SOILS

REPORT

MEMORANDUM

TO: Jim Steele

FROM: John T. Caldwell JTC

SUBJECT: Soils Report
Pittsburg, CA
CDM # 859-113-PD-GEAD

DATE: June 19, 1987

As a minimum, the soils report for the Pittsburg plant should include site history, field operation description, laboratory testing, subsurface conditions, analysis and recommendations and soil boring logs. Soil borings shall be drilled under each new structure. Large structures may require two borings. The soils sub may move or add borings as necessary depending on obstacles and/or whatever he feels necessary. The bottom line is to take whatever borings that are necessary to provide accurate analysis and recommendations for the new structures' foundation and design requirements.

Under the analysis and recommendations, the following detailed information is required as a minimum:

- Allowable soil bearing pressures at bottom of foundation for structures (NOTE: They will need the depths of structures) TESTS
- Are piers required? If so, what is end bearing and skin friction? What is negative skin friction? What type of pile? (i.e., steel pipe, concrete with recommended diameter) ~~How far drill into bedrock?~~ TESTS
- What is maximum groundwater level for 100 year flood?
- Soil densities and equivalent lateral soil pressure (active, passive, at rest) TESTS
- Is engineered fill required for subgrade preparation? If so, what are properties of soil including gradation, PI limits, etc. TESTS
- Give pertinent earthquake loading conditions for substructures based on UBC 1985 including accelerations, S, nearest fault location, etc.
- Shrink/swell potential for clays including settlements TESTS

REPORT

to

CAMP, DRESSER AND MCKEE

WALNUT CREEK, CALIFORNIA

on

GEOTECHNICAL EXPLORATION

for

CITY OF PITTSBURG,
WATER TREATMENT PLANT EXPANSION

PITTSBURG, CALIFORNIA

ENGEO INCORPORATED N7-2494-M1

JULY 24, 1987

ENGEO INCORPORATED
ENGINEERS AND GEOLOGISTS • CONSULTANTS IN THE APPLIED EARTH SCIENCES

In Reply
Please Refer to:
N7-2494-M1

July 24, 1987

Camp, Dresser and McKee
710 South Broadway, Suite 201
Walnut Creek, CA 94596

Attention: Mr. Jim Steele

Subject: City of Pittsburg
Water Treatment Plant Expansion

GEOTECHNICAL EXPLORATION

References:
1) Dibblee, T. W.; Preliminary Geologic Map of the Honker Bay Quadrangle, Solano and Contra Costa Counties, California

2) U.S. Department of Agriculture Soil Conservation Service; Soil Survey of Contra Costa County, California; September 1977.

3) Contra Costa County Community Development Department; Contra Costa County Seismic Safety Element; August 1975, revised January 1986.

Gentlemen:

With your authorization, we conducted a geotechnical exploration for the proposed water treatment plant expansion project in Pittsburg, California.

The accompanying report contains our exploration data and recommendations for the development of the subject project. On the basis of the data included in this report, we find that the development is feasible from a geotechnical standpoint.

2280 DIAMOND BOULEVARD • SUITE 200 • CONCORD, CALIFORNIA 94520-5719 • PHONE (415) 687-9700 • TELECOPIER (415) 687-0126

We are pleased to have been of service to you on this project, and we will be glad to consult further with you and your design team.

Very truly yours,

ENGEO INCORPORATED

for Uri Eliahu

Reviewed by:

Jean Meuris SE

Jean Meuris

vc
cc: 4 - Client

TABLE OF CONTENTS

Purpose and Scope

The purpose of this report is to provide recommendations to assist you and your design team in developing design and construction criteria for the proposed water treatment plant expansion facilities in Pittsburg, California.

The scope of our work included exploratory drilling, sampling and laboratory testing of subsurface materials from the boreholes. The geotechnical data obtained was analyzed, and our findings and recommendations are reported herein.

This report has been prepared for the exclusive use of The City of Pittsburg, Camp, Dresser and McKee and the design consultants. In the event that any changes are made in the character, design or layout of the development, the conclusions and recommendations contained in this report will need review by our office to determine if modifications to the report are necessary.

Site Location and Proposed Development

The City of Pittsburg water treatment plant is located at the end of Olympia Drive, just south of the Contra Costa Canal (see Vicinity Map, Figure 1).

At the present time, the plant consists of a 6-million gallon water reservoir, a sludge storage lagoon, an operations building, sedimentation and flocculation basins, filters and pump stations.

The Site Plan included in this report as Figure 2 shows the locations of these existing facilities and the proposed improvements. These improvements include sedimentation and flocculation basins, several small tanks, pump stations, an improved intake structure at the Contra Costa Canal, an expansion of the operations building and an additional concrete sludge basin. This basin will replace the three sludge lagoons which were proposed earlier (see Figure 2). Exploration of the sludge basin area is to be done at a later date.

Site Geology and Seismicity

Dibblee (1980, Reference 1) has mapped this site as being underlain by Quaternary alluvial deposits and Tertiary (Pliocene) non-marine sedimentary rocks (see Geology Map, Figure 3). The U.S. Department of Agriculture Soil Conservation Service has mapped the soils on this site as belonging to the Altamont and Capay Series (Reference 2). They describe these soils as having a high shrink-swell potential and low strength. During our exploration, we encountered thin surficial deposits of gravelly clay; however, most of the site soils are sandy clays to clayey sand which vary somewhat from the description given by the U.S.D.A.

This site is approximately 4.3 miles southwest of the Special Seismic Study Zone for the Antioch fault (Reference 3). The magnitudes of the maximum probable and credible earthquakes on the Antioch fault are listed as 5.75 and 6.5, respectively. The maximum peak horizontal bedrock acceleration is estimated at 0.40g (Reference 3).

Other faults in the vicinity of the site are listed below.

Fault	Approx. Dist. From Site	Maximum Prob. EQ.*	Max. Peak Acceleration at Site
Greenville-Clayton Segment	11 SW	5.50	.15g

Concord	7 SW	5.75	.30g
Hayward	20 SW	6.50	.25g
San Andreas	35 SW	8.25	.25g

*Reference 3

During our research of literature and maps of this site, we found no active faults passing through the property.

Field Explorations

The field exploration of July 15, 1987, consisted of drilling eight auger holes at the locations indicated in your letter of June 25, 1987 (see Site Plan, Figure 2). The test borings were drilled using a CME-45 drill rig with 6-inch diameter continuous flight augers.

Soil samples were recovered during drilling using a 3-inch O.D. California-type split-spoon sampler fitted with 6-inch long brass liners. The sampler was driven by a 140-pound hammer dropped from a height of 30 inches. The number of blows required to drive the sampler in 6-inch increments was recorded at the time of drilling. These numbers were converted to Standard Penetration Test values by using a comparison of energy and surface area of the samplers (the standard sampler is 2 inches in diameter). The Standard Penetration Test (SPT) results which are recorded on the borelogs (Figures 5-12) are the converted number of blows required for the last foot of penetration.

The elevations on the borelogs are estimations based on topographic contours. The logs depict subsurface conditions within the borings at the time of drilling. However, note that subsurface conditions can vary with time.

Laboratory Testing

Samples obtained during drilling were tested to determine the following soil characteristics:

Natural unit weights (ASTM D-2216)
Natural moisture contents (ASTM D-2216)
Atterberg limits (ASTM D-4318)
Unconfined Compressive Strength (ASTM D-2166)

The laboratory test results are given in Table I, on the borelogs, and in Figures 13 and 14.

Subsurface Stratigraphy

During our field exploration, we encountered a surficial deposit of stiff, brown, gravelly silty clay underlain by light brown clayey sand/sandy clay and gravelly sand. These soils have a hard/dense consistency, and in Borings 1 and 8, drilling refusal occurred in the gravelly deposits.

