PRELIMINARY FOUNDATION AND SITE RECOMMENDATIONS

WHITE OAK TECHNOLOGY PARK
HENRICO COUNTY, VIRGINIA

Froehling & Robertson, Inc.

Since 1881

PRELIMINARY FOUNDATION AND SITE RECOMMENDATIONS

WHITE OAK TECHNOLOGY PARK
HENRICO COUNTY, VIRGINIA

Made for

HENRICO COUNTY ECONOMIC DEVELOPMENT AUTHORITY

RICHMOND, VIRGINIA

Made by

FROEHLING & ROBERTSON, INC.

RICHMOND, VIRGINIA

F&R No. C60-0197G

June 2001

SINCE
1881
FROEHLING & ROBERTSON, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"
Richmond Branch Office
3015 Dumbarton Road, Richmond, Virginia 23228
(804) 264-2701 Fax (804) 264-7862

CONFIDENTIAL

June 7, 2001

Henrico County Economic Development Authority
8011 Villa Park Drive, Suite 160, B Building
Richmond, Virginia 23228

Attention: Mr. B. Anthony Hall

Reference: Preliminary Foundation and Site Recommendations
White Oak Technology Park
Henrico County, Virginia
F&R Project No. C60-0197G

Dear Mr. Hall:

Froehling & Robertson, Inc. has completed the preliminary borings for the proposed future phase of White Oak Technology Park in Henrico County. This letter will provide general site and soils information, along with preliminary foundation recommendations for proposed future construction.

The site is located on approximately 700 acres bounded by Technology Boulevard, Elko Tract Road and Elko Road in White Oak Technology Park. The site is near the existing Infineon and Hewlett Packard plants. The majority of the site is fairly heavily wooded with approximately 20 to 25 feet of relief across the property.

A total of six borings were performed throughout the property. Five of the six borings were located on the northwestern portion of the property (near the intersection of Elko Tract and Elko Roads), and the remaining boring was located on the eastern portion of the property. The borings were drilled to depths of 15 feet each; however, boring B-3 was extended to 20 feet due to soft soil conditions at 15 feet. The borings mainly encountered fine to medium sandy clays transitioning to fine to medium sands in the majority of the borings. The sandy clays were classified as CH soils (highly plastic clays) of varying depths at four of the six boring locations. Auger refusal was not encountered in the borings, and groundwater was only encountered in borings B-3 and B-6 at depths of 9 and 14 feet below the ground surface. Boring B-3 was performed near an existing lowlying wet area, which may explain the higher groundwater level and softer soil conditions from 15 to 20 feet.

