

Woodward-Clyde Consultants

**GEOTECHNICAL ENGINEERING STUDY
UNIVERSITY OF CALIFORNIA
NORTHERN REGIONAL LIBRARY FACILITY, PHASE 2
RICHMOND FIELD STATION
Richmond, California**

Prepared for

University of California
Department of Facilities Management

June 3, 1988

Prepared by

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June 3, 1988

Project: 14676B

University of California
Department of Facilities Management
2000 Carleton Street
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Attention: Ms. Florence Baldwin
Senior Architect

Gentlemen:

GEOTECHNICAL ENGINEERING STUDY
UNIVERSITY OF CALIFORNIA
NORTHERN REGIONAL LIBRARY FACILITY, PHASE 2
RICHMOND FIELD STATION
Richmond, California

We are pleased to present herein the results of our geotechnical engineering study of the site for the proposed Phase 2 addition to the Northern Regional Library Facility at the Richmond Field Station in Richmond, California. Our recommendations for foundation support and our conclusions regarding the performance of the existing facility have been discussed in detail with Mr. Joe Ungerer with Rutherford and Chekene Consulting Engineers to enable them to complete the work within their time constraints.

Our findings indicate that the proposed Phase 2 addition is feasible provided the recommendations for foundation support and earthwork contained herein are followed. It appears feasible, based on our observations and analyses, to support the building on shallow spread foundations with a concrete slab-on-grade provided the grading recommendations are followed.

The field exploration work was performed by Ms. Katherine Fung, a Senior Staff Engineer with Woodward-Clyde Consultants. The engineering analysis work was done by Mr. Francis Chan, and the project management and review was performed by Mr. Jack McConnell and Mr. Ted Splitter.



We appreciate this opportunity to be of service to you, and we look forward to being of continued service as the Phase 2 addition design and construction proceed. If you have any questions concerning the contents of this report, please call.

Sincerely,

A handwritten signature in black ink, appearing to read "Francis Chan". The signature is fluid and cursive, with a large initial "F" and a long, sweeping underline.

Francis Chan
Assistant Project Engineer

A handwritten signature in black ink, appearing to read "Ted Splitter". The signature is cursive and somewhat stylized, with a large initial "T" and a long, sweeping underline.

Ted Splitter
Senior Project Engineer

FC/TS:eg
E230Ltr:ELG

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INTRODUCTION

This report presents the results of our study of the subsurface conditions at the site of the proposed Phase 2 addition to the Northern Regional Library Facility. The library facility is located at the University of California Richmond Field Station in Richmond, California. The existing Regional Library Facility site was previously studied by Woodward-Clyde Consultants (WCC) and several reports were prepared by our firm. These reports include the "Preliminary Geotechnical Exploration for the Proposed UC Regional Library Compact Shelving Facility", dated March 23, 1979, "Geotechnical Exploration, Northern Regional Library Compact Shelving Facility", dated April 23, 1980, and the "Supplemental Geotechnical Exploration, Northern Regional Library Compact Shelving Facility", dated December 16, 1980.

The purpose of this geotechnical study is to provide geotechnical engineering information and recommendations for your design team, sufficient for the design of the proposed Phase 2 addition. The scope of our work is presented in detail in our proposal for the project dated September 28, 1987, and the subsequent amendment dated October 27, 1987. Major items of the scope of work are summarized as follows:

1. Perform a site reconnaissance of the site and observe the condition of the existing facilities;
2. Perform a level survey of the existing facility floor slabs;

conditioned to 1 to 3 percent wet of optimum and compacted to a degree of compaction between 90 and 93 percent based on laboratory test method ASTM D 1557. One additional 6-inch compacted lift of the on-site material could then be placed on the recompact subgrade. This lift should also be compacted to between 90 and 93 percent compaction. Select fill should then be placed in lifts and compacted to provide a minimum of 3 feet of select fill, including the capillary break gravel and sand under slab. The select fill should be compacted to a minimum of 95 percent compaction. All fill material should be placed in uniform lifts not exceeding 8 inches in compacted thickness and be compacted with equipment approved by the Geotechnical Engineer.