An Atterberg Limits test on a sample of the near surface soil resulted in a Plasticity Index of 29 which indicates a high potential for soil swelling.

No ground water was encountered during drilling and the holes were still dry one week later. It should be noted, however, that ground water levels are subject to seasonal and longer-term fluctuations.

Site Grading

Grading plans have not been finalized as of the writing of this report, therefore, the recommendations made here are of a general nature and may need revisions once grading plans become available. We recommend that final grading plans be reviewed by ENGEO before contract bidding.

We anticipate that a balanced cut-and-fill operation will be used to provide design pad grades for the structures.

In order for ENGEO to coordinate its schedule with the Grading Contractor, a minimum notification of 48 hours prior to grading will be required.

Grading operations will require observation by the Soil Engineer's field representative and should meet the requirements of the "Guide Grading Specifications" included in the Appendix.

Demolition and Stripping

The initial step in grading consists of the removal of any existing structures interfering with the proposed development. Demolition includes removal of all buried pipes and utilities that could act as water traps, resulting in detrimental soil expansion.

Debris and loose materials within grading limits should be removed as necessary. The depth of removal of loose materials should be determined by the Soil Engineer in the field.

Vegetation, including trees not marked for saving, should be removed from areas to receive structures.

All excavations from demolition and stripping below design grades should be cleaned to a firm undisturbed soil surface determined by the Soil Engineer. The surface should then be scarified, moisture conditioned and backfilled with compacted engineered fill.

No loose or uncontrolled backfilling of depressions resulting from demolition and stripping are permitted.

Placement of Fill, Monitoring and Testing

On-site materials which are not contaminated by debris, vegetation or organic materials may be used as engineered fill.

The Soil Engineer should be informed if any importation of soil is contemplated. Import materials, if any are needed, should have a Plasticity Index of less than 15. A sample of such material should be submitted to the Soil Engineer for evaluation prior to delivery at the site.

Areas to receive fill should be scarified to a depth of at least 6 inches, moisture conditioned and recompacted to provide an adequate bond with the initial lift of fill. All fills should be placed in thin lifts. The lift thickness should not exceed the depth of penetration of the compaction equipment used.

The following compaction requirements should be generally applied to all grading:

Test Procedure:	ASTM D-1557.
Required Moisture Content:	Not less than 3 percent above moisture content.
Minimum Relative Compaction:	Not less than 90 percent.

Because of the expected high swell potential of some of the site soils, special subgrade preparations may be required where vertical movements should be minimized. Such preparations include moisture conditioning of site soils or replacement of subgrade soils by low plasticity import fill. We will be glad to consult with you further on this matter on a case-by-case basis.

Foundation Design

Because of the variability of structure types proposed, we expect that several foundation systems will be considered. These may include spread footings, mat foundations, and drilled piers.

The following design criteria may be used for foundations consisting of continuous strip and isolated spread footings:

Minimum depth of footing embedment:	24 inches below lowest adjacent subgrade level.
Minimum footing width:	12 inches.

Maximum allowable footing pressure:	2,500 psf for dead-plus-live loads in firm soil. This value may be increased by 1/3 for total loads including wind or seismic loads.

Footing trenches should not be allowed to desiccate and should be cleaned of all loose soil prior to pouring concrete.

For drilled pier foundations, the following design values are applicable.

Minimum pier diameter:	10 inches.
Allowable skin friction:	500 psf. Neglect the upper 24" in pier friction calculations.

The following soil pressures may be used in design calculations for retaining walls.

Active Pressure:	45 pcf with level backfill.
Passive Pressure:	300 pcf.
At Rest Pressure:	60 pcf.

For earthquake-resistant design of the proposed structures, a soil profile coefficient, S, of 1.0 may be used.

Foundation plans should be reviewed by the Soil Engineer prior to contract award.

Slab-on-Grade Construction

The slab-on-grade should be designed by the Structural Engineer for the anticipated loads and should be a minimum of 4 inches thick with reinforcement or joints for control of cracking.

In areas where a capillary break is desired, a layer of clean gravel or crushed rock a minimum of 4 inches thick may be placed under the slabs. A vaporproof membrane may be placed in the operations building to minimize moisture condensation under the slabs.

Site Surface Drainage

The project site should be positively graded at all times to provide for rapid removal of surface water runoff away from foundation systems and to prevent ponding of water under structures or seepage toward foundation systems at any time during or after construction. Ponding of water may result in undesirable weakening of the subgrade materials, loss of compaction, and slab and foundation movements.

As a minimum requirement, finished grades should provide a slope of at least 3 to 5 percent within 7 feet from the foundation systems at right angles to them to allow surface water to drain positively away from the structures.

No concentrated discharge of roof storm waters from the operations building should be allowed within 3 feet from the foundation system or slabs. Storm water from roof downspouts should be carried away in closed conduits in a structure designed and approved by a Civil Engineer.

Underground Pipes

If sand is used as utility trench backfill, all utility trenches entering the operations buildings should be provided with an impervious seal consisting of native materials where the trench passes under the building perimeter. The impervious plug should extend at least 3 feet into, and out of, the building perimeter.

All trench backfill should be compacted using approved techniques to a minimum of 90 percent compaction. Utility trenches should not be located upslope of any foundation area unless the placement, depth and backfill material to be used is reviewed by the Soil Engineer. Where utility trenches are located beside foundation areas, the trencher should be placed entirely above a plane extending downward from the lower edge of the footings at an angle of 45 degrees.

In order to minimize stresses due to swelling soils, buried pipes entering tanks or other fixed structures may be fitted with flexible joints.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

The recommendations of this report are based upon the assumption that the soil and bedrock conditions do not deviate from those disclosed in our subsurface explorations. If variations from our findings or undesirable conditions are found during construction, or if the proposed construction differs from that presently planned, ENGEO Incorporated should be notified so that supplemental recommendations can be given.