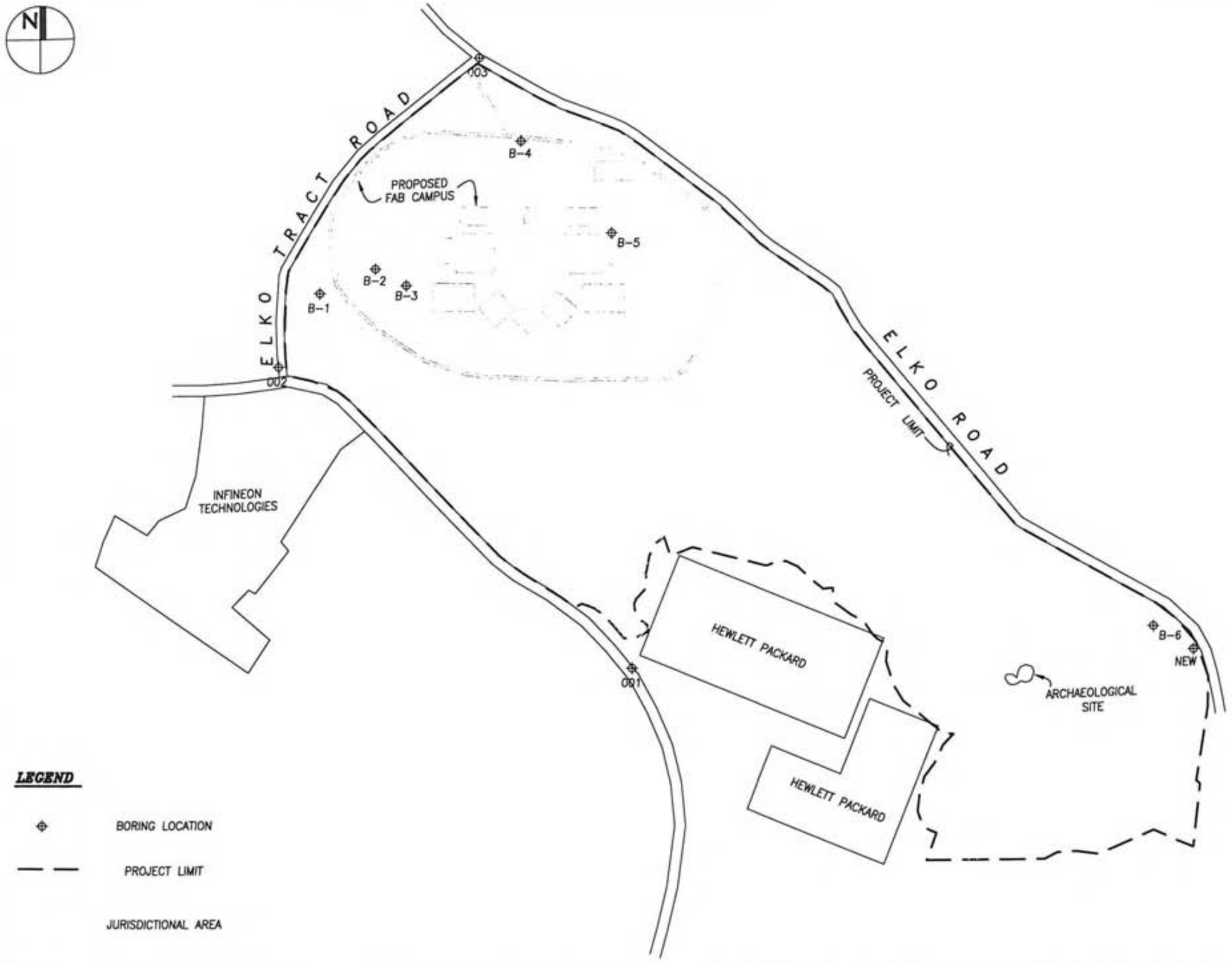
Based upon the soil conditions encountered in the borings, and our preliminary visual classification of the samples, it appears that future construction on this parcel similar to the Infineon and Hewlett Packard buildings could be supported on conventional spread column footing and slab-on-grade foundation systems with a minimum design bearing pressure of 2500 to 3000 pounds per square foot. A higher design bearing pressure (3000 to 4000 psf) may be available in certain areas of the site. Soft soil conditions were encountered in boring B-3 below a depth of 10 feet; however, this appears to be an isolated condition due to the adjacent lowlying wet area and the higher groundwater level encountered in that boring. Due to the shrink/swell potential of the CH soils in the majority of the borings, there may be a possibility that the shallow foundations may need to be installed at a bearing depth of 2.5 to 3 feet. It does not appear that groundwater would affect the grading operations unless cut depths exceed 10 to 15 feet. The low plastic clays and clayey sands encountered in the borings should be suitable for reuse as structural fill, provided that the moisture contents are kept within acceptable ranges. The highly plastic clays (CH) encountered in some of the borings would not be suitable for use as structural fill; however, these soils could be used as fill in grass areas or other non-structural areas. Depending on the time of year that grading is performed, some undercut and/or stabilization of the subgrade soils may be required, especially near the lowlying wet areas of the site.

These preliminary recommendations are based upon our visual classification of the samples, and may not be reflective of conditions between our boring locations or in unexplored areas of the site. When the actual location of any future buildings are finalized, additional borings at specific locations within the buildings will be required. These borings have been performed for preliminary information only, and the recommendations in this report should not be used for design purposes.

We appreciate the opportunity to work with you on this project. If there are any questions, or if you need additional information, please do not hesitate to contact us.

Respectfully Submitted,
FROEHLING & ROBERSTON, INC.

Ross R. Deaver, P.E.
Branch Manager



BORING LOCATION PLAN

WHITE OAK TECHNOLOGY PARK
ELKO ROAD
HENRICO COUNTY, VIRGINIA

DRAWN: SJH	SCALE: 1"=1000'	PROJ. # C60-1970	
CHKD: KA	DATE: 6/01	DWG. 1	

SINCE 1881

Froehling and Robertson, Inc.

