Harding Lawson Associates
Engineering and Environmental Services

1855 Gateway Blvd., Suite 500
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LETTER OF TRANSMITTAL

DATE 1-29-96 JOB NO.

ATTENTION Mr. Dale Klettke

RE

To Alameda County Environmental Health
1131 Harbor Bay Parkway, #250
Alameda, CA 94502-6577

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ ______

COPIES	DATE	NO.	DESCRIPTION
1	5/4/87		Soil Investigation Report

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ____ copies for approval

☒ For your use ☐ Approved as noted ☐ Submit ____ copies for distribution

☐ As requested ☐ Returned for corrections ☐ Return ____ corrected prints

☐ For review and comment ☐ ______

☐ FOR BIDS DUE ______ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS: This is the report with borings drilled in February 1987. There is no report dated Feb 87. For your file.

COPY TO: ______

SIGNED:

If enclosures are not as noted, kindly notify us at once.

Harding Lawson Associates
A Subsidiary of Harding Associates

HLA

David F. Scrivner, P.E.
Project Engineer

Engineering and
Environmental Services

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A Report Prepared for

Blue Print Service Company
c/o Garcia/Wagner and Associates
555 Sutter Street
San Francisco, California 94102

SOIL INVESTIGATION
CITY BLUE PRODUCTION FACILITY
1700 JEFFERSON STREET
OAKLAND, CALIFORNIA

HLA Job No. 18106,001.04

by

Daniel A. Louis
Project Engineer

Henry T. Taylor
Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
HENRY T. TAYLOR
8787
EXP 12/31/88
CIVIL
STATE OF CALIFORNIA

Harding Lawson Associates
666 Howard Street
San Francisco, California 94105
415/543-8422

May 4, 1987

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

I INTRODUCTION

This report presents the results of the soil investigation we performed for the proposed City Blue Production facility in Oakland, California. The project is located on the northeast corner of 17th and Jefferson streets; it has approximately 70 feet of frontage on Jefferson Street and 190 feet of frontage on 17th Street. The site is almost entirely surfaced with asphalt pavement, except the southwest corner, where a small gas station is operated by Blue Print Service Company.

The City Blue Production facility will consist of a one-story structure measuring approximately 70 by 120 feet in plan dimensions and an adjacent fenced-in parking area. The structure will have approximately 16-foot-high concrete block walls and a concrete slab-on-grade floor. The proposed finished floor elevation is 31.85 feet.* The fence enclosing the parking area will consist of free-standing concrete block walls.

The existing gas station has three underground gasoline tanks that will eventually be excavated and removed from the site. We are currently evaluating potential ground contamination, and will present the results in a separate report.

The scope of our investigation was defined in our proposal dated January 28, 1987. It included providing conclusions and recommendations regarding:

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* City of Oakland Datum

1. Site preparation and grading
2. The most appropriate foundation type(s) for the proposed building and free-standing walls for the parking area
3. Design criteria for the recommended foundation type(s)
4. Estimates of foundation settlement
5. Subgrade preparation for concrete slabs-on-grade
6. Pavement design for the proposed parking area.

During our investigation we have discussed the project with the architects, Messrs. David Wagner and Felix Rodriguez of Garcia/Wagner and Associates; the structural engineer, Mr. George Greenwood of H. J. Degenkolb Associates; and the civil engineer, Mr. Jim Diggins of DeBolt Civil Engineers.

We met with the architects and Mr. Paul Koze of Blue Print Service Company on April 13, 1987 to discuss underground tank removal and other aspects of the project.

II FIELD INVESTIGATION AND LABORATORY TESTING

We explored the subsurface conditions at the proposed production facility site by drilling three borings 5 to 40 feet deep, located as shown on the Site Plan, Plate 1. The locations of two additional borings drilled as part of our underground tank investigation are also shown on Plate 1. The borings were drilled on February 20, 1987 with truck-mounted, hollow-stem auger equipment under the direction of our field engineer, who logged the soils encountered and obtained undisturbed samples for visual examination and laboratory testing.

Samples were obtained using a Sprague and Henwood (S&H) split-barrel sampler driven with a 140-pound hammer falling 30 inches. The number of blows required to drive the S&H sampler was converted to equivalent standard penetration test (SPT) resistance values, which are presented on the Logs of Borings, Plates 2 through 4. The soil is described in accordance with the Unified Soil Classification System and the ASTM D2487-85 standard test method described on Plate 5.

We tested selected samples obtained from the borings in our laboratory to confirm their field classifications and determine engineering parameters. The results of moisture content/dry density and sieve analysis tests are presented on the Logs of Borings in the manner described on Plate 5. The results of the triaxial compression tests are presented on Plates 6 through 8.

III SITE AND SUBSURFACE CONDITIONS

The site slopes slightly from north to south; elevations vary between 31 and 33-1/2 feet.