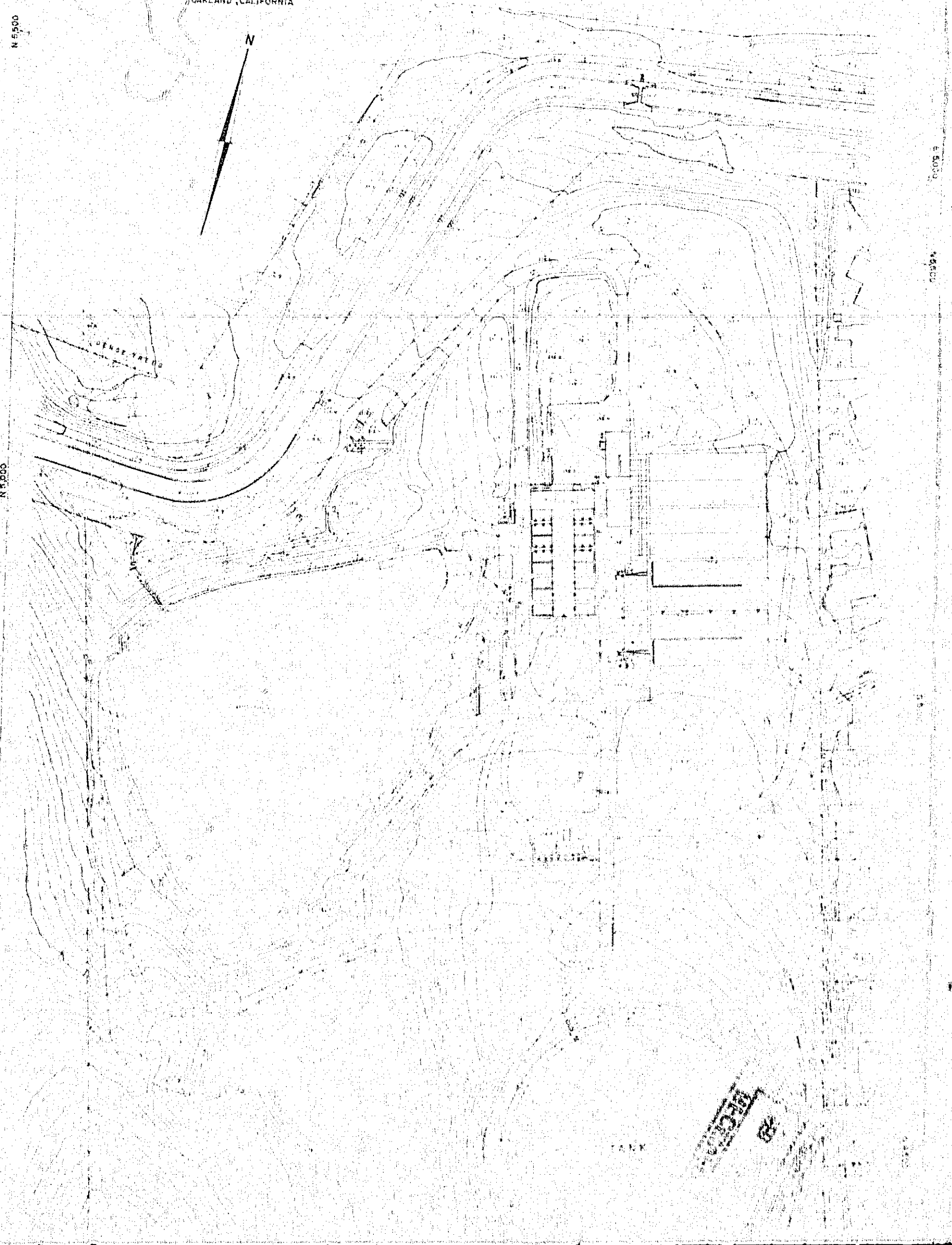
This report is issued with the understanding that it is the responsibility of the owner to transmit the information and recommendations of this report to developers, owners, buyers, Architects, Engineers, and Designers for the project so that the necessary steps can be taken by the Contractors and Subcontractors to carry out such recommendations in the field. The conclusions and recommendations contained in this report are solely professional opinions derived in accordance with current standards of professional practice.

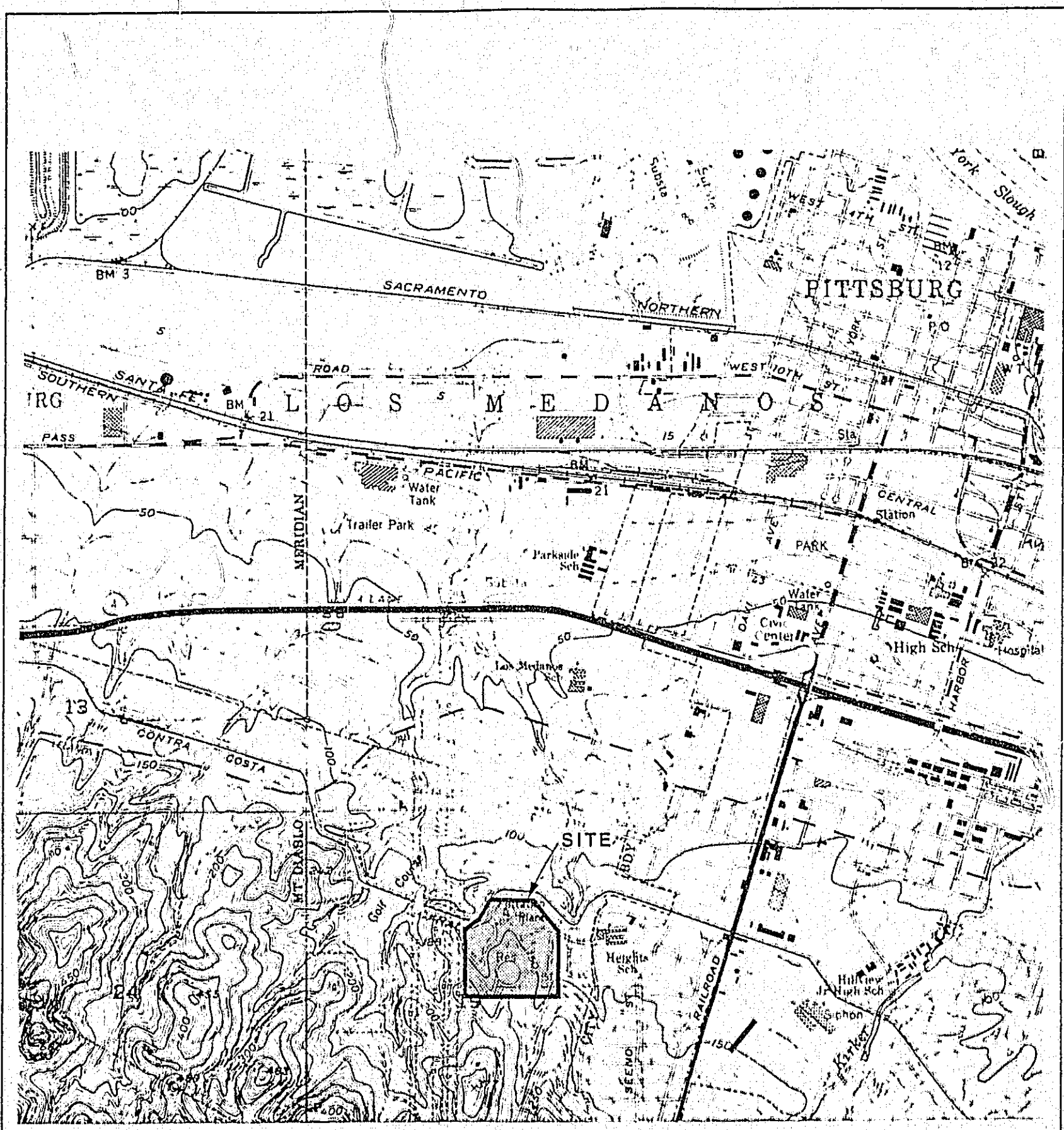
The professional staff of ENGEO Incorporated strive to perform their services in a proper and professional manner with more than reasonable care and competence but are not infallible. We understand that there are risks of earth movement and property damage inherent in land development. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our work.

The standard of care is time-dependent. The report for this project is in accordance with the duty of care of geotechnical consultants in 1987. The work was performed for the sole use of our client. Others who seek to rely on the findings contained in this report have a duty to determine the adequacy of this report for their time, location and intended use.

APPENDIX

COMPOSITE TOPOGRAPHIC MAP
PITTSBURG WATER TREATMENT PLANT
MAP SCALE 1"=100' CONTOUR INTERVAL 2'
PHOTO SCALE 1 1920 DATE OF PHOTOGRAPHY 7-2-87
PREPARED BY
HAMMON, JENSEN, WALLEN & ASSOCIATES
OAKLAND, CALIFORNIA