BORING LOG

SINCE F&R 1851

FROEHLING & ROBERTSON, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No.: **C60-0197G**

Date: **May 2001**

Client: **Henrico County Economic Development Authority**

Project: **White Oak Business Park, Henrico County, Virginia**

Boring No.: **B-1** (1 of 1) | Total Depth **15.0'** | Elev: | Location: **See Drawing No. 2**

Type of Boring: **Hollow Stem Auger** | Started: **5/25/01** | Completed: **5/25/01** | Driller: **England**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (feet)	N Value (blows/ft)	REMARKS
	0.4	Driller Reported "Surficial Organic Soil"	1-2-2	0.0	4	Groundwater was not encountered during drilling or observed upon removal of auger
	1.5	Soft, Brown Fine Sandy CLAY, Trace Organics - Moist (CL)	5-10-9	1.5	19	
		Very Stiff, Brown/Reddish Brown CLAY - Moist (CH)	5-10-12	3.0 3.5 5.0	22	Cave-in depth at 13.0'
	6.0	Medium Dense, Brown/Reddish Brown/Light Gray Clayey Fine to Medium SAND - Moist (SC)	5-9-13	6.0 7.5	22	
	8.0	Very Stiff, Reddish Brown/Brown Fine Sandy CLAY - Moist (CL)	7-9-12	8.5 10.0	21	
			5-10-7	13.5	17	
	15.0	Boring Terminated at 15.0'		15.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N.

BORING LOG C60-0197G.GPJ F&R.GDT 5/31/01

BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No.: **C60-0197G**

Date: **May 2001**

Client: **Henrico County Economic Development Authority**

Project: **White Oak Business Park, Henrico County, Virginia**

Boring No.: **B-2** (1 of 1) | Total Depth **15.0'** | Elev: | Location: **See Drawing No. 2**

Type of Boring: **Hollow Stem Auger** | Started: **5/25/01** | Completed: **5/25/01** | Driller: **England**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (feet)	N Value (blows/ft)	REMARKS
	0.5	Driller Reported "Surficial Organic Soil"	1-2-3	0.0	5	
	1.5	Firm, Brown Fine Sandy CLAY - Moist (CL)	5-8-14	1.5	22	Groundwater was not encountered during drilling or observed upon removal of auger
		Very Stiff, Brown/Reddish Brown CLAY - Moist (CH)		3.0		
			5-8-11	3.5	19	Cave-in depth at 13.0'
				5.0		
			5-11-15	6.0	26	
				7.5		
			9-12-16	8.5	28	
				10.0		
	13.0	Medium Dense, Reddish Brown Clayey Fine to Medium SAND - Moist (SC)	4-5-5	13.5	10	
	15.0	Boring Terminated at 15.0'		15.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N.

BORING LOG C60-0197.GPJ F&R.GDT 5/31/01

BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No.: **C60-0197G**

Date: **May 2001**

Client: **Henrico County Economic Development Authority**

Project: **White Oak Business Park. Henrico County, Virginia**

Boring No.: **B-3** (1 of 1) | Total Depth **20.0'** | Elev: | Location: **See Drawing No. 2**

Type of Boring: **Hollow Stem Auger** | Started: **5/25/01** | Completed: **5/25/01** | Driller: **England**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (feet)	N Value (blows/ft)	REMARKS
	0.5	Driller Reported "Surficial Organic Soil"	1-1-1	0.0	2	
		Very Loose to Medium Dense, Grayish Brown Clayey Fine SAND - Moist (SC)	3-5-6	1.5	11	Groundwater was encountered at 13.0' during drilling
				3.0		
			3-5-9	3.5	14	Groundwater was observed at 9.0' upon removal of auger
				5.0		
			4-4-4	6.0	8	Cave-in depth at 10.5'
	8.0			7.5		
		Stiff, Light Brown/Reddish Brown/Light Gray Fine Sandy CLAY - Moist (CL)	4-5-6	8.5	11	
				10.0		
	13.0	Very Loose, Brown Silty Fine to Medium SAND - Wet (SM)	2-1-2	13.5	3	
				15.0		
			2-2-1	18.5	3	
	20.0			20.0		
		Boring Terminated at 20.0'				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N.

