Eng. Lab for Office of Ground Water Resources
Camp Pendleton
2. High total dissolved solids due to contamination of ground water by effluent drilling water from San Clemente.

Figure E-13

SOUTHERN CALIFORNIA EDISON COMPANY

EDISON BUILDING • P.O. BOX 351
LOS ANGELES 53, CALIFORNIA

GROUND WATER ANALYSES

Investigation S.O.I.G.S.
State No.
USGS No.
County San Diego
Near San Onofre
Company No. T.H. 13
Other Nos. Formerly P-3

Description and Location Test Hole 13
N 440, 277.0 E 1, 600 815.0

Owner So. California Edison Company Address 601 W. 5th Street, L. A. 53, Calif.
Use Oil Depth 50' Date Completed 5/63 Capacity (gpm) 3 SWL 10.2'
Drawdown - Perforations 40 feet Size Casing and Depth 1-1/2 inch plastic pipe
Gravel Packed Yes Seal No At What Depth - Log Yes Water Level Record Yes
Surface Elev. 15.09 Datum MLLW Source of Information Report 176

Lab. Field No.		1									
Sampled By		G. S. Hunt									
Date Collected		5/20/63									
Date Analyzed		5/28/63									
Temperature pH		3.8									
FC x 10^6 @ 25° C		933									
Constituents in		epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm
Cations:	Ca	2.36		47.2									
	Mg	.52		6.3									
	Na	6.00		140.									
	K	.02		0.8									
Total Cations		8.90											
Anions:	CO_3	.96		28.8									
	HCO_3	2.10		129.3									
	SO_4	3.54		170									
	CL	2.25		80									
	NO_3												
	F			0.6									
Total Anions		8.87											
Balance													
Boron				0.00									
Silica				40									
Total Solids Sum		650											
Per Cent Sodium													
Hardness: Total NC		144											
Turbidity		180											
Laboratory Chemist		*											
Copied: Date By													

REMARKS: 1. *San. Eng. Lab. for office of Ground Water Resources, Camp Pendleton.

Figure E-14

SOUTHERN CALIFORNIA EDISON COMPANY

EDISON BUILDING • P. O. BOX 351

LOS ANGELES 53, CALIFORNIA

GROUND WATER ANALYSES

Investigation S.O. [illegible]

County San Diego

Near San Onofre

State No. 9S/7W/1[illegible]

USGS No.

Company No.

Other Nos.

Description and Location San Onofre [illegible]

Owner ______ Address ______

Use ______ Depth ______ Date Completed ______ Capacity (gpm) ______ SWL ______

Drawdown ______ Perforations ______ Size Casing and Depth ______

Gravel Packed ______ Seal ______ At What Depth ______ Log ______ Water Level Record ______

Surface Elev. ______ Datum ______ Source of Information Office of Ground Water Resources, Camp Pendleton.

Lab./Field No.												
Sampled By												
Date Collected	1/1[illegible]/62											
Date Analyzed	[illegible]/1[illegible]-[illegible]/1[illegible]/62											
Temperature / pH			9.[illegible]									
EC x 10⁶ @ 25° C	6[illegible]											
Constituents in	epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm	epm	% RV	ppm
Cations: Ca	1.12		2[illegible]									
Mg	.96		11.7									
Na	[illegible]		1[illegible]0									
K	.0[illegible]		1.6									
Total Cations	[illegible]											
Anions: CO_3	1.04		31.2									
HCO_3	.1[illegible]		7[illegible]									
SO_4	1.[illegible]		[illegible]									
CL	[illegible]		1[illegible]									
NO_3												
F			[illegible]									
Total Anions	[illegible]											
Balance												
Boron			0.16									
Silica			26									
Total Solids, Sum	450											
Per Cent Sodium												
Hardness: Total / NC	104											
Laboratory/Chemist												
Copied: Date / By												

REMARKS: 1. [illegible]

2.

3.

Figure E-15

MAIN OFFICE
[illegible] GAYLORD ST. — P.O. BOX 9069
LONG BEACH 10, CALIFORNIA
HEMLOCK 9-7493
BRANCH OFFICE
1816 D NORTH HARPER ST.
SANTA ANA, CALIFORNIA
JEFFERSON 1-2048
JEFFERSON 1-2048

JUL 9 1964

Twining Laboratories of Southern California, Inc.

July 7, 1964

Examination 64-2284
Project 340A-64-3683
P.O. No. BSO 253

Bechtel Corporation Power Division
P.O. Box 58587
Vernon Branch
Los Angeles 58, California

Attention: Mr. J. R. McEntee

PROJECT: SAN ONOFRE NUCLEAR GENERATING STATION
San Onofre, California

SUBJECT: Soil Compaction Tests - Progress Report No. 1

This report contains the results of Density Test Nos. 1 thru 13 taken on the above project on June 4, 8 and 12, 1964, as directed. Refer to the attached Plot Plan, Plate "A", for the location of tests. Results are as follows:

COMPACTION STANDARD

AASHO T180-57: 10 pound hammer; 18 inch drop; 25 blows per layer on each of 5 equal layers of soil in a 1/30 cubic foot mold.