All select fill materials should be approved by the Geotechnical Engineer. The fill material should be a soil or rock mixture which is free from organic matter or other deleterious materials. The fill material should not contain rock or lumps over 6 inches in greatest dimension, and not more than 15 percent larger than 2-1/2 inches. In addition, the select fill material should have a PI of less than 12, a maximum expansion pressure of 150 psf, based on Test Method 301-F of the Materials Manual, and a minimum R-value of 40.

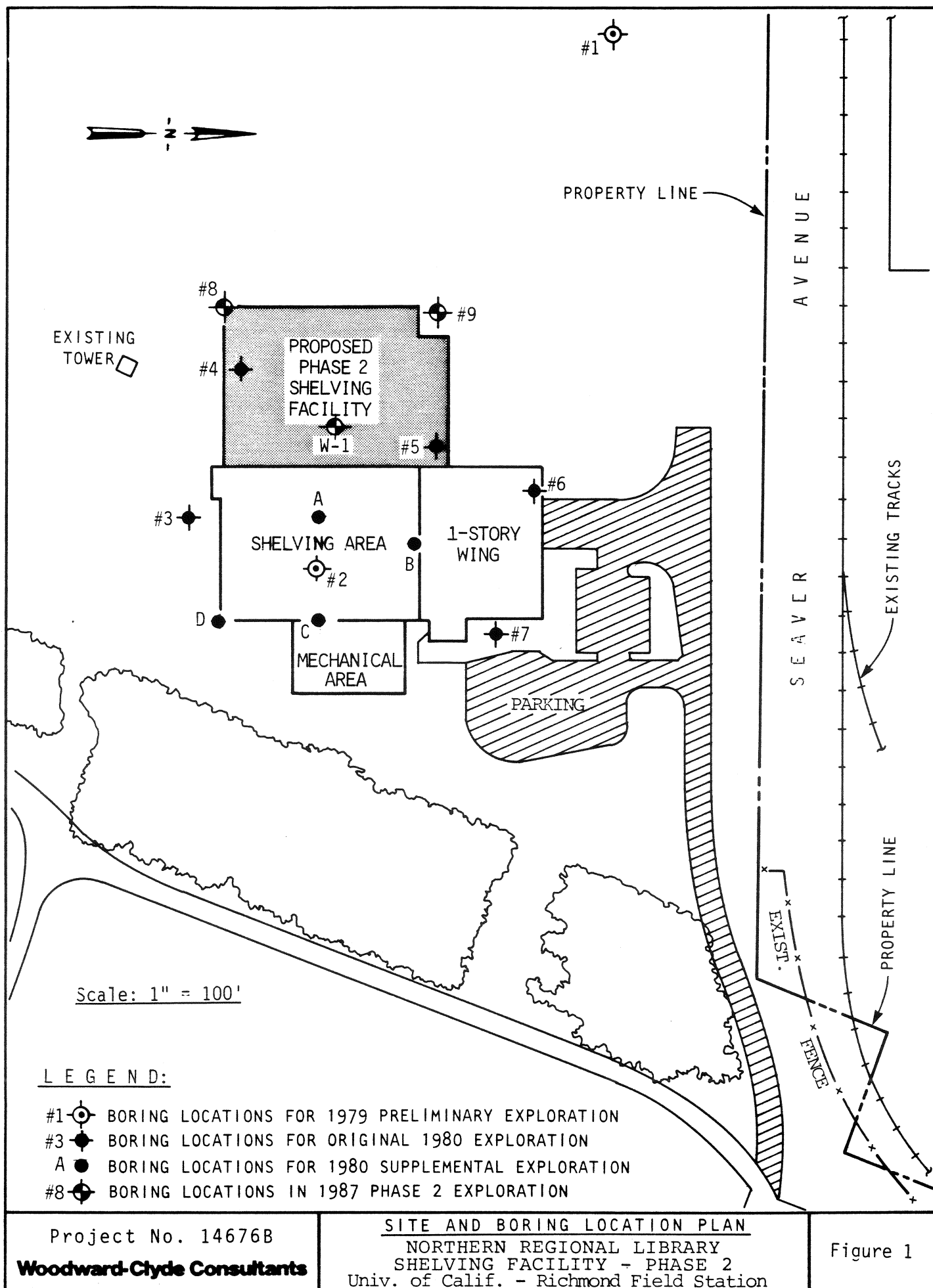
The gravel under the floor slabs should consist of clean rounded gravel conforming to the following gradations:

<u>Sieve Size</u>	<u>Percentage Passing</u>
1"	100
3/4"	90-100
No. 4	0-10

LIMITATIONS

The recommendations made in this report are based on the assumption that the soil, bedrock, and groundwater conditions do not deviate appreciably from those disclosed in the test borings. If any variations or

FIGURES



Project: NORTHERN REGIONAL LIBRARY SHELVING FACILITY - PHASE 2			BORING LEGEND SHEET		
Date Drilled: _____			Remarks: _____		
Type of Boring: _____			_____		
Hammer Weight: _____			_____		

Depth, Ft.	Samples	Blows / Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS		
				Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
Surface Elevation: _____						
<div style="margin-top: 100px;">5</div> <div style="margin-top: 100px;">10</div> <div style="margin-top: 100px;">15</div> <div style="margin-top: 100px;">20</div> <div style="margin-top: 100px;">25</div>	<div style="margin-top: 100px;">5</div> <div style="margin-top: 100px;">10</div> <div style="margin-top: 100px;">15</div> <div style="margin-top: 100px;">20</div> <div style="margin-top: 100px;">25</div>	<div style="margin-top: 100px;">5</div> <div style="margin-top: 100px;">10</div> <div style="margin-top: 100px;">15</div> <div style="margin-top: 100px;">20</div> <div style="margin-top: 100px;">25</div>	<div style="margin-top: 100px;">←</div> <div style="margin-top: 100px;">←</div> <div style="margin-top: 100px;">←</div> <div style="margin-top: 100px;">←</div> <div style="margin-top: 100px;">←</div>			
			2-1/2-INCH O.D. MODIFIED CALIFORNIA SAMPLER (SPLIT BARREL)			
			2-INCH O.D. STANDARD SPLIT-SPOON SAMPLER			
			3-INCH O.D. DOUBLE-BARREL PITCHER CORING SAMPLER			
			BLOW COUNT WITH A 140-LB. HAMMER FALLING 30 INCHES			
			BLOW COUNT WITH A 320-LB. DOWNHOLE "SLIP-JAR" HAMMER FALLING 18 INCHES THROUGH DRILLING FLUID			

Project No. 14676B	Woodward-Clyde Consultants	Figure 2
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Project: NORTHERN REGIONAL LIBRARY SHELVING FACILITY - PHASE 2			<h1 style="margin: 0;">Log of Boring No. 8</h1>		
Date Drilled: February 22-23, 1988			Remarks:		
Type of Boring: 4-7/8"Ø Rotary Wash					
Hammer Weight: 140 lbs.			(See Legend Sheet for sampler types and hammer weights)		



