

LOG OF BORING NO. 2

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CLIENT HAWKINS CONSTRUCTION COMPANY		ARCHITECT/ENGINEER								
SITE WAHOO, NEBRASKA		PROJECT WAHOO SOUTH BRIDGE								
GRAPHIC LOG	Boring Location: STA 355+00.0	DESCRIPTION					SAMPLES	TESTS		
	Approx. Surface Elev.: 1181.0 ft	DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
	LEAN CLAY, TRACE SAND Brown Soft				HS					
10		CL	1	SS	18	3	33.6			
					HS					
		CL	2	SS	18	2	37.1		<500*	
	LEAN CLAY, TRACE SAND Dark Brown Soft to Medium				HS					
		CL	3	SS	12	2	30.6		500*	
					HS					
		CL	4	SS	18	2	39.1			
					HS					
		CL	5	SS	18	2	36.2			
					WB					
28	FINE TO MEDIUM SAND Gray Loose	SP	6	SS	12	3	17.8			
					WB					
Continued Next Page										
The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.										*Calibrated Hand Penetrometer **CME Automatic Hammer
WATER LEVEL OBSERVATIONS, ft				BORING STARTED 6-21-01						
WL	▽ 18	WD	▽	BORING COMPLETED 6-21-01						
WL	▽	WD	▽	RIG	CME 55	FOREMAN	PG			
WL				APPROVED	RLM	JOB #	05015121			

LOG OF BORING NO. 2

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CLIENT HAWKINS CONSTRUCTION COMPANY		ARCHITECT/ENGINEER							
SITE WAHOO, NEBRASKA		PROJECT WAHOO SOUTH BRIDGE							
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
35	Medium Dense at 33.5 to 35' 35	1146	SP	7	SS	12	19	15.6	
	FINE TO MEDIUM SAND, TRACE GRAVEL Brown Medium Dense		WB						
	Dense at 38.5 to 40'		SP	8	SS	12	38	11.9	
			WB						
			SP	9	SS	12	12	12.6	
			WB						
	Clay Seam at 48.5 to 50'		SP	10	SS	18	13	20.8	
			CL						
	Gravelly Below 51'		WB						
56		1125	SP	11	SS	12	16	10.1	
	FINE TO MEDIUM SAND, TRACE GRAVEL Orangish Brown Medium Dense With Clay Seam at 59'		WB						
			SP	12	SS	12	20	20.3	
			WB						
			SP	13	SS	18	21	22.9	
			WB						
Continued Next Page									
The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.									
*Calibrated Hand Penetrometer **CME Automatic Hammer									
WATER LEVEL OBSERVATIONS, ft				BORING STARTED 6-21-01					
WL	± 18	WD	▼	BORING COMPLETED 6-21-01					
WL	▼	▼		RIG	CME 55	FOREMAN	PG		
WL				APPROVED	RLM	JOB #	05015121		

LOG OF BORING NO. 2

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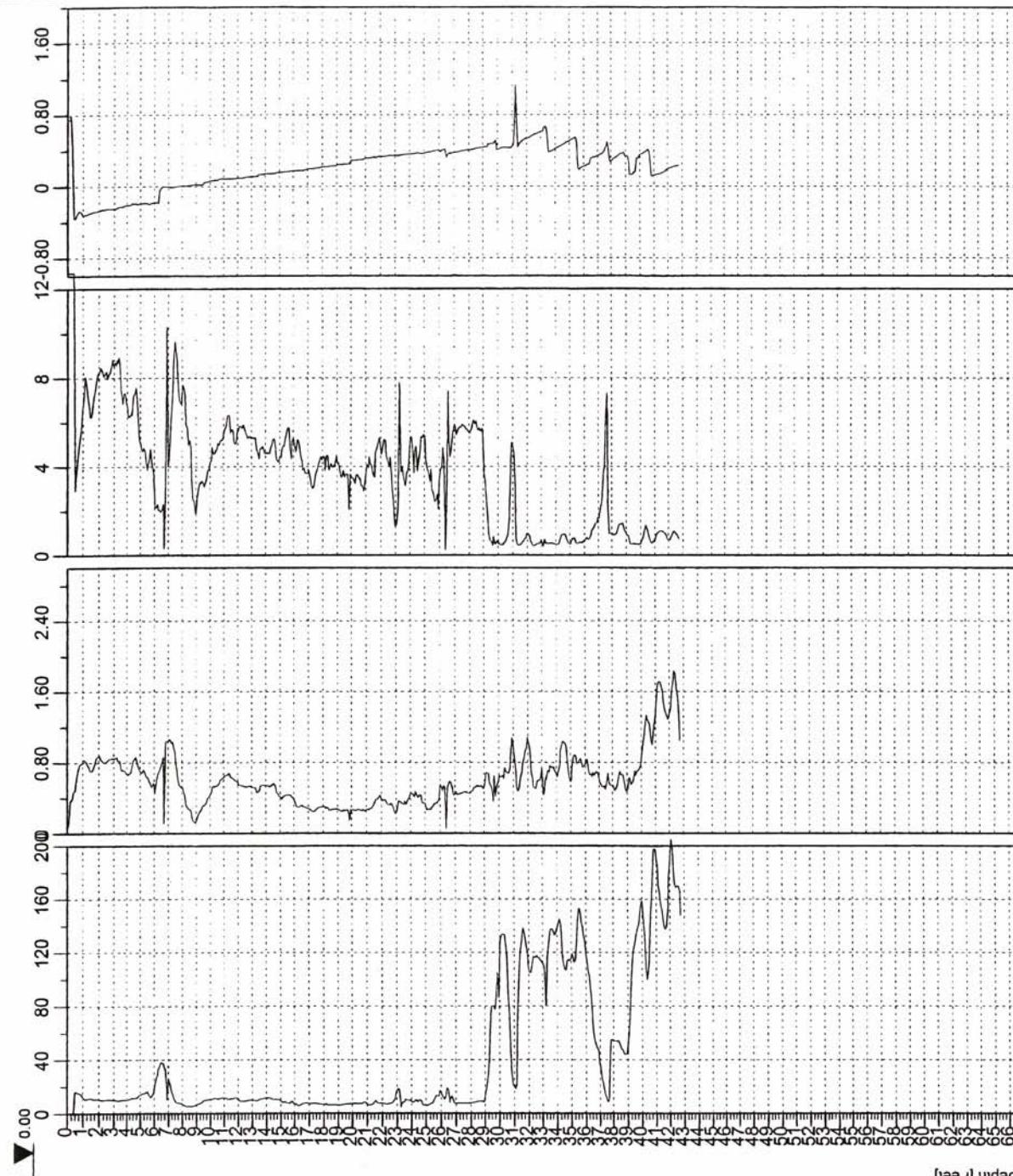
CLIENT HAWKINS CONSTRUCTION COMPANY		ARCHITECT/ENGINEER							
SITE WAHOO, NEBRASKA		PROJECT WAHOO SOUTH BRIDGE							
GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	Hard Drilling in Apparent Cobbles Below 66'		WB						
68.5	Took Approximately One Hour to Drill Through Apparent Boulder at 67.7 to 68.4' 1112.5	SP	14	SS	12	35	15.6		
	FINE TO MEDIUM SAND, TRACE GRAVEL (Weathered Sandstone) Orangish Brown Medium Dense to Dense	WB							
	Very Dense at 78.5 to 80'	SP	15	SS	12	42	16.6		
		WB							
		SP	16	SS	12	52	12.9		
		WB							
		SP	17	SS	12	21	12.6		
		WB							
88		CH	18	SS	18	30	18.0		
90	FAT CLAY (Weathered Shale) Light Yellow 1091								
	BOTTOM OF BORING								
The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.									
*Calibrated Hand Penetrometer **CME Automatic Hammer									
WATER LEVEL OBSERVATIONS, ft				BORING STARTED 6-21-01					
WL	▽ 18	WD	▽	BORING COMPLETED 6-21-01					
WL	▽	▽		RIG	CME 55	FOREMAN	PG		
WL				APPROVED	RLM	JOB #	05015121		

Cone - u [TSE]

Fr [%] —

Fs [TSF] —

Qc [TSF] —

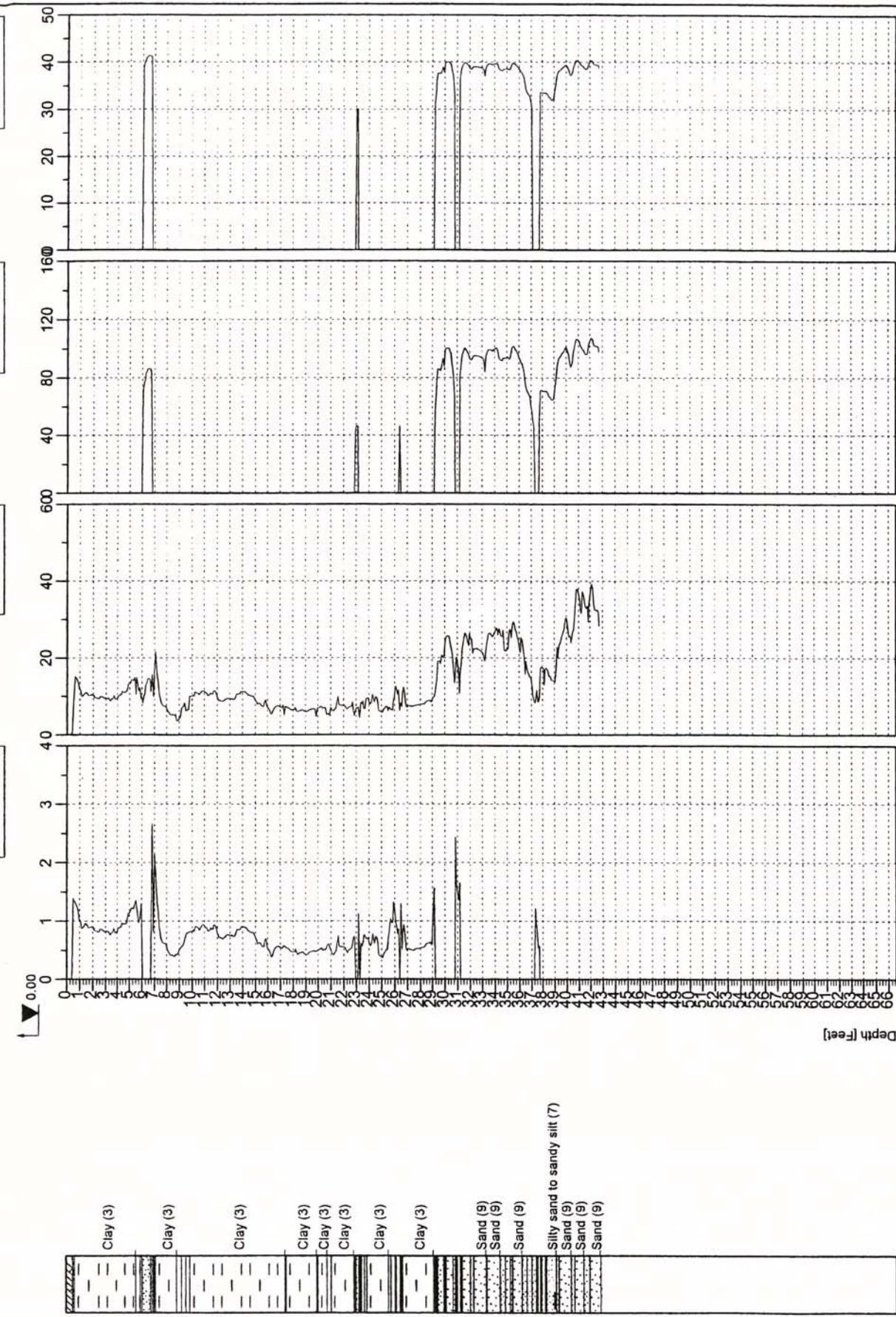