The project's northern property line is bordered, from east to west, by: 1) an existing two-story brick building, which is not believed to contain a basement, 2) an existing three-story brick building with a basement, and 3) an approximately 15-foot-deep depressed area, which is believed to be the former basement of a building that was demolished. A two-story, wood-frame building with a basement is located approximately 10 feet east of the eastern property line.

It is not known whether buildings previously existed on the project site that were subsequently removed. The existing one-story, metal-frame gas station located on the southwest portion of the site will be demolished.

The site is blanketed by loose to medium dense silty sand fill, which contains occasional debris, including brick fragments. As measured in the borings, this sand fill varies from approximately 3 to 6 feet thick. The sand fill is underlain by an approximately 15- to 20-foot-thick layer of native, medium dense to dense clayey sand. This clayey sand is, in turn, underlain by an approximately 10-foot-thick layer of dense, fine-grained sand. Beneath the sand, a stiff to very stiff silty clay extends to the 40-foot depth investigated.

Ground water was encountered in Boring 1 and in Borings 4 and 5, which were drilled for our underground tank investigation; it was measured at approximately 26 feet below the surface, or an elevation of approximately +5 feet.* We believe that some fluctuations of the water level are likely, but that it will not rise above an elevation of approximately +8 feet.

* City of Oakland Datum

IV DISCUSSION AND CONCLUSIONS

The primary geotechnical engineering consideration affecting design and construction of the project is the proximity of the proposed structure to the adjacent buildings and sidewalks. Because of the existing basements along the northern property line, moderately deep foundations will be required to provide support for the portion of the proposed structure adjacent to existing footings and prevent the proposed structure from increasing loads on the adjacent existing basement walls and footings. Shallow spread footing foundations bearing on natural sand or recompacted fill are suitable for the remaining portion of the building.

We believe that drilled, end-bearing or friction piers will be suitable where moderately deep foundations are necessary. Spread footings can be used for the portion of the structure not adjacent to existing building footings, provided they are founded on the native clayey sands or on recompacted sand fill. The free-standing walls in the parking areas can be founded on spread footings. Temporary shoring may be needed to support footing excavations and to prevent undermining of existing sidewalks to the south and the adjacent short retaining wall to the east.

For foundations constructed in accordance with the following recommendations, we estimate that post-construction structural settlement will be less than 1/4 inch.

Based on conversations with the architect and the civil engineer, we understand that the machinery placed directly on concrete slab-on-grade floors within the proposed structure will not create excessive vibrations that could densify the supporting soils.

V RECOMMENDATIONS

A. Foundation Support

1. Drilled Piers

Drilled, cast-in-place concrete piers along the northern property line may gain support by either end-bearing or friction.

End-bearing piers should be at least 30 inches in diameter and at least 12 feet deep to achieve support in the native clayey sand below the adjacent building footings. End-bearing piers may be designed using an allowable bearing pressure at the base of the piers of 8,000 pounds per square foot (psf) for dead loads, 10,000 psf for dead plus sustained live loads, and 12,000 psf for total design loads, including wind or seismic forces.

Drilled piers designed to gain support by friction along the shaft should be at least 18 inches in diameter and at least 12 feet deep. They may be designed using an allowable friction value of 650 psf for dead plus sustained live loads. This allowable friction value may be increased by one-third for total design loads, including wind or seismic forces. No frictional resistance should be included for pier sections in the fill (above Elevation +22 feet) or below the water level (below Elevation +8 feet).

To resist seismic overturning forces, uplift resistance gained from skin friction of drilled piers can be used for design. Both types of piers may be designed for an allowable uplift friction value of 50 psf at the top of the pier (immediately beneath the floor slab), increasing by 50 psf per foot of depth to a limiting friction value of 650 psf.

The lateral resistance of drilled end-bearing or friction piers can be calculated using a passive equivalent fluid pressure of 300 pounds per cubic foot (pcf) over an area equal to twice the pier diameter but limited to a 10-foot depth. If the pier centerline is within three pier diameters of an existing basement or retaining wall, we should be consulted to analyze its individual lateral resistance. Piers should be placed no closer than three pier diameters center to center.

Drilled end-bearing pier excavations should be thoroughly cleaned of loose material prior to concrete placement.

2. Spread Footings

Spread footings may be used to support the proposed structure in areas more than 10 feet away from existing basements and for the free-standing walls in the parking area. Footings should be at least 18 inches wide and founded at least 18 inches below the lowest adjacent final grade. They should be founded on the native clayey sand at a depth of approximately 3 to 4 feet or on recompacted sand fill. The sand fill beneath the footings should be excavated to the underlying native clayey sand. The excavation should be backfilled with the on-site sand fill that is placed in 8-inch lifts, moisture-conditioned and recompacted to at least 95 percent relative compaction.*

---

* Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material as determined by the ASTM D1557-78 laboratory compaction procedure.