Depth, Ft.	Samples	Blows / Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS		
				Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
Surface Elevation:						
1	1	6	SILTY CLAY (CL-CH) Soft to medium stiff, wet, dark gray brown, with organic matter and roots	26	96	1430
5	2	60	SILTY CLAY (CL-CH) Medium stiff to stiff, wet, gray-brown, with some sand	15	118	19,450
			SANDY CLAY (CL-CH): Hard, gray-brown, with sand, cemented			
10	3	31	GRAVELLY CLAY (CL) Very stiff, damp, light brown, with some sand	-	-	-
15	4	26	SILTY CLAY (CL) Very stiff, light brown, with some sand	21	108	5770
20	5	24	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> </div> <div> More silty and sandy </div> </div>	19	111	4410
			SILTY SAND (SM) Medium dense, brown, with gravel			
25	6	-	SILTY CLAY (CL) Stiff, brown, with some sand	26	97	2160

Project No. 14676B	Woodward-Clyde Consultants	Figure 3a
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Project:

NORTHERN REGIONAL LIBRARY
SHELVING FACILITY - PHASE 2


Log of Boring No. 8

Depth, Ft.	Samples	Blows / Ft.	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
30			SILTY CLAY (CL)Cont'd.			
	7	21	 Very silty, some rust staining	29	94	2240
35			GRAVELLY SAND (SW) Medium dense, brown			
			CLAYEY SAND (SC-CL): Medium dense, black, organic			
40	8	-	SILTY CLAY (CL-CH) Stiff, blue-gray With calcareous nodules	21	108	2640
45						
	9	55		-	-	-
50			SILTY CLAY (CL-CH) Very stiff, green-gray, with sand lenses			
55	10	-		21	106	4900
60	11	38	 With calcareous inclusions, rust-brown staining	24	102	5510
Project No. 14676B			Woodward-Clyde Consultants	Figure 3 b		

Project:

NORTHERN REGIONAL LIBRARY
SHELVING FACILITY - PHASE 2

Log of Boring No. 8

Depth, Ft.	Samples	Blows / Ft.	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
65	12	23	SILTY SAND (SM) Dense	-	-	-
70			SILTY CLAY (CL) Hard, blue-gray, with calcareous inclusions			
75			SANDY CLAY Very stiff, blue-gray, with gravel			
80	13	-	SILTY CLAY (CL) Very stiff to stiff, brown, with lenses of clayey silt <div>  Hard, with rust-brown staining </div>	31	92	1220
95						
Project No. 14676B			Woodward-Clyde Consultants	Figure 3c		

Project:

NORTHERN REGIONAL LIBRARY
SHELVING FACILITY - PHASE 2

Log of Boring No. 8

Depth, Ft.	Samples	Blows / Ft.	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
14	14	97*	SILTY CLAY (CL)Cont'd.	21	106	8170
100			CLAYEY SAND (SC) Dense to very dense, brown			
105			SILTY CLAY (CL) Hard, light brown, with gravel			
110	15	100/6"	SANDSTONE Highly weathered, friable, light brown to brown	-	-	-
115			BOTTOM OF BORING @ 110'-6"			
120						
125						
Project No. 14676B			Woodward-Clyde Consultants	Figure 3d		

Project: NORTHERN REGIONAL LIBRARY SHELVING FACILITY - PHASE 2			Log of Boring No. 9		
Date Drilled: February 23, 1988			Remarks: _____		
Type of Boring: 4-7/8"Ø Rotary Wash			_____		
Hammer Weight: 320 lbs.			(See Legend Sheet for sampler types and hammer weights)		

Depth, Ft.	Samples	Blows / Ft.	MATERIAL DESCRIPTION	LABORATORY TESTS		
				Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
Surface Elevation: _____						
5	1	33*	SILTY CLAY (CL-CH) Medium stiff, moist, dark brown, with some organic matter and roots	18	113	10820
	SILTY CLAY (CH): Hard, damp to dry, gray-brown, with calcareous inclusions, trace of sand, slightly cemented					
10	2	28*	SILTY CLAY (CL) Very stiff, moist, light brown, with some gravel and clayey silt lenses	20	108	7350
	SILTY CLAY (CL-CH) Stiff to very stiff, gray-brown with black staining					
15	3	35*	<div style="display: flex; align-items: center; justify-content: center;"> <div style="font-size: 2em; margin-right: 10px;">}</div> Sandy </div>	24	102	7170
	4	30*		23	103	3880
20	5	37*		22	105	7550
25						