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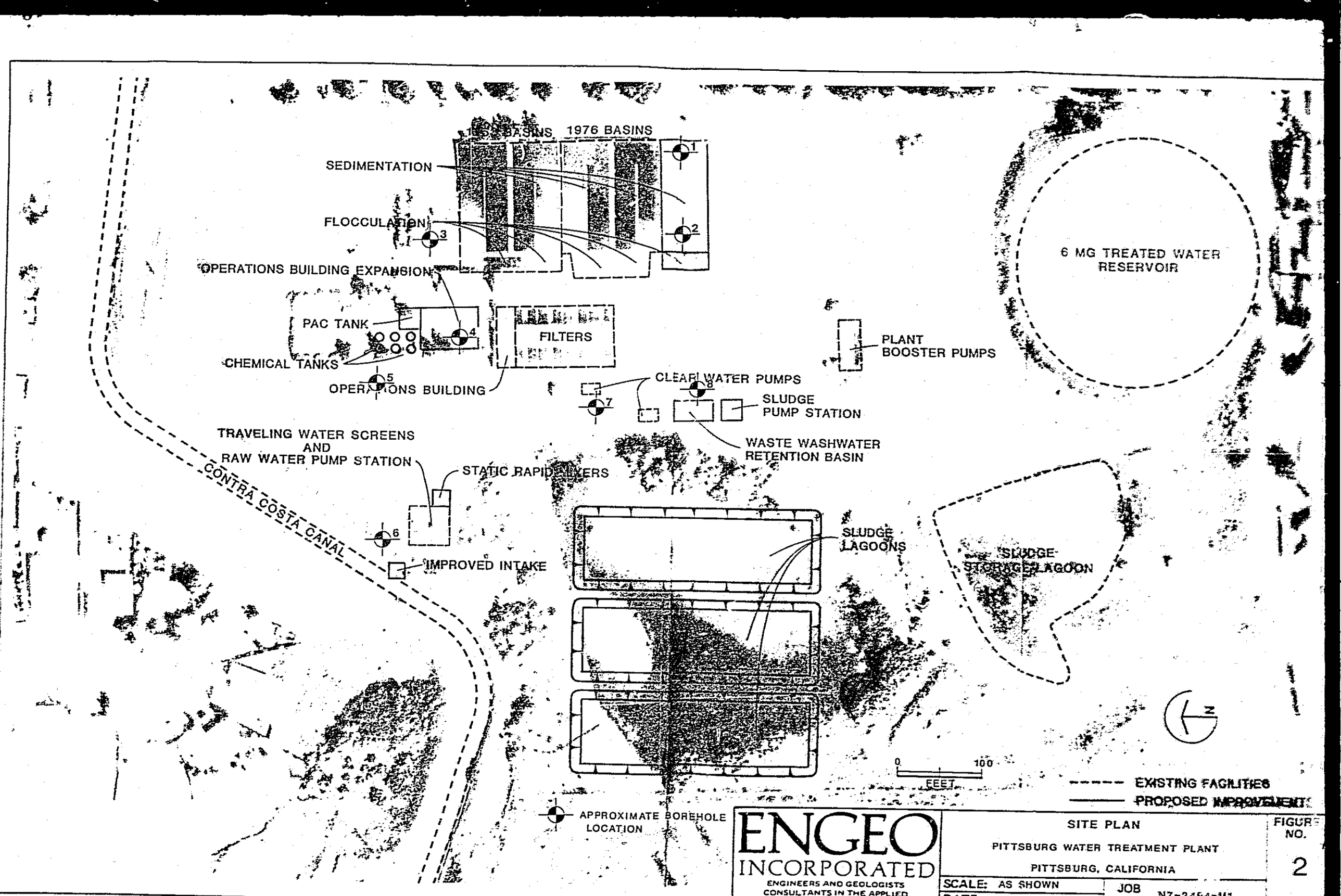
VICINITY MAP