Material Classification	Maximum Density Lbs./Cubic Foot	Optimum Moisture Per Cent
Brown clayey fine to medium sand	123.0	12.0

FIELD DENSITY TESTS

Test No.	Wet Density Lbs./cu.ft.	% Field Moisture	Dry Density Lbs./cu.ft.	Relative Compaction	Elev. of Test	Depth of Fill
			June 4, 1964			
1	127.6	13.0	112.8	91.7*	76.0	2.0'
2	134.4	14.9	117.1	95.3	76.0	2.0'
			June 8, 1964			
3	134.2	14.3	117.4	95.5	retest of #1	
4	131.2	11.7	117.6	95.6	78.6	4.0'
5	132.8	11.7	118.8	96.6	78.0	4.0'
6	124.8	9.3	114.3	92.8**	83.0	4.0'

Continued on page 2.

SAN ONOFRE NUCLEAR GENERATING STATION
Bechtel Corporation

Examination 64-2284
Project 340A-64-3683
July 7, 1964

FIELD DENSITY TESTS - Continued

Test No.	Wet Density Lbs./cu.ft.	% Field Moisture	Dry Density Lbs./cu.ft.	Relative Compaction	Elev. of Test	Depth of Fill
			June 8, 1964			
7	132.2	9.9	120.4	97.9	83.0	4.0'
8	127.8	11.1	114.9	93.4**	83.0	4.0'
9	125.4	9.9	114.2	92.9**	83.0	4.0'
			June 12, 1964			
10	130.4	11.7	116.8	95.1	90.0	4.0'
11	132.0	12.4	117.6	95.6	90.0	4.0'
12	127.4	10.5	115.2	93.8**	90.0	4.0'
13	130.8	11.1	117.6	95.6	90.0	4.0'

* Denotes areas reworked and retested.
** Denotes areas which do not meet the required 95% Compaction.

TWINING LABORATORIES OF SOUTHERN CALIFORNIA, INC.