Project No. 14676B	Woodward-Clyde Consultants	Figure 4 a
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Project:

NORTHERN REGIONAL LIBRARY
SHELVING FACILITY - PHASE 2

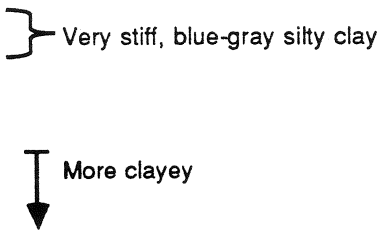
Log of Boring No. 9

Depth, Ft.	Samples	Blows / Ft.	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
30			SILTY CLAY (CL-CH).....Cont'd.			
35	6	-	GRAVELLY CLAY (CL-GC) Stiff, brown, clayey, with some sand	-	-	-
			SILTY CLAY (CL) Stiff, blue-gray			
40	7	34*	SILTY CLAY (CL) Very stiff, green-gray, with caliche	24	102	4570
			SANDY CLAY (CL) Stiff, brown, silty			
45			SILTY CLAY (CL-CH) Stiff, brown			
50	8	-	CLAYEY SAND (SC) Dense, brown, with gravel	19	112	3420
			SILTY CLAY (CL) Stiff, light brown, sandy			
55			CLAYEY SAND (SC-SW) Very dense, brown-gray, silty, with gravel			
60	9	40/6"		12	124	-
Project No. 14676B			Woodward-Clyde Consultants	Figure 4 b		

Project:

NORTHERN REGIONAL LIBRARY
SHELVING FACILITY - PHASE 2

Log of Boring No. 9

Depth, Ft.	Samples	Blows / Ft.	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf
65						
70	10	21		-	-	-
			SILTY CLAY (CL) Stiff, brown			
75			CLAYEY SILT (ML) Medium dense, brown			
			SAND : Dense, brown			
80	11	63*	SILTY CLAY (CL) Very stiff, mottled gray-brown and rust brown	22	105	5510
85			SAND (SP-SM) Dense, brown, clayey			
90	12	50/5**		-	-	-
			BOTTOM OF BORING @ 91'			
95						
Project No. 14676B			Woodward-Clyde Consultants	Figure 4c		

Project: NORTHERN REGIONAL LIBRARY SHELVING FACILITY - PHASE 2			<h2 style="margin: 0;">Log of Boring No. W-1</h2>		
Date Drilled: February 23, 1988			Remarks: _____		
Type of Boring: 4-7/8" ø Rotary Wash			_____		
Hammer: 140 lbs.			(See Legend Sheet for sampler types and hammer weights)		

Depth Ft.	Samples	Blows/Ft	MATERIAL DESCRIPTION	LABORATORY TESTS		
				Moisture Content, %	Dry Density pcf	Unconfined Compress. Strength, psf
Surface Elevation: _____						
5			CLAYEY GRAVEL (GC) FILL Medium dense, damp, dark brown to brown, with gravel up to 1 inch, with concrete rubble			
			SILTY CLAY (CL) Medium stiff, damp to wet, dark brown, with roots			
			SILTY CLAY (CL) Medium stiff to stiff, moist, gray-brown			
			SILTY CLAY (CL) Stiff to very stiff, moist, light gray-brown, with calcareous concretions and white streaks			
			SILTY CLAY (CL) Stiff to very stiff, moist, tan-brown, sandy			
10						
15			4/1/88 6/8/88			
20						
			SANDY CLAY (CL) Stiff to very stiff, moist, tan-brown, with fine- grained sand and occasional fine gravel			
25						
			BOTTOM OF BORING @ 26' Bottom of water level observation well at 25'.			

Project No. 14676B	Woodward-Clyde Consultants	Figure 5
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