PITTSBURG WATER TREATMENT PLANT

PITTSBURG, CALIFORNIA

SCALE: AS SHOWN	JOB NO. N7-2494-M1
DATE: JULY 1987	

FIGURE NO. 1



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EARTH SCIENCES

SITE PLAN

PITTSBURG WATER TREATMENT PLANT

PITTSBURG, CALIFORNIA

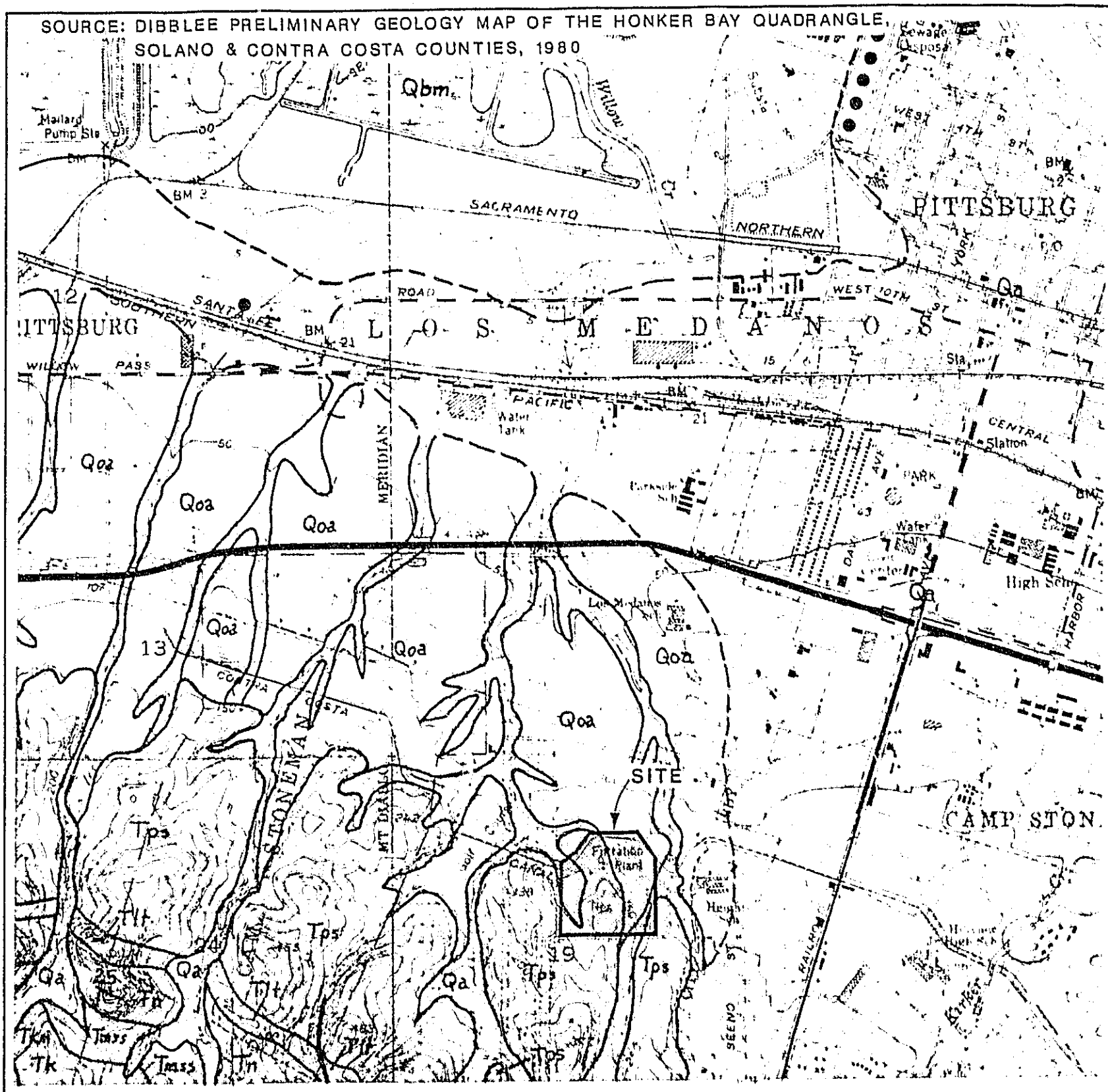
SCALE: AS SHOWN

DATE: JULY 1987

JOB NO. N7-2494-M1

FIGURE NO. 2

SOURCE: DIBBLEE PRELIMINARY GEOLOGY MAP OF THE HONKER BAY QUADRANGLE, SOLANO & CONTRA COSTA COUNTIES, 1980



— — — CONTACT; DASHED WHERE GRADATIONAL OR APPROXIMATE

STRIKE AND DIP OF STRATA

30 INCLINED

Qbm QUATERNARY BAY MUD

Qa QUATERNARY ALLUVIUM

Qoa QUATERNARY OLDER ALLUVIUM

Tps PLIOCENE NON-MARINE SEDIMENTARY ROCKS

Tf PLIOCENE LAWLOR TUFF

Tn MIOCENE NEROLY FORMATION NON-MARINE SANDSTONE

Tmss MIOCENE MARINE SANDSTONE

EOCENE KREYENHAGEN FORMATION

Tk CLAYSHALE

Tkm MARKLEY SANDSTONE MEMBER

0 2000 FEET

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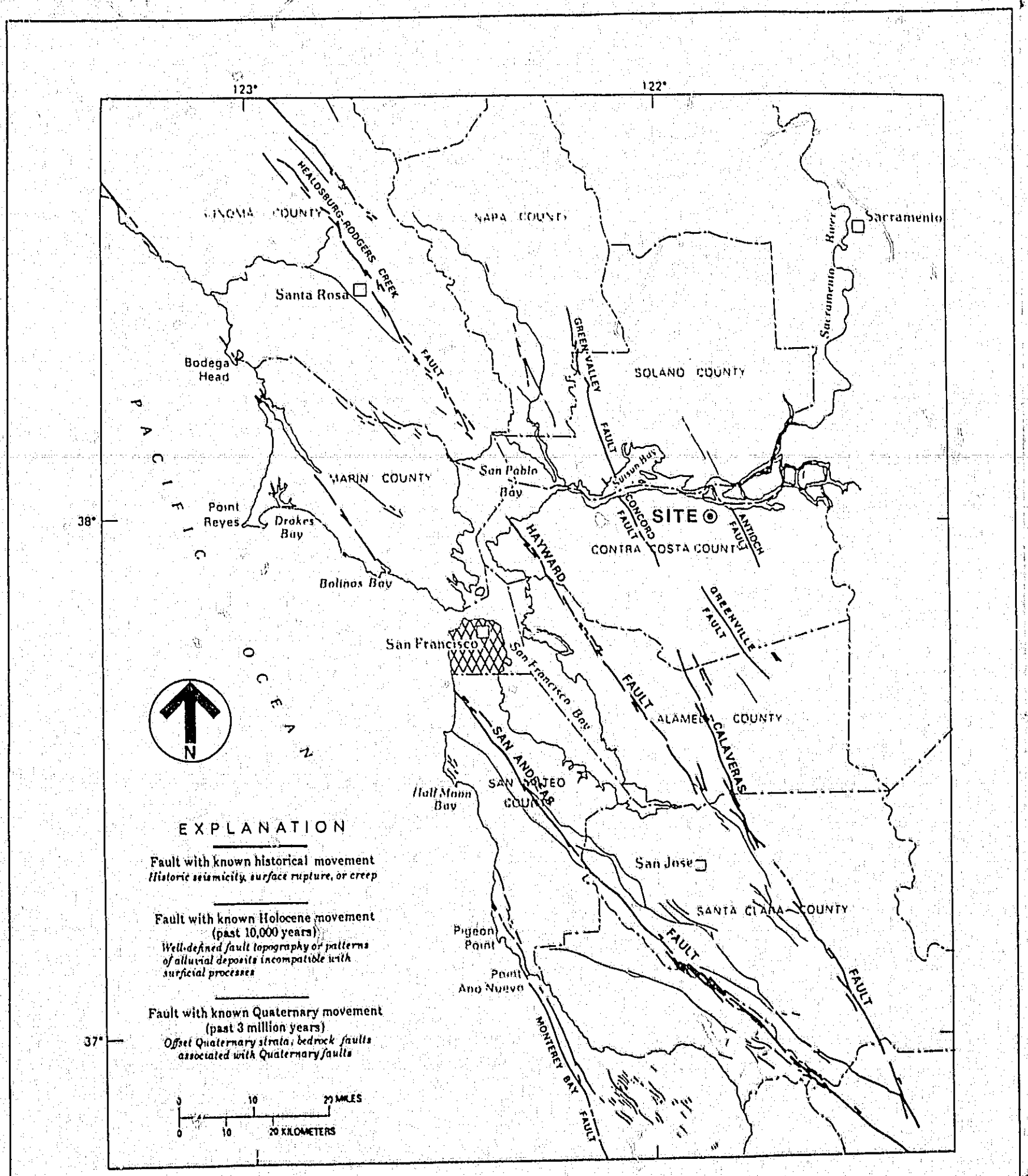
GEOLOGY MAP
PITTSBURG WATER TREATMENT PLANT
PITTSBURG, CALIFORNIA

SCALE: AS SHOWN
DATE: JULY 1987
JOB NO. N7-2494-M1

FIGURE NO. 3



SOURCE: U.S.G.S. PROFESSIONAL PAPER #946

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FAULT MAP
PITTSBURG WATER TREATMENT PLANT
PITTSBURG, CALIFORNIA

FIGURE NO. 4

SCALE: AS SHOWN	JOB NO. N7-2194-M1
DATE: JULY, 1987	

KEY TO BORING LOGS

MAJOR TYPES			DESCRIPTION
COARSE-GRAINED SOILS MORE THAN HALF OF MAT'L LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	Well graded gravels, little or no fines
			Poorly graded gravels or gravel-sand mixture
		GRAVELS WITH OVER 12 % FINES	Silty gravels, gravel and silt mixtures
			Clayey gravels, gravel and clay mixtures
			Clayey sandy gravel, gravel-sand-clay mixtures
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	Well graded sands, little or no fines
		SANDS WITH OVER 12 % FINES	Silty sand, sand-silt mixtures
			Clayey sand, sand-clay mixtures
FINE-GRAINED SOILS MORE THAN HALF OF MAT'L SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		Silt
			Clay
			Clayey silt, silt-clay mixtures
			Silty clay, clay-silt mixtures
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		Gravelly clay, clay-gravel mixtures
			Sandy silty clay, clay-silt-sand mixtures
			Gravelly silt, silt-gravel mixtures
	HIGHLY ORGANIC SOILS		Peat and other highly organic soils
BEDROCK	SEDIMENTARY BEDROCK		Sandstone
	OTHER BEDROCK TYPES		Siltstone
	DESCRIBED ON LOGS		Claystone

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT (S.P.T.)
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH*	BLOWS/FOOT (S.P.T.)
VERY SOFT	0-1/4	0-2
SOFT	1/4-1/2	2-4
MEDIUM STIFF	1/2-1	4-8
STIFF	1-2	8-15
VERY STIFF	2-4	15-30
HARD	OVER 4	OVER 30

SAMPLER SYMBOLS

- Modified California (3" O.D.) sampler
- S.P.T. - Split Spoon sampler
- Bulk - Bag sample
- Lost - Sample attempted, no recovery
- Shelby tube

LINE TYPES

- Solid - Layer Break
- Angled - Approximate Layer Break
- Dashed - Gradational Layer Break

(S.P.T.) Number of blows of 140 lb. hammer falling 30" to drive a 2-inch O.D. (1-3/8 inch I.D.) Sampler.

ENGEO

* Unconfined compressive strength in tons/sq. ft., asterisk on log means determined by Pocket Penetrometer.