This recompacted fill must extend a lateral distance outward from the footing edges equal to the depth of fill beneath footings. This requirement may make recompaction infeasible adjacent to sidewalks or existing walls unless the obstructions are removed. In this case, footings should be founded on the native clayey sand. The spread footings should be designed using the allowable bearing pressures presented in Table 1.

Table 1

Loading Condition	Allowable Bearing Pressure (pounds per square foot): Footings on Recompacted Fill	Allowable Bearing Pressure (pounds per square foot): Footings on Native Clayey Sand
Dead Loads	2000	4000
Dead plus Sustained Live Loads	2500	5000
Total Design Loads, including Wind or Seismic Forces	3000	6000

The resistance of spread footings to lateral forces can be achieved by friction along the base of the footings and by passive soil pressure on the vertical footing faces. A base friction coefficient of 0.4 should be used to determine the available frictional resistance for spread footings. For passive resistance, we recommend using an equivalent fluid pressure of 300 psf against the footings. Excavations should be thoroughly cleaned of loose material prior to concrete placement.

B. Concrete Slab-on-Grade Floors

We recommend that at least 12 inches of fill beneath concrete slab-on-grade floors be excavated, moisture-conditioned, replaced, and recompacted to at least 95 percent relative compaction to provide a smooth, nonyielding surface. A 4-inch-thick layer of clean, free-draining gravel or 3/4-inch crushed rock should be placed over the recompacted fill surface as a capillary moisture break beneath the slab. To prevent the movement of moisture vapor through the slab, a vapor barrier such as plastic sheeting and 2 inches of clean sand (to act as a bedding for the placement of concrete) should be installed between the slab and the gravel/crushed rock.

C. Site Preparation and Backfill Placement for Buried Tank Excavation

The site should be stripped of all asphalt pavement and debris prior to subgrade preparation.

We understand that the excavations created by tank removal in the existing gas station area will require backfilling. On-site soil is suitable for use as backfill. Any imported material to be used for backfill should be sand or gravel free of organic material, debris, and rock fragments larger than 6 inches in diameter. It should have a liquid limit not greater than 40 and a plasticity index not greater than 15. Backfill should be placed in lifts not greater than 8 inches in loose thickness and should be compacted to at least 90 percent relative compaction. The upper 6 inches of all backfill should be compacted to at least 95 percent relative compaction. If "clean" sand backfill (sand with little or no fines) is used, all lifts should be compacted to at least 95 percent relative compaction.

D. Pavement Design

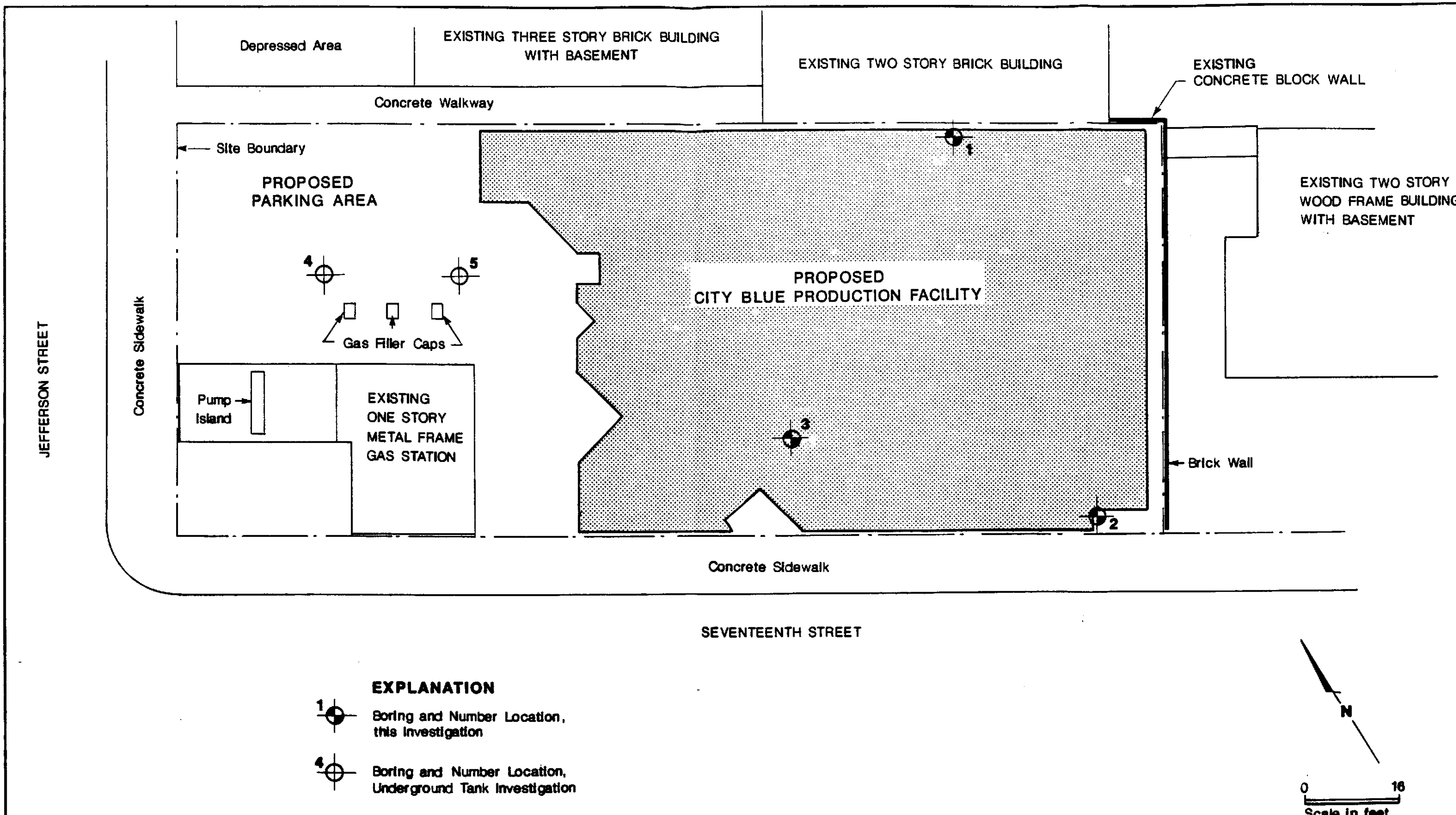
Prior to paving, the subgrade should be scarified to a depth of 8 inches, moisture-conditioned, and compacted to at least 95 percent relative compaction to provide a smooth, nonyielding surface. For design of the paved parking areas, we recommend a pavement section consisting of at least 2 inches of asphalt concrete over at least 8.5 inches of Class 2 aggregate base, for a total pavement section of at least 10.5 inches. This pavement design is based on a traffic index of 5.0. The pavement compo- nents should meet the requirements of Caltrans standard specifications and be compacted to at least 95 percent relative compaction.