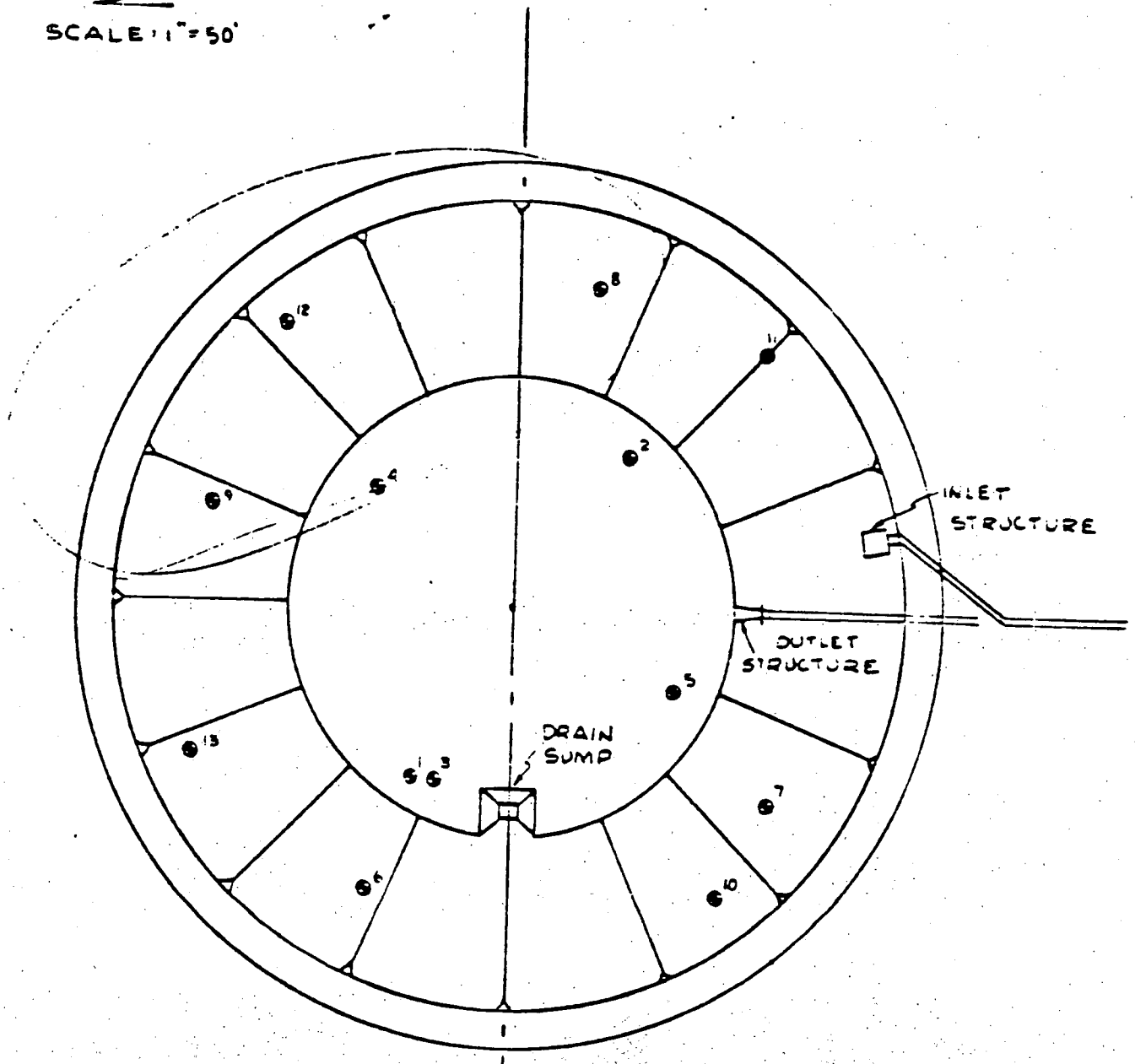
Stanley C. Davidson

SCD:PLB:pj

cc: (5)

P. L. Bailey
Civil Engineer, No. 8128

SCALE: 1" = 50'



● DENOTES APPROX. LOCATION OF TESTS

PLATE "A"

MAIN OFFICE
1937 WEST GAYLORD ST. — P.O. BOX 9069
LONG BEACH 10, CALIFORNIA
MEMLOCK 9-7693

BRANCH OFFICE
1514 E. NORTH MARKET ST.
SANTA ANA, CALIFORNIA
JEFFERSON 1-2045
JEFFERSON 1-2046

Twining Laboratories of Southern California, Inc.

July 28, 1964

Examination [illegible]
Project 3405-64-3862 No 3246
P.O. No. 55[illegible]
Job No. 324

DATE RECEIVED	FILE NO. 2-71	INITIALS
	MGR. ENG.	
	ASST. MGR. ENG.	
	[illegible] ENG.	
	ASST. PROJ. ENG.	
	SECT. SUP. M. E.	
	SECT. SUP. E. E.	
	SECT. SUP. C. E.	
	SECT. SUP. NUCLEAR	
	SECT. SUP. ARCH.	
	PROJECT M. E.	
	PROJECT E. E.	
	PROJECT C. E.	
	PROJECT NUCLEAR	
	PROJ. ARCH.	
	CONTROLS	
	SERVICES	
	[illegible]	
	ADMINISTRATIVE	
	ESTIMATING	
	PURCHASING	
	WESTINGHOUSE	

Bechtel Corporation
P. O. Box 58587 Vernon Branch
Los Angeles 58, California

Attention: Mr. J. R. McEntee

PROJECT: SAN ONOFRE NUCLEAR GENERATING STATION
Unit 1
San Onofre, California

SUBJECT: Soil Compaction Tests - Progress Report No. 2

The following report contains the results of Density Test Nos. [illegible] taken on the subject project on July 17 thru 23, 1964. Refer to Plot Plan, Plate "A", for the location of tests.

All tests were taken as directed, results are as follows:

NOTE: Tests are on an Outlet line trench backfill, fill was placed in two phases - Test No. 14 thru 20 are on a two foot wide trench and Tests 23 and 26, 21 thru 23 and 24 and 25 were taken on trench approximately 20 feet wide.

COMPACTION STANDARD

AASHO T180-57: 10 pound hammer, 18 inch drop, 25 blows per layer on each of 5 equal layers of soil in a 1/30 cubic foot mold.

Material Classification	Maximum Density Lbs./Cubic Foot	Optimum Moisture Per Cent
Brown clayey fine to medium clay	123.0	12.0

continued on page 2.

JUL 28 [illegible]

SAN ONOFRE NUCLEAR GENERATING STATION
Bechtel Corporation

Examination 64-2501
Project 340A-64-3683
July 28, 1964

FIELD DENSITY TESTS

Test No.	Wet Density Lbs./cu.ft.	% Field Moisture	Dry Density Lbs./cu.ft.	Relative Compaction	Depth of Test	Depth of Fill
			July 17, 1964			
14	114.4	12.4	101.7	82.7*	0.8'	4.0'
15	124.4	12.4	110.7	90.0*	0.8'	4.0'
			July 20, 1964			
16	128.8	9.9	117.3	95.4	retest of #14	
17	128.8	9.3	117.5	95.6	retest of #15	
18	125.4	19.8	104.8	85.2*	0.8'	8.0'
19	132.0	13.0	116.8	95.1	retest of #18	
20	131.2	11.1	118.2	96.2	0.8'	8.0'
			July 21, 1964			
21	130.6	11.1	118.1	96.0	0.6'	3.0'
22	136.6	14.3	119.8	97.7	0.6'	3.0'
			July 23, 1964			
23	121.8	18.3	102.6	83.6*	0.8'	8.0'
24	[illegible]	[illegible]	[illegible]	[illegible]	0.8'	8.0'
25	135.0	13.6	118.8	96.6	0.8'	8.0'
26	127.6	10.5	115.5	93.7	retest of #23	

* Denotes areas reworked and retested.