DATE OF BORING: July 15, 1987

SURFACE ELEVATION: Approx. 150.0 feet

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	N S.P.T. BLOWS/FT *MODIFIED FOR 3" O.D. SAMPLER	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0	1-1		Dark grayish brown, sandy CLAY with gravel and disseminated, stiff, dry.	11*	4.5+*	85.0	12.0
5	1-2		Light yellowish brown, clayey fine-grained SAND with disseminated carbonates, dense, moist.	39*		110.3	11.2
10	1-3		Light yellowish brown, gravelly fine-grained SAND with disseminated carbonates, very dense, moist. Gravels, subround to round, up to 4".	57*		116.6	7.1
15	1-4		Bottom of boring at approximately 17.5 feet.	21*		104.2	9.0
20							
25							
30							

ENGEO INCORPORATED

Pittsburg Water Treatment Plant
Pittsburg, California

BORING NO.: 1
DATE: July 1987
JOB NO.: N7-2494-M1

FIGURE NO. 5

DATE OF BORING: July 15, 1987

SURFACE ELEVATION: Approx. 155.0 feet

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	N S.P.T. BLOWS/FT *MODIFIED FOR 3" O.D. SAMPLER	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0			Dark brown, gravelly sandy CLAY.				
5	2-1		Pale yellow, clayey fine-grained SAND with disseminated carbonates, very dense, moist.	74*		102.7	15.1
10	2-2		Light yellowish brown, sandy CLAY, very stiff, moist.	43*	4.5+*	113.9	14.4
15	2-3		Light yellowish brown CLAY, hard, moist.	47*		109.2	14.6
	2-4		Light yellowish brown, clayey SAND, dense, moist.	32*		110.0	13.3
20			Bottom of boring at approximately 18.5 feet.				
25							
30							

ENGEO INCORPORATED

Pittsburg Water Treatment Plant
Pittsburg, California

BORING NO.: 2
DATE: July 1987
JOB NO.: N7-2494-M1

FIGURE NO. 6

DATE OF BORING: July 15, 1987

SURFACE ELEVATION: Approx. 148.0 feet

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	N S.P.T. BLOWS/FT *MODIFIED FOR 3" O.D. SAMPLER	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0	3-1		Dark grayish brown, gravelly silty CLAY with disseminated carbonates, very stiff, moist.	16*	4.5+*	114.3	13.6
5							
10	3-2		Light yellowish brown, silty fine-grained SAND with carbonate veins, very dense, moist.	53*		105.5	14.1
	3-3		Light yellowish brown, clayey SAND/sandy CLAY, very stiff/dense, moist.	45*		104.5	11.8
15							
			Light yellowish brown, clayey SAND, trace of carbonates dense, moist.				
20	3-4		Bottom of boring at approximately 19.5 feet.	38*		101.1	17.3
25							
30							

ENGEO INCORPORATED

Pittsburg Water Treatment Plant
Pittsburg, California

BORING NO.: 3
DATE: July 1987
JOB NO.: N7-2494-M1

FIGURE NO. 7

DATE OF BORING: July 15, 1987

SURFACE ELEVATION: Approx. 145.0 feet

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	N S.P.T. BLOWS/FT *MODIFIED FOR 3" O.D. SAMPLER	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0			2" AC				
	4-1		6" AB	39*		113.4	16.1
			Olive, gravelly CLAY with abundant carbonates, moist, hard.				
5	4-2		Olive yellow, clayey SAND with disseminated carbonates, moist, very dense. Hard drilling from 4.75 feet.	73*		101.7	20.3
10	4-3		With some gravel, maximum gravel size 1".	59*		112.5	8.8
15	4-4			80*		110.6	15.8
			Bottom of boring at approximately 16.5 feet.				
20							
25							
30							

ENGEO INCORPORATED

Pittsburg Water Treatment Plant
Pittsburg, California

BORING NO.: 4
DATE: July 1987
JOB NO.: N7-2494-M1

FIGURE NO. 8

DATE OF BORING: July 15, 1987

SURFACE ELEVATION: Approx. 140.0 feet

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	N S.P.T. BLOWS/FT *MODIFIED FOR 3" O.D. SAMPLER	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0			Dark brown, silty CLAY, dry, hard.				
			Pale olive, clayey SAND with carbonates, very dense, moist.				
5	5-1			36*		94.2	12.2
			Light olive brown, gravelly clayey SAND some disseminated carbonates, moist, very dense.				
10	5-2			70*		110.4	18.7
			Light olive brown, gravelly SAND, clean, moist, dense.				
15	5-3			43*		103.8	8.2
			Bottom of boring at approximately 16 feet.				
20							
25							
30							

ENGEO INCORPORATED

Pittsburg Water Treatment Plant
Pittsburg, California

BORING NO.: 6
DATE: July 1987
JOB NO.: N7-2494-M1

FIGURE NO. 9

DATE OF BORING: July 15, 1987

SURFACE ELEVATION: Approx. 120.0 feet

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	N S.P.T. BLOWS/FT *MODIFIED FOR 3" O.D. SAMPLER	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0	6-1		Light olive brown, gravelly clayey SILT some disseminated carbonates, hard, dry.	66*		119.6	10.9
5			Light olive brown, gravelly silty SAND, moist, dense.				
	6-2		Light olive brown, clayey gravelly SILT, moist, hard.	44*		110.8	17.4
10			Hard drilling from 10 feet.				
15	6-3		Light olive brown, gravelly silty SAND some disseminated carbonates, moist, very dense.	84*		112.9	14.1
20			Bottom of boring at approximately 16.5 feet.				
25							
30							

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Pittsburg Water Treatment Plant
Pittsburg, California

BORING NO.: 6
DATE: July 1987
JOB NO.: N7-2494-M1

FIGURE NO. 10

DATE OF BORING: July 15, 1987

SURFACE ELEVATION: Approx. 140.0 feet

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	N S.P.T. BLOWS/FT *MODIFIED FOR 3" O.D. SAMPLER	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0			Brown, gravelly clayey SILT, dry, hard. CONCRETE and GRAVEL to 4" diameter (FILL).				
5	7-1		Very dark gray, sandy CLAY with disseminated carbonates, hard, moist.	22*		112.9	15.7
10	7-2		Light olive brown, gravelly clayey SAND with abundant carbonates, very dense, moist.	67*		114.2	14.0
15	7-3		Light olive brown, gravelly silty SAND with disseminated carbonates, moist, very dense, or weathered sandstone.	61/6"*		109.1	12.2
20			Bottom of boring at approximately 16.5 feet.				
25							
30							

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Pittsburg, California

BORING NO.: 7

DATE: July 1987

JOB NO.: N7-2494-M1

FIGURE NO. 11

DATE OF BORING: July 15, 1987

SURFACE ELEVATION: Approx. 145.0 feet

DEPTH (FEET)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	N S.P.T. BLOWS/FT *MODIFIED FOR 3" O.D. SAMPLER	qu UNCON. COMP. STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0			Dark grayish brown, gravelly silty CLAY, dry, hard.				
5	8-1			41*		124.9	8.0
10	8-2		Olive brown, gravelly clayey SAND, moist, very dense. Gravel to 1 inch.	51*		120.7	14.4
15	8-3		Light olive brown, silty gravelly SAND, moist, very dense. Gravel to 3 inches. Refusal at 16 feet.	50/1"			
20			Bottom of boring at approximately 16 feet.				
25							
30							