VI GEOTECHNICAL SERVICES DURING CONSTRUCTION

Prior to construction, we should review those portions of the final plans and specifications that pertain to earthwork and foundations to check that they conform to the intent of our recommendations. During construction, our field engineer should check the following:

1. Backfill placement and compaction (including placement subsequent to tank removal)
2. On-site and imported fill to verify that they meet the project requirements
3. Drilled pier installation to verify that the required depth and cleanout are achieved
4. Spread footing, drilled pier, and grade beam excavations prior to concrete placement
5. Subgrade preparation for concrete slab-on-grade floors and asphalt concrete pavements.

In addition, it may be necessary for our field engineer to obtain bulk samples of on-site or imported fill soil to perform laboratory resistance value (R-value), sieve analysis, and/or Atterberg limits tests to determine that the on-site materials conform to our fill placement and pavement design recommendations. These services will allow us to check all geotechnical aspects of the work for conformance with the project plans and specifications.



REFERENCES: 1. "Preliminary Site Plan, City Blue Production Facility, 1700 Jefferson Street, Oakland, California," by Garcia/Wagner and Associates, dated Feb. 17, 1987.

2. Untitled Survey (partial print), Seventeenth Street and Jefferson Street, Surveyor unknown

HLA Harding Lawson Associates
Engineers, Geologists & Geophysicists

Site Plan (Soil Investigation)
City Blue Production Facility
Oakland, California

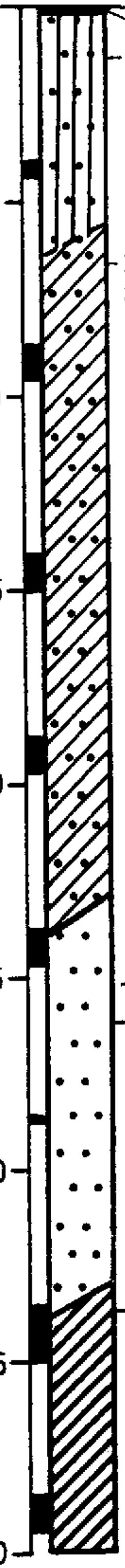
PLATE 1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
AG	18106,001.04	DL	2/87		

Equipment: Hollow Stem Auger

Elevation: 33.5 feet * Date: 2-20-87

Laboratory Tests	Blows/foot **	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Description
				0	2 inches asphalt pavement DARK BROWN SILTY SAND (SM), loose to medium dense, moist with some clay and debris/brick fragments (FILL)
	7			4	debris at 4 feet
				5–6	MOTTLED GRAY AND BROWN CLAYEY SAND (SC), medium dense to dense, moist, fine-grained, with some silt
	26	16	110	9	
	41			14	increased silt at 14 feet
	46	10	134	19	brown with decreased clay at 19 feet
TxUU 4390 (2500)	45	18	105	24	
				25	▽ water level measured on 2-20-87 MOTTLED BROWN AND GRAY SAND (SP), dense, moist, fine-grained, with some silt
	45			28	
	31	29	94	34	GRAY SILTY CLAY (CH) stiff to very stiff, saturated, trace sand
				38	increased sand at 38 feet
	13	27	95	39	No petroluem odors were detected in any samples.
				40	