TESTING LABORATORIES OF SOUTHERN CALIFORNIA, INC.

Stanley C. Davidson

P.C. Bailey
Civil Engineer, No. 8125

CC: Bechtel Corp. (5)
File
S.A. Lab.

Testing Laboratories

MAIN OFFICE
1631 WEST GARDENA BLVD. — P.O. BOX 6068
LONG BEACH 10, CALIFORNIA
HEMLOCK 9-7483

BRANCH OFFICE
1515 SOUTH MAIN STREET
SANTA ANA, CALIFORNIA
JEFFERSON 1-2040
JEFFERSON 1-2046

Twining Laboratories of Southern California, Inc.

FILE: 3246 B-4-1A

Examination 6L-5107
Project 3L04-6L-3463
P.O. No. 7SC-253
Job No. 3216

December 24, 1964

INITIALS	
JOB NO. 3246	
FILE RET.	
BUR. ENG.	
ASST. BUR. ENG.	
PROJ. ENG.	
ASST. PROJ. ENG.	
SECT. SUP. M. E.	
SPEC. SUP. E. E.	
SECT. SUP. C. E.	
SECT. SUP. NUCLEAR	
SECT. SUP. ARCH.	
PROJECT M. E.	
PROJECT E. E.	
PROJECT C. E.	
PROJECT NUCLEAR	
PROJ. ARCH.	
CONTROLS	
SERVICES	
AREA MGR.	
ADMINISTRATIVE	
ESTIMATING	
PURCHASING	
WAREHOUSE	
ROUTING	

Bechtel Corporation
P.O. Box 58587 Vernon Branch
Los Angeles 58, California

Attention: Mr. J. R. McEnc

PROJECT: SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1
San Onofre, California

SUBJECT: Soil Compaction Tests - Progress Report No. 3

The following report contains the results of Density Test Nos. 27 thru 3[illegible] taken on the above project on December 16, 1964. All tests were taken as directed.

TEST RESULTS

COMPACTION STANDARD

ASTM D1557-57: 10 pound hammer, 18 inch drop, 25 blows per layer on each of 5 equal layers of soil in a 1/30 cubic foot mold.

Material Classification	Maximum Density Lbs./Cubic Foot	Optimum Moisture Per Cent
Light brown fine to medium sand, trace of silt	121.0	12.[illegible]

Continued on page 2

DEC 30 1964

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT I
Bechtel Corporation

Examination 64-5107
Project 3404-64-3683
P.O. No. 180-253
Job No. 3246
December 24, 1964

FIELD DENSITY TESTS

Test No.	Wet Density Lbs./cu.ft.	% Field Moisture	Dry Density Lbs./cu.ft.	% Maximum Density	Depth of Test
			12-16-64		
27	124.6	8.7	114.8	95.[illegible]	-12.0
28	114.4	6.4	107.4	88.7*	-12.0
29	125.2	9.7	115.1	95.1	-12.0
30	120.0	7.5	111.6	92.1	-12.0
31	112.4	3.6	108.6	89.7	+12.0
32	110.4	3.6	106.4	87.9	+12.0
			12-18-64		
33	124.4	8.1	115.1	95.[illegible]	-12.0
34	121.7	5.3	115.1	95.[illegible]	+12.0
35	113.2	8.1	109.2	90.4	+12.0

LOCATION OF TESTS

27 Pump Well Area East of Intake Structure
28 Pump Well Area East of Intake Structure
29 North of Intake Structure
30 North of Intake Structure
31 South Side Field Storage Building
32 South Side Field Storage Building
33 Pump Well Area East of Intake Structure
34 North Side of Field Storage Building
35 North Side of Field Storage Building

Full

Note: Tests Nos. 30, 31, 32 and 35 do not meet the required 95 per cent Compaction.

* Denotes area reworked and retested.

TESTING LABORATORIES OF SOUTHERN CALIFORNIA, INC.

Stanley C. Davidson

SCD:vb

cc: Bechtel - 5 File
S.A. Lab

MAIN OFFICE

BRANCH OFFICE

Twining Laboratories of Southern California, Inc.