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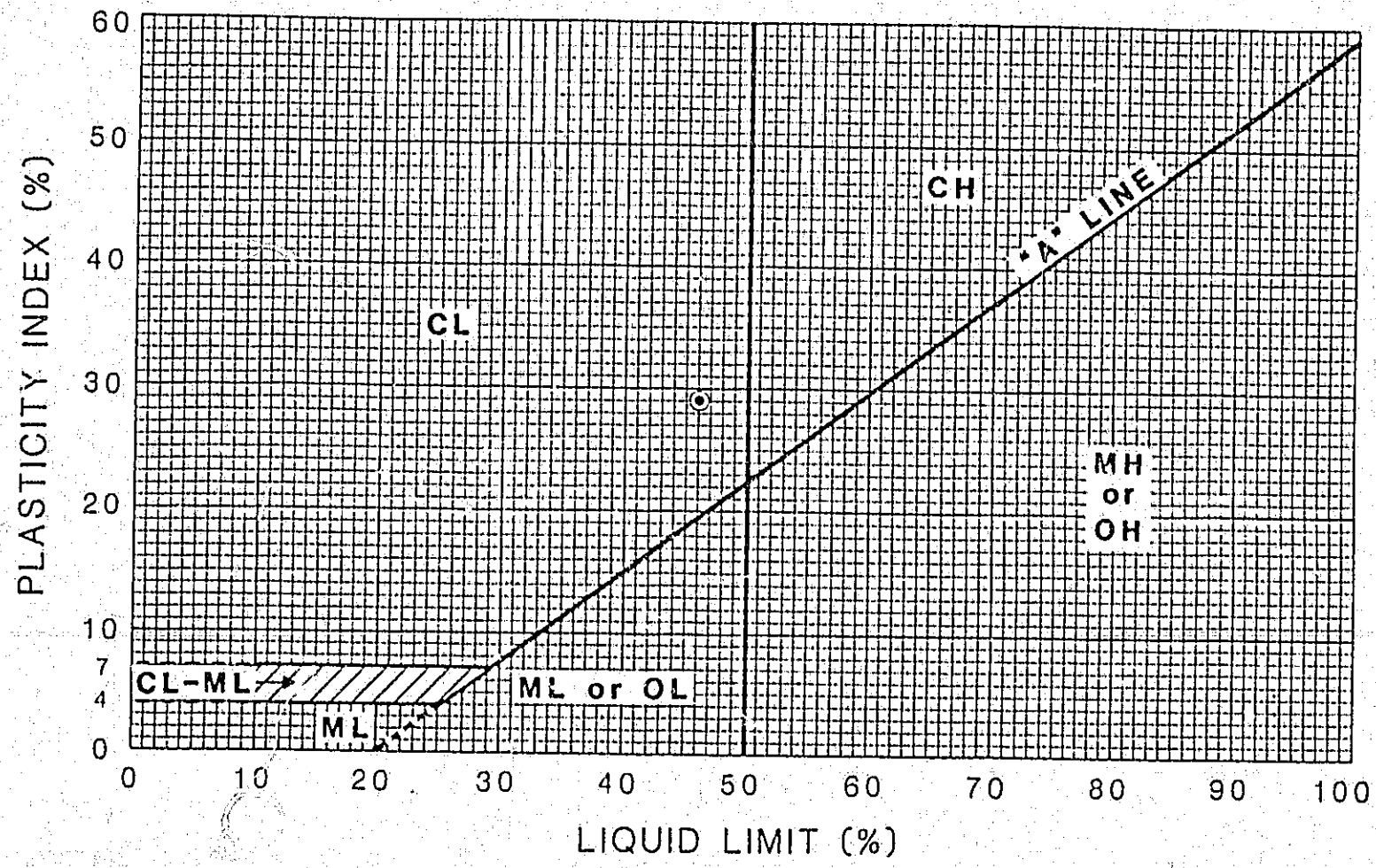
Pittsburg Water Treatment Plant
Pittsburg, California

BORING NO.: 8
DATE: July 1987
JOB NO.: N7-2494-M1

FIGURE NO. 12



NO.	SAMPLE DEPTH (FEET)	NATURAL WATER CONTENT %	ATTERBERG LIMITS			PERCENT PASSING NO. 200 SIEVE	UNIFIED SOIL CLASSIFICATION SYMBOL
			LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX %		
7-1	6	15-7	46	17	29		CL

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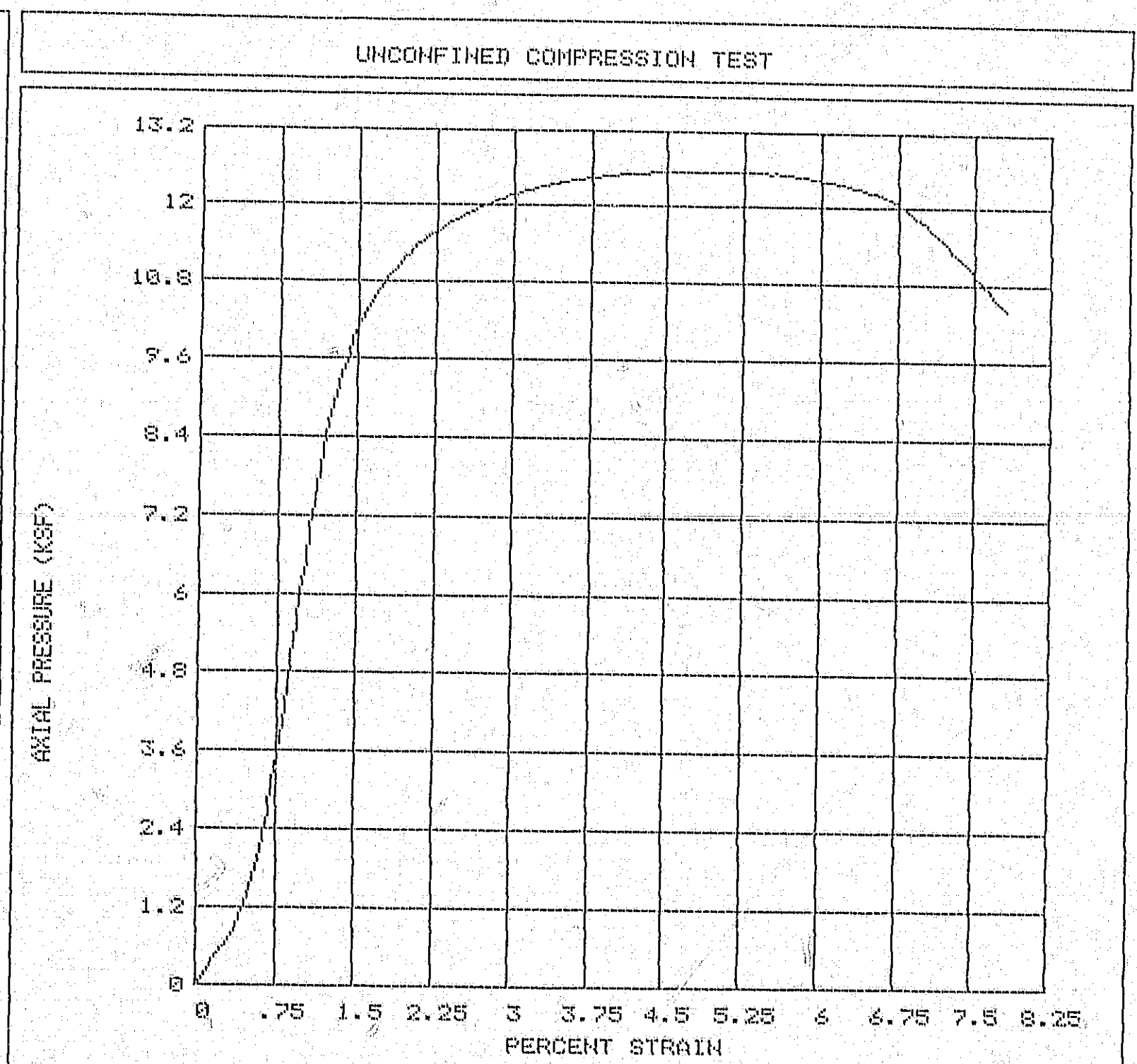
ENGINEERS AND GEOLOGISTS
CONSULTANTS IN THE APPLIED EARTH SCIENCES

PLASTICITY CHART
PITTSBURG WATER TREATMENT PLANT
PITTSBURG, CALIFORNIA

SCALE ---
DATE JULY, 1987
JOB NO. N7-2494-M1

FIGURE NO. 13



Sample Description: Dark gray clay w/silt
UNCONFINED COMPRESSIVE STRENGTH: 10000 psf

SAMPLE NO.	: P-1	Plastic Limit	: n/a
Initial Diameter	: 2.375 in.	Liquid Limit	: n/a
Initial Height	: 4.5 in.	Dry Unit Weight	: 112.9 pcf
Strain Rate	: 1.463 %/MIN	Moisture Content	: 15.7 %
Total Strain	: 7.833 %	Depth Of Sample	: 5.5 ft.