* City of Oakland Datum

** Equivalent Standard Penetration Test (SPT) Resistance Values

Harding Lawson Associates
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& Geophysicists

Log of Boring 1

City Blue Production Facility
Oakland, California

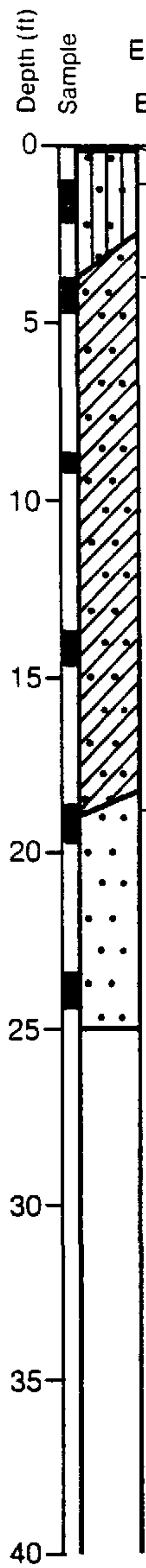
PLATE **2**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
Shields	18106,001.04	DL	2/87		

Equipment: Hollow Stem Auger

Elevation: 32.0 feet   Date: 2-20-87

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)
25% passing #200 sieve	22	10	111
	39		
TxUU 1370 (950)	33	14	108
17% passing #200 sieve	36	18	113
	33		
12% passing #200 sieve	35	14	96



2 inches asphalt pavement

BROWN SILTY SAND (SM) medium dense, moist — FILL

ORANGE-BROWN CLAYEY SAND (SC) dense, moist

decreased clay below 8½ feet

mottled gray-brown at 14 feet

GRAY SAND (SP), dense, moist, fine-grained, with silt

mottled brown-gray with increased silt below 23½ feet

No ground water was encountered during drilling

No petroluem odors were detected in any samples.

Harding Lawson Associates
Engineers, Geologists & Geophysicists

Log of Boring 2

City Blue Production Facility
Oakland, California

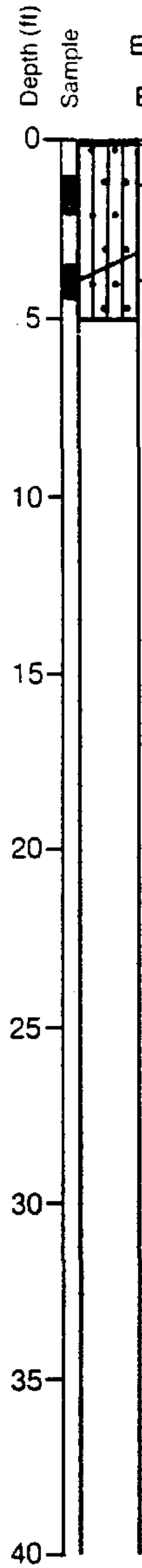
PLATE **3**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
Shields	18106,001.04	DL	2/87		

Equipment Hollow Stem Auger

Elevation 31.6 feet Date 2-20-87

Laboratory Tests	Blows/foot	Moisture Content (%)	Dry Density (pcf)
	23		
TxUU 1000 (350)	34	16	107



2 inches asphalt pavement

DARK BROWN SILTY SAND (SM)
medium dense, moist, with
some clay and debris

FILL

MOTTLED BROWN AND DARK GRAY
CLAYEY SAND (SC)
dense, moist

No ground water was encountered

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Log of Boring 3

City Blue Production Facility
Oakland, California

PLATE **4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
Shields	18106,001.04	DJ	2/87		

MAJOR DIVISIONS				TYPICAL NAMES
COARSE - GRAINED SOILS MORE THAN HALF IS LARGER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN No. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL-GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE - GRAINED SOILS MORE THAN HALF IS SMALLER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

UNIFIED SOIL CLASSIFICATION SYSTEM / ASTM

Perm	—	Permeability
Consol	—	Consolidation
LL	—	Liquid Limit (%)
PI	—	Plastic Index (%)
G_s	—	Specific Gravity
MA	—	Particle Size Analysis
■	—	"Undisturbed" Sample
⊠	—	Bulk or Classification Sample

Test	Shear Strength (psf)	Confining Pressure		
TxUU	3200	(2600)	—	Unconsolidated Undrained Triaxial Shear
(FM) or (S)				(field moisture or saturated)
TxCU	3200	(2600)	—	Consolidated Undrained Triaxial Shear
(P)				(with or without pore pressure measurement)
TxCD	3200	(2600)	—	Consolidated Drained Triaxial Shear
SSCU	3200	(2600)	—	Simple Shear Consolidated Undrained
(P)				(with or without pore pressure measurement)
SSCD	3200	(2600)	—	Simple Shear Consolidated Drained
DSCD	2700	(2000)	—	Consolidated Drained Direct Shear
UC	470		—	Unconfined Compression
LVS	700		—	Laboratory Vane Shear