February 17, 1965

Examination 65-529
Project [illegible]
P.O. No. [illegible]
Job No. 3246

Bechtel Corporation
P. O. Box 58587
Vernon Branch
Los Angeles, California

PROJECT: SAN ONOFRE NUCLEAR GENERATING STATION - UNIT NO. 1
San Onofre, California

SUBJECT: Soil Compaction Tests - Progress Report

This report contains the results of Density Test Nos. 36 thru 41 taken on the above project on January 12 and February 12, 1965. All tests were taken as directed. Results are as follows:

COMPACTION STANDARD

AASHO T180-57: 10-pound Hammer, 18-inch drop, 25 blows per layer on each of 5 equal layers of soil in a 1/30 cubic foot mold.

Material Classification	Maximum Density Lbs./Cubic Foot	Optimum Moisture Per Cent
Light brown fine to medium sand trace of silt	121.0	12.0

FIELD DENSITY TESTS

Test No.	Wet Density Lbs./cu.ft.	% Field Moisture	Dry Density Lbs./cu.ft.	% Maximum Density	Depth of Test	Depth of Fill
			1/12/65			
36	120.8	4.7	115.2	95.1	+14	10.0'
37	122.0	5.8	115.4	95.3	+14	10.0'
			2/12/65			
38	131.6	9.9	119.9	98.8	+2.0	9.0'
39	128.2	8.3	119.2	98.5	+2.0	9.0'
40	128.0	7.5	119.0	98.4	+8.0	14.0'
41	129.6	8.3	119.8	98.7	+8.0	14.0'

FEB 19 1965

continued on page 2.

SAN ONOFRE NUCLEAR GENERATING STATION
Bechtel Corporation

Examination 65-53
Project 340A-64-366
February 17, 1965

LOCATION OF TESTS

36 - South of Turb-ped mat
37 - South of Turb-ped mat
38 - Between intake culverts
39 - Between intake culverts
40 - Top of discharge culvert - east end
41 - Top of discharge culvert - east end

TWINING LABORATORIES OF SOUTHERN CALIFORNIA, INC.

Stanley C. Davidson

SCD/PLB:pj

P. L. Bailey
R.C.E. 6125

cc: Bechtel (5)
File
S.A.

Please refilm

Twining Laboratories

Inspection and Testing Engineers o Soil Engineering Analysis o Chemical Analysis

March 1, 1965

Examination 65-[illegible]
Project 340A-64-3683
P.O. #880-253

Bechtel Corporation
[illegible]
San Clemente, California

Attention: W. W. Aversman

PROJECT: SAN ONOFRE NUCLEAR GENERATING STATION - UNIT NO. 1
San Onofre, California

SUBJECT: Soil Compaction Tests
Progress Report No. 5

This report contains the results of Density Test Nos. 42 thru 48 taken on the above project on February 24, 1965. All tests were taken as directed. Results are as follows:

COMPACTION STANDARD

AASHO T180-57, 10-pound hammer, 18-inch drop, 25 blows per layer on each of 5 equal layers of soil in a 1/30 cubic foot mold.

Material Classification	Maximum Density Lbs./Cubic Foot	Optimum Moisture Per Cent
Light brown fine to medium sand trace of silt	121.0	12.[illegible]

FIELD DENSITY TESTS

Test No.	[illegible]	Moisture	Dry Density Lbs./Cu. Ft.	% Maximum Density	Elev. of Test
42	[illegible]	[illegible]	10[illegible].6	85.6	[illegible]
43	121.[illegible]	[illegible]	112.1	92.6	[illegible]
44	12[illegible].1	[illegible]	11[illegible]	93.8	[illegible]
45	121.[illegible]	[illegible]	[illegible]	93.9	[illegible]
46	12[illegible]	[illegible]	[illegible]	94.6	[illegible]
47	1[illegible]	[illegible]	11[illegible]	96.8	[illegible]
48	[illegible]	[illegible]	[illegible]	96.8	[illegible]

continued on page 2

SAN ONOFRE NUCLEAR GENERATING STATION
Bechtel Corporation

Examination 65-657
Project 340A-64-3783
March 1, 1965

LOCATION OF TESTS

No. 42 - South side screen well
No. 43 - South side pump well
No. 44 - South side pump well
No. 45 - North side intake culverts
No. 46 - West side screen well
No. 47 - North side screen well
No. 48 - North side pump well

TESTING LABORATORIES OF SOUTHERN CALIFORNIA, INC.

Stanley C. Davidson

SCD/TIR:al

cc: Bechtel (3)
File
L.A. Lab.

MAIN OFFICE
5533 WEST GAYLORD ST. — P.O. BOX 9068
LONG BEACH 10, CALIFORNIA
HEMLOCK 9-7493
SPRUCE 3-6526
JACKSON 7-3691

BRANCH OFFICE
1316 E. NORTH MAIN ST.
SANTA ANA, CALIFORNIA
JEFFERSON 1-3049
JEFFERSON 1-3048

Twining Laboratories of Southern California, Inc.