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JOB NO.: H7-2494-H1
PITTSBURG WATER TREATMENT
Pittsburg Calif.

Date: 07-21-1987

Fig : 14

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TABLE I

PROJECT NUMBER: N7-2494-M1

BORING AND SAMPLE NUMBER	DEPTH FEET	IN-PLACE		ATTERBERG LIMITS			DIRECT SHEAR		UNCONFINED COMPRESSIVE STRENGTH psf	
		DRY UNIT WEIGHT pcf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX	ANGLE OF INTERNAL FRICTION	UNIT COHESION psf		
1-1	2	85.0	12.0							
1-2	7	110.3	11.2							
1-3	12	116.6	7.1							
1-4	17	104.2	9.0							
2-1	3	102.7	15.1							
2-2	8	113.9	14.4							
2-3	13	109.2	14.6							
2-4	18	110.0	13.3							
3-1	4	114.3	13.6							
3-2	9	105.5	14.1							
3-3	14	104.5	11.8							
3-4	19	101.1	17.3							
4-1	2	113.4	16.1							
4-2	6	101.7	20.3							
4-3	11	112.5	8.8							
4-4	16	110.6	15.8							
5-1	4	94.2	12.2							
5-2	9	110.4	18.7							
5-3	14	103.8	8.2							
6-1	2	119.6	10.9							
6-2	8.5	110.8	17.4							
6-3	16	112.9	14.1							
7-1	8.3	112.9	15.7	46	17	29			10,000	
7-2	10.5	114.2	14.0							
7-3	16	109.1	12.2							

SUMMARY OF LABORATORY TEST RESULTS

ENGEO
INCORPORATED

TABLE I

PROJECT NUMBER: N7-2494-M1

BORING AND SAMPLE NUMBER	DEPTH FEET	IN-PLACE		ATTERBERG LIMITS			DIRECT SHEAR		UNCONFINED COMPRESSIVE STRENGTH psf	
		DRY UNIT WEIGHT pcf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX	ANGLE OF INTERNAL FRICTION	UNIT COHESION psf		
8-1	6	124.9	8.0							
8-2	11	120.7	14.4							

SUMMARY OF LABORATORY TEST RESULTS

GUIDE GRADING SPECIFICATIONS

for

City of Pittsburg

Water Treatment Plant Expansion

Pittsburg, California

1.0 General Description

1.1 These specifications have been prepared for grading and site development of Water Treatment Plant Expansion, Pittsburg, Calif. The Soil Engineer should be consulted prior to any on-site work so that compliance with these specifications can be obtained.

1.2 This item relates to all clearing and grubbing, preparation of land to be filled, filling of the land, spreading, compaction and testing of the fill, and all subsidiary work necessary to complete the grading of the filled areas to conform with the lines, grades, and slopes as shown on the accepted plans. Lines, grades, and slopes shall be controlled by the Civil Engineer's surveyor.

1.3 Tests and observations shall be made by the Soil Engineer during grading operations so that he is able to report whether in his opinion the project was constructed in conformance with the intent of these specifications.

1.4 The Soil Engineer must be notified at least 48 hours prior to commencement of grading operations, and not less than 24 hours prior to placement of fill, so that arrangements for observations and testing can be made.

1.5 Any grading operations and/or placement of fill done without engineering observation will be at the Contractor's risk, and no responsibility will be accepted by the Soil Engineer.

2.0 Tests

2.1 The standard test used to define maximum dry unit weights and optimum moisture content of all compaction work shall be the Standard ASTM Test Procedure No. D-1557--latest revision. All

densities shall be expressed as a relative compaction in terms of the maximum dry weight obtained in the laboratory.

3.0 Clearing, Grubbing, and Preparing Areas to be Filled

3.1 All brush and other rubbish, as well as trees when necessary, shall be removed, piled, burned, or otherwise disposed of so as to leave the areas that have been disturbed with a neat and finished appearance free from unsightly debris. No burning is permitted in the area to be filled. Debris, rubbish, and vegetable matter that cannot be burned must be removed from the site.

3.2 Any existing structures, foundations, underground storage tanks, or debris must be removed from the site prior to any building, grading, or fill operations. Septic tanks, including all connecting drain fields and other lines, if encountered, must be totally removed. The resulting depressions shall be properly reconstructed and filled to the satisfaction of the Soil Engineer.

3.3 Vegetation and organic topsoil shall be removed from the surface upon which the fill is to be placed. The surface shall then be plowed or scarified to a depth of at least six (6) inches until the surface is free from ruts, hummocks, or other uneven features which would tend to prevent uniform compaction by the equipment to be used.

3.4 After the foundation for the fill has been cleared, plowed, or scarified, it shall be disced or bladed until it is uniform and free from large clods. The proper moisture content must be obtained by adding water or aerating. The foundation shall be compacted at the proper moisture content to a relative compaction as specified in Paragraph 5.4.

4.0 Materials

4.1 Materials for engineered fill are to be evaluated by the Soil Engineer before the start of grading operations. Any imported material must be evaluated for suitability before being brought to the site. The materials used must be free from organics and other deleterious material.

4.2 Rock of sizes in excess of two-thirds (2/3) the planned compacted lift thickness shall be removed from any fill material, to the satisfaction of the Soil Engineer.

5.0 Placing, Spreading, and Compacting Fill Material

5.1 Fill material shall be placed in layers no thicker than will permit adequate bonding and compaction. Each layer shall be spread evenly and thoroughly blade-mixed to obtain uniformity of material.

5.2 When fill material includes rock, no large rocks will be allowed to nest. All voids must be carefully filled with small stones or earth and properly compacted. No large rocks will be permitted closer than twelve (12) inches below the bottom of footings.

5.3 When the moisture content of the fill material is below that specified, water must be added. The moisture content is as specified to obtain thorough bonding during the compacting process. When the moisture content of the fill material is above that specified, the fill material shall be aerated by blading or other satisfactory method until the moisture content is as specified.

5.4 Moisture content and compaction requirements must be as follows:

TYPE OF MATERIALS	MOISTURE REQUIREMENTS	COMPACTION REQUIREMENTS
On site soils	Not less than 3% over optimum moisture content	Not less than 90% relative compaction

Optimum moistures and maximum dry unit weights shall be determined as specified in Paragraph 2.1.

5.5 Compaction shall be by sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction rollers. Rollers shall be of such design that they will be able to compact the fill to the specified compaction. Rolling shall be accomplished while the fill material is within the specified moisture content range. Rolling of each layer must be continuous so that the required compaction may be obtained.

5.6 Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compacting operations shall be continued until the slopes are firm. While no appreciable amount of loose soil will be permitted on the slopes, compaction shall not be so dense as to prohibit planting. Compacting of the slopes may be done progressively in increments of three-to-five (3-to-5) feet in fill height. All completed fill slopes shall be properly compacted by track rolling.

5.7 Field density tests are to be made by the Soil Engineer. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below the required compaction, the particular layer or portion shall be reworked until the required density has been obtained.

5.8 The fill operations will be continued in compacted layers as specified above until the fill has been brought to the finished slopes and graded as shown on the accepted plans.

5.9 All earthworking and moving operations shall be controlled by the contractor to prevent water from running into excavated areas. All water must be promptly removed and the site kept dry.

6.0 Seasonal Limits

6.1 No fill material will be placed, spread, or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until tests by the Soil Engineer indicate that the moisture content and density of the fill are as previously specified.

7.0 Unusual Conditions

7.1 In the event that any unusual conditions not covered by the special provisions are encountered during grading operations, the Soil Engineer must be immediately notified for directions.

8.0 Engineer's Report--Post-construction

8.1 A Soil Engineer's Report of tests and observations is to be issued after grading is completed. This report shall consist of professional opinions of the adequacy of the construction. This report shall be in accordance with current standards of professional practice and no warranty will be expressed or implied.