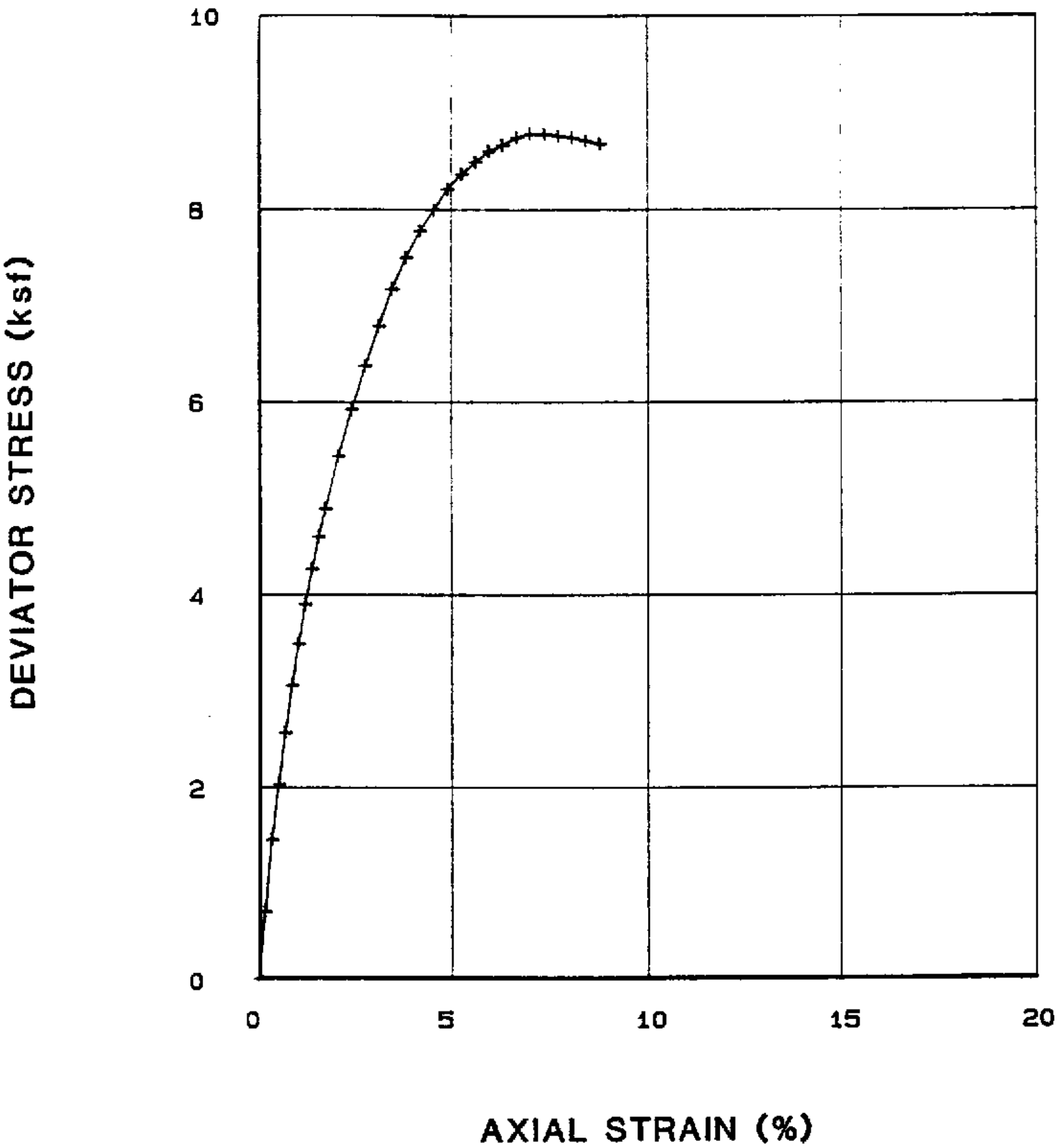
KEY TO TEST DATA

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Soil Classification Chart and Key to Test Data
City Blue Production Facility
Oakland, California

PLATE
5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
Shields	18106,001.04	DL	2/87		