March 24, 1965

Examination 65-94[illegible]
Project 3401-64-3053
P.O. DSO-253

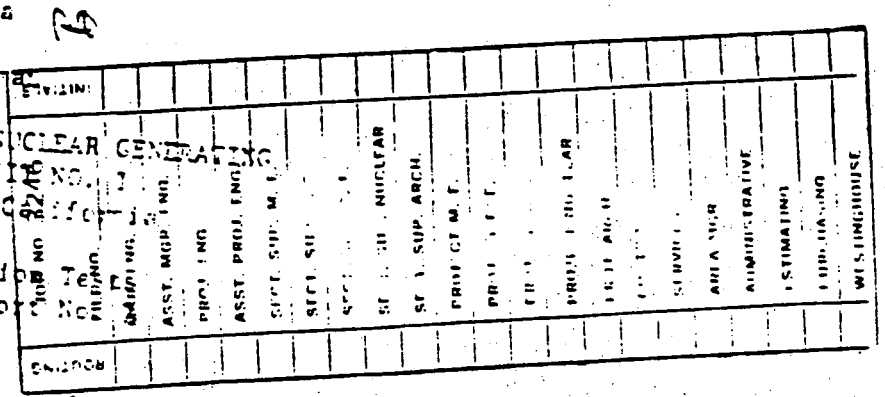
B-4-1A

Lechtel Corporation
P.O. box 67
San Clemente, California

Attention: R. W. Ayersman

PROJECT: SAN ONOFRE NUCLEAR GENERATING STATION - UNIT NO. 1
San Onofre, California

SUBJECT: Soil Compaction Tests
Progress Report No. 2



This report contains the results of Density Test Nos. 55 thru 61 taken on the above project on March 23, 1965. All tests were taken as directed, results are as follows:

COMPACTION STANDARD

AASHO T180-57: 10-pound hammer, 18-inch drop, 25 blows per layer on each of 5 equal layers of soil in a 1/30 cubic foot mold.

Material Classification	Maximum Density Lbs./Cubic Foot	Optimum Moisture Per Cent
Light brown fine to medium sand trace of silt	121.0	12.0

FIELD DENSITY TESTS

Test No.	Wet Density Lbs./cu.ft.	% Field Moisture	Dry Density Lbs./cu.ft.	% Maximum Density	Elev. of Test
55	129.4	8.1	119.5	98.7	+ 8
56	133.6	12.4	118.8	98.0	+ 8
57	126.8	7.5	117.8	97.3	+13
58	118.0	5.6	111.4	92.2	+13
59	130.6	8.1	120.5	99.6	+13
60	126.2	7.0	118.0	97.5	+18
61	111.4	3.6	107.4	88.6	+13

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continued on page 2

SAN ONOFRE NUCLEAR GENERATING STATION
Bechtel Corporation

Examination 65-940
Project 3683
March 24, 1965

LOCATION OF TESTS

Test Nos.	
55	South of screen well.
56	South of screen well.
57	South of Pump well.
58	Area 12 over discharge culvert.
59	Area 13.
60	Area 11 over discharge culvert.
61	Undisturbed soil, south of intake structure.

TWINING LABORATORIES OF SOUTHERN CALIFORNIA, INC.

Stanley C. Davidson

SCD:pj

P.J. Bailey
R.C.E. 8128

cc: Bechtel (5)
S.A. Lab.
File

203 North Golden Circle Drive
Santa Ana, California 92705
(714) 835-6886
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Telex 68-3420

Woodward-Clyde Consultants

10 December 1981
Project No. 41352I-0001

Southern California Edison
P.O. Box 800
Rosemead, California 91770

Attention: Mr. R. C. Blaschke

SUBJECT: POTENTIAL FOR CYCLIC MOBILITY
SONGS, UNIT 1
SAN ONOFRE, CALIFORNIA

Gentlemen:

At your request we have performed the subject evaluation for the Unit 1 soil conditions. This was accomplished by extrapolating from the data developed in the liquefaction studies for the adjacent Units 2 and 3.

The majority of the important backfills at Unit 1 were placed in the early 1960's. You have informed us that the specified minimum relative compaction was 95 percent (relative to the laboratory determined maximum density by ASTM D1557), that tests were performed to verify that the specification was met, and that compaction was accomplished with large vibratory rollers. Under those conditions, the actual average relative compaction should be greater than the specified 95 percent; but, to add conservatism to the analysis, we will assume only the minimum values of 95 percent, which is a dry density of 114 pcf.

The liquefaction analyses performed for Units 2 and 3 are described in the FSAR, Section 2.5.4.8. The composite summary, Figure 2.5-62, shows the safety factor below the water table in the plant area under Units 2 and 3 to be in the range of 1.5 to 2. For this analysis of Unit 1, we will use the lower value of 1.5.

When we were considering the liquefaction potential of Units 2 and 3, the maximum magnitude for the OZD had not been agreed upon. Our intent at that time was to design for a very large, nearby earthquake of unspecified characteristics. Within that framework, we conservatively chose an equivalent number of significant cycles which corresponded to the 84th percentile for a nearby large earthquake. That number of cycles was N = 30, for which

normalized strength is 0.5 as shown as point 1 in Figure 1. In the case of Units 2 and 3 at the present time, the maximum magnitude has been agreed upon as M_s 7. We do not recognize that value as being appropriate for Unit 1, but we do recognize that it may be mandated by precedent. Therefore, we recommend that N = 10 be chosen for analysis of Unit 1: that value is a conservative 84th percentile for M_s 6.5; and it is a mean for M_s 7 (Figure 2.5-58, SONGS 2 and 3 FSAR). For N = 10, the normalized strength for 114 pcf is 0.44 as developed as point 2 in Figure 1. Thus, the factor of safety for Units 2 and 3 should be multiplied by the ratio (0.44/0.50) = 0.88 to account for the combined effects of the number of significant cycles and the specified density.

Recognizing that the depth to the water table varies across the site (depth of 25 to 30 ft at Units 2 and 3, and 14 to 17 ft at Unit 1), we have reviewed the SONGS Units 2 and 3 analysis to evalute the effect of this on the calculated factor of safety for liquefaction. From this review we find that the normalized strength at a shallower water table condition at Unit 1 (low confinement) is higher than that at a deeper water table condition at Units 2 and 3 (high confinement), see Figure C-6, Section 2.5.A.3 of the SONGS 2 and 3 FSAR. Further, it was noted that the seismic-induced normalized stresses would be somewhat higher for the shallower groundwater condition at Unit 1. For the analyses completed, the strength was found to be about as much higher as the induced stress was lower. For this reason no adjustment was required for the different water table depth range at Unit 1.

The analysis for Units 2 and 3 was for native San Mateo sand. Laboratory dynamic tests show that the native San Mateo sand has about 15 percent more strength than when it is remolded and then recompacted to the same density (Figure C-3, Section 2.5.A.2 of the SONGS 2 and 3 FSAR). This increase together with a conservative estimate of the effects of overconsolidation on C_r (C_r = 0.75 used in the Units 2 and 3 analysis as opposed to the normally consolidated case of C_r = 0.57, Figure 2.5-57 in the SONGS Units 2 and 3 FSAR) yielded an effect of aging as reported by H.B. Seed (ASCE, GT2, Paper 14380, February 1979, pp. 227-228, Figure 17) as a lower bound for the San Mateo sand

of about 50% above the remolded-unaged strength (1.15 x $\frac{0.75}{0.57}$ = 1.51). Considering this lower bound value for the native soil together with: (1) the fact that the fill at Unit 1 has been in place for about 15 years and (2) the range of increase of 40 to 70 percent suggested by H.B. Seed's Figure 17 referenced above for 10 to 20 year old fills; we have chosen a conservative value for aging of 25 percent for the Unit 1 fill. Thus the Units 2 and 3 safety factor should be multiplied by the ratio 1.25/1.51 or 0.83 to account for the differences in aging from the native soil to the Unit 1 compacted fill at 95 percent compaction.

Based on these considerations, the factor of safety against cyclic mobility for Unit 1 is calculated as:

$$FS = (1.5)\ (0.88)\ (0.83) = 1.1$$

We believe that this analysis is conservative, yielding a factor of safety against cyclic mobility for the original conservative specification of the earthquake as 0.67 g PGA.

As an alternate view of the adequacy of the factor of safety, you may wish to consider hypotetically the results which would be obtained by applying a more realistic, but nonetheless conservative, acceleration for a M_s 6-1/2 earthquake at R = 8 km. Under these conditions, the WCC regression study indicates a mean instrumental acceleration at the site of 0.42 g, and an 84th percentile instrumental acceleration of 0.57 g (Figure 361.55-5, Response to NRC questions SONGS Units 2 and 3, Vol. 1). Using the mean value of acceleration but the 84th percentile number of significant cycles from M_s 6-1/2 (N = 10), the factor of safety for Unit 1 would be:

$$FS = 1.1\ \frac{(0.67)}{(0.42)} = 1.8$$

Alternatively, using the 84th percentile value of acceleration but the mean number of significant cycles for M_s 6-1/2 (N = 7, normalized strength of 0.48, point 3 Figure 1), the results would be:

$$FS = 1.1\ \frac{(0.67)}{(0.57)}\ \frac{(0.48)}{(0.44)} = 1.4$$

Thus, the factor of safety against cyclic mobility for Unit 1 ranges from as low as 1.1 for conservative earthquake loading assumptions, and is probably 1.8 for more realistic earthquake loading assumptions.

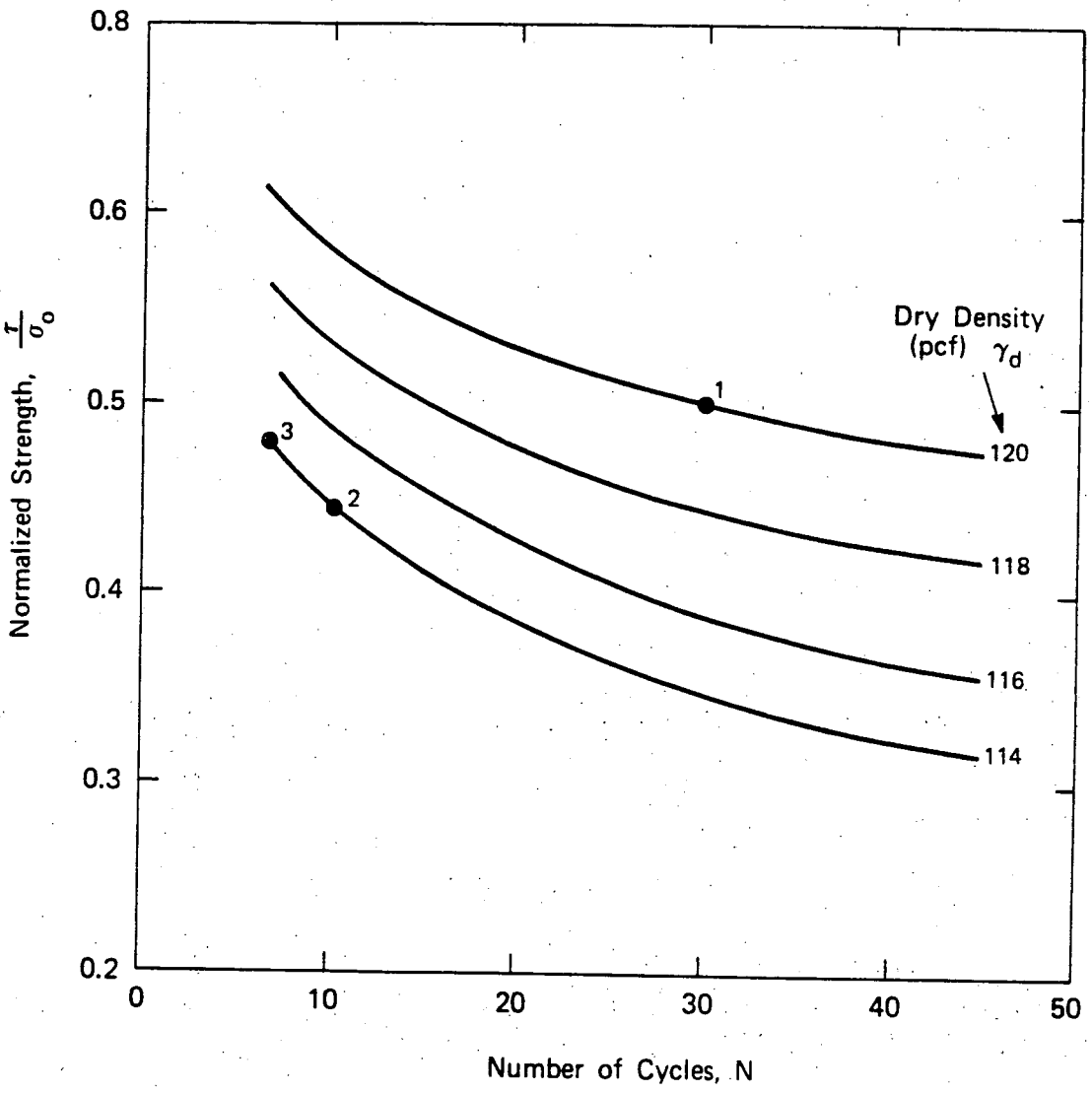
If you have further questions, please do not hesitate to call.

Very truly yours,

Robert L. McNeill
Consultant

John A. Barneich
Senior Associate

RLM:JAB/hab
Attachment



NOTES:

● 1 See text.

Data from Figure C-2, Appendix 2.5.A.2
SONGS 2 & 3, FSAR Volume 5.

Project: SONGS UNIT 1 BOP Project No. 413521	SUMMARY OF CYCLIC STRENGTH DATA FOR SAN MATEO SAND	Fig. 1

REFERENCES

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TOPIC II - 4.D - STABILITY OF SLOPES

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2. Bishop, A.W., "The Use of the Slip Circle in the Stability Analysis of Slopes", Geotechnique, Volume 5, 1955.

3. Ambraseys, A.A., Hendron, A.J., Amin, M., "Earthquake Resistance of of Earth and Rockfill Dams", Miscellaneous Paper 5-71-17, U.S. Army Engineers Waterways Experiment Station.