BORING LOG C60-0197.GPJ F&R.GDT 5/31/01

BORING LOG

SINCE 1881
FROEHLING & ROBERTSON, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No.: C60-0197G

Date: May 2001

Client: Henrico County Economic Development Authority

Project: White Oak Business Park, Henrico County, Virginia

Boring No.: B-4 (1 of 1) | Total Depth 15.0' | Elev: | Location: See Drawing No. 2

Type of Boring: Hollow Stem Auger | Started: 5/25/01 | Completed: 5/25/01 | Driller: England

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (feet)	N Value (blows/ft)	REMARKS
	0.4	Driller Reported "Surficial Organic Soil"	1-3-3	0.0	6	Groundwater was not encountered during drilling or observed upon removal of auger Cave-in depth at 13.0'
	1.5	Firm, Light Brown Fine Sandy CLAY - Moist (CL)	5-10-12	1.5	22	
		Very Stiff, Brown/Reddish Brown CLAY - Moist (CH)		3.0		
			6-12-16	3.5	28	
				5.0		
	6.0	Very Stiff, Brown/Reddish Brown/Light Gray Fine Sandy CLAY - Moist (CL)	7-10-12	6.0	22	
				7.5		
			7-12-16	8.5	28	
				10.0		
	13.0	Medium Dense, Reddish Brown Clayey Fine to Medium SAND - Moist (SC)	5-7-8	13.5	15	
	15.0	Boring Terminated at 15.0'		15.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N.

BORING LOG C60-0197.GPJ F&R.GDT 5/31/01

BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No.: **C60-0197G**

Date: **May 2001**

Client: **Henrico County Economic Development Authority**

Project: **White Oak Business Park, Henrico County, Virginia**

Boring No.: **B-5** (1 of 1) | Total Depth **15.0'** | Elev: | Location: **See Drawing No. 2**

Type of Boring: **Hollow Stem Auger** | Started: **5/25/01** | Completed: **5/25/01** | Driller: **England**

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (feet)	N Value (blows/ft)	REMARKS
	0.4	Driller Reported "Surficial Organic Soil"	3-6-9	0.0	15	Groundwater was not encountered during drilling or observed upon removal of auger Cave-in depth at 15.0'
	1.5	Stiff, Brown/Reddish Brown Fine Sandy CLAY - Moist (CL)	9-16-20	1.5	36	
		Hard to Stiff, Reddish Brown/Brown/Light Gray CLAY - Moist (CH)	6-10-14	3.0 3.5	24	
				5.0		
			5-7-8	6.0	15	
				7.5		
			7-10-11	8.5	21	
				10.0		
	13.5	Very Stiff, Brown/Light Gray Fine to Medium Sandy CLAY - Moist (CL)	6-8-11	13.5	19	
	15.0	Boring Terminated at 15.0'		15.0		

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N.

BORING LOG C60-0197.GPJ F&R.GDT 5/31/01

BORING LOG

FROEHLING & ROBERTSON, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No.: C60-0197G

Date: May 2001

Client: Henrico County Economic Development Authority

Project: White Oak Business Park, Henrico County, Virginia

Boring No.: B-6 (1 of 1) | Total Depth: 15.0' | Elev: | Location: See Drawing No. 2

Type of Boring: Hollow Stem Auger | Started: 6/4/01 | Completed: 6/4/01 | Driller: Shumaker

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	* Sample Blows	Sample Depth (feet)	N Value (blows/ft)	REMARKS
	0.4	Driller Reported "Surficial Organic Soil"	1-2-2	0.0	4	
		Soft, Gray Fine Sandy SILT - Moist		1.5		Groundwater was encountered at 14.0' during drilling
	2.0	(ML)	3-4-6		10	
		Stiff, Tan to Gray Fine Silty CLAY, Some Sand - Moist		3.0		
	3.0	(CL)	9-12-16	3.5	28	Groundwater was not observed upon removal of auger
		Medium Dense, Tan to Gray Fine to Medium Clayey SAND - Moist		5.0		
	6.0	(SC)	6-10-13	6.0	23	Cave-in depth at 8.5'
		Medium Dense, Tan to Gray Fine to Medium SAND, Trace Clay - Moist		7.5		
		(SC)	6-8-9	8.5	17	
				10.0		
	14.0		6-6-8	13.5	14	
	15.0	Medium Dense, Tan Fine to Medium SAND, Trace Clay - Wet		15.0		
		(SC)				
		Boring Terminated at 15.0'				

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N.

BORING LOG C60-0197.GPJ F&R.GDT 6/7/01