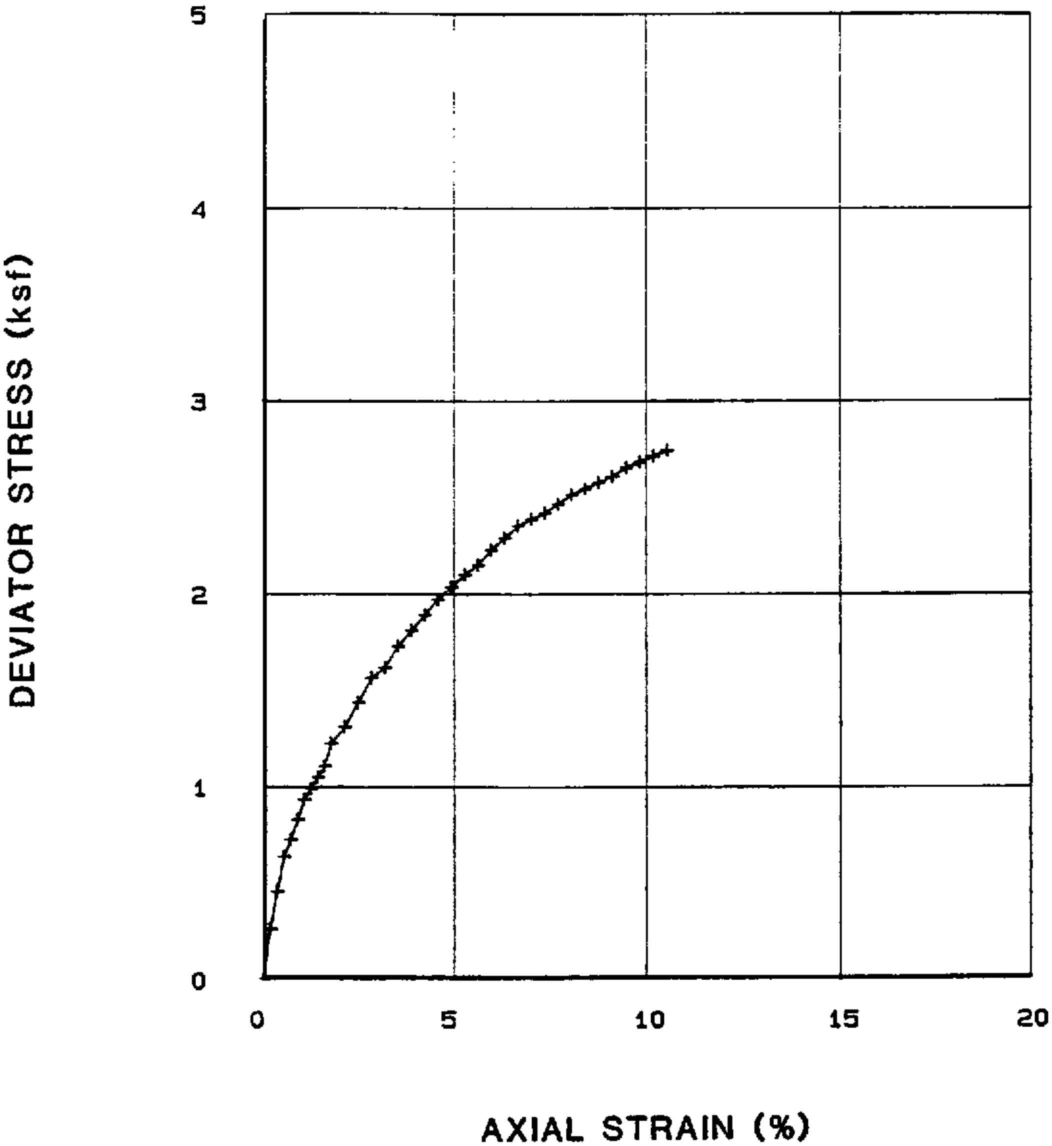
SPECIMEN TYPE UNDISTURBED		SHEAR STRENGTH	4390	psf
DIAMETER (in) 2.43	HEIGHT (in) 5.7	STRAIN AT FAILURE	7.02	%
MOISTURE CONTENT 18.5 %		CONFINING PRESSURE	2500	psf
DRY DENSITY 105 pcf		STRAIN RATE	.6	%/min
CLASSIFICATION SAND W/CLAY (SP-SC)		SOURCE 3 @ 23.8 ft		

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Unconsolidated-Undrained
Triaxial Compression Test Report
City Blue Production Facility
Oakland, California

PLATE
6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	18106.001.04	DCS	03/87		



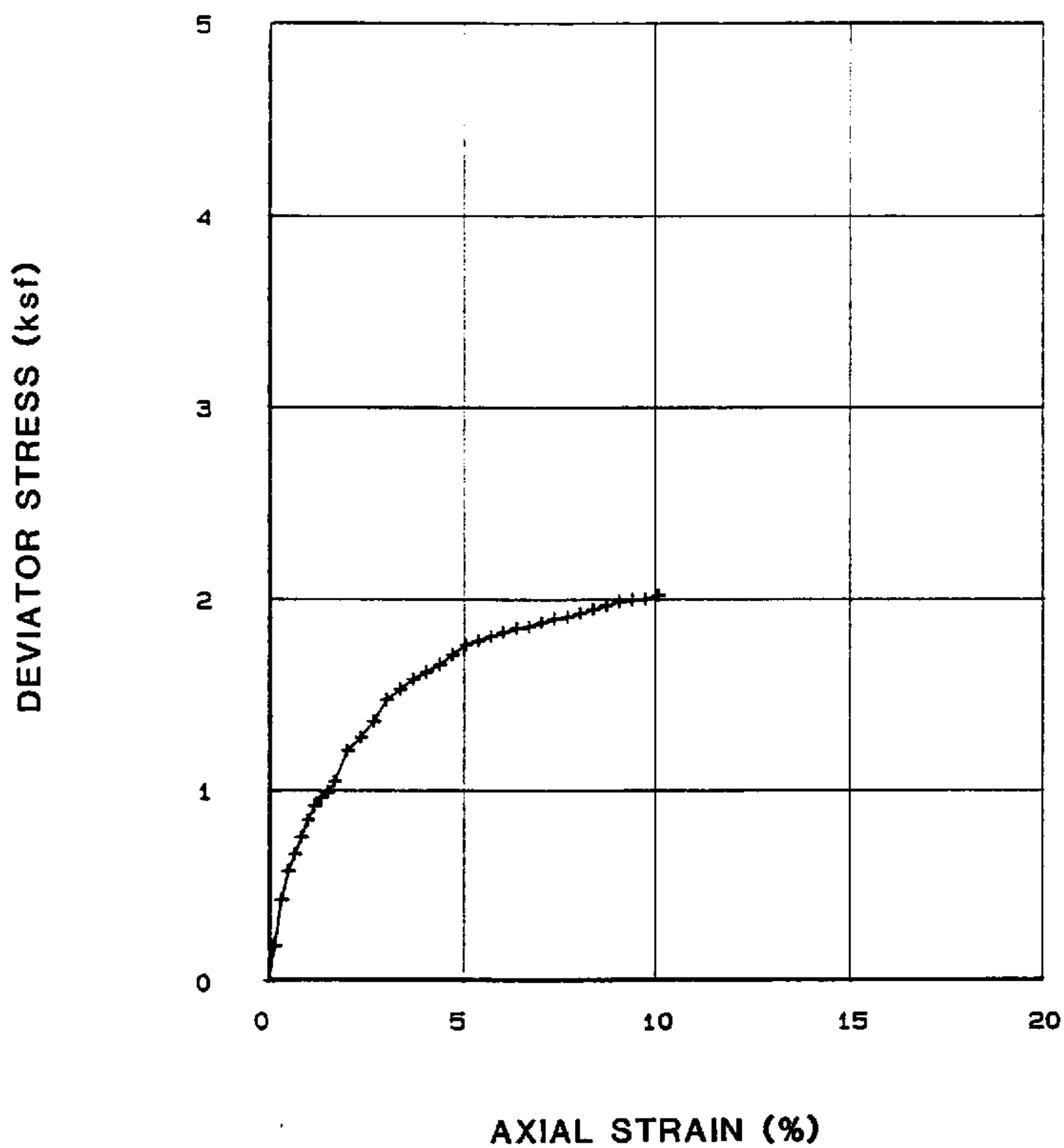
SPECIMEN TYPE	UNDISTURBED		SHEAR STRENGTH	1370	psf
DIAMETER (in) 2.43	HEIGHT (in) 5.7		STRAIN AT FAILURE	10.53	%
MOISTURE CONTENT	13.8	%	CONFINING PRESSURE	950	psf
DRY DENSITY	108	pcf	STRAIN RATE	.6	%/min
CLASSIFICATION	BRN CLAYEY SAND (SC)		SOURCE	4 @ 8.7 ft	

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Unconsolidated-Undrained
Triaxial Compression Test Report
City Blue Production Facility
Oakland, California

PLATE
7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	18106.001.04	DMS	03/87		



SPECIMEN TYPE	UNDISTURBED		SHEAR STRENGTH	1000	psf
DIAMETER (in) 2.43	HEIGHT (in) 5.95		STRAIN AT FAILURE	10.08	%
MOISTURE CONTENT	16.4	%	CONFINING PRESSURE	350	psf
DRY DENSITY	107	pcf	STRAIN RATE	.6	%/min
CLASSIFICATION	BROWN CLAYEY SAND (SC)		SOURCE	5 @ 3.5 ft	

HLA **Harding Lawson Associates**
Engineers, Geologists
& Geophysicists

Unconsolidated-Undrained Triaxial Compression Test Report
City Blue Production Facility
Oakland, California

PLATE **8**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	18106.001.04	DMS	03/87		

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1 copy:	DeBolt Civil Engineers 811 San Ramon Valley Boulevard Danville, California 94526 Attention: Mr. Jim Diggins

DAL/HTT/sjp/nlh

QUALITY CONTROL REVIEWER

G. Scott Crowther

G. Scott Crowther
Civil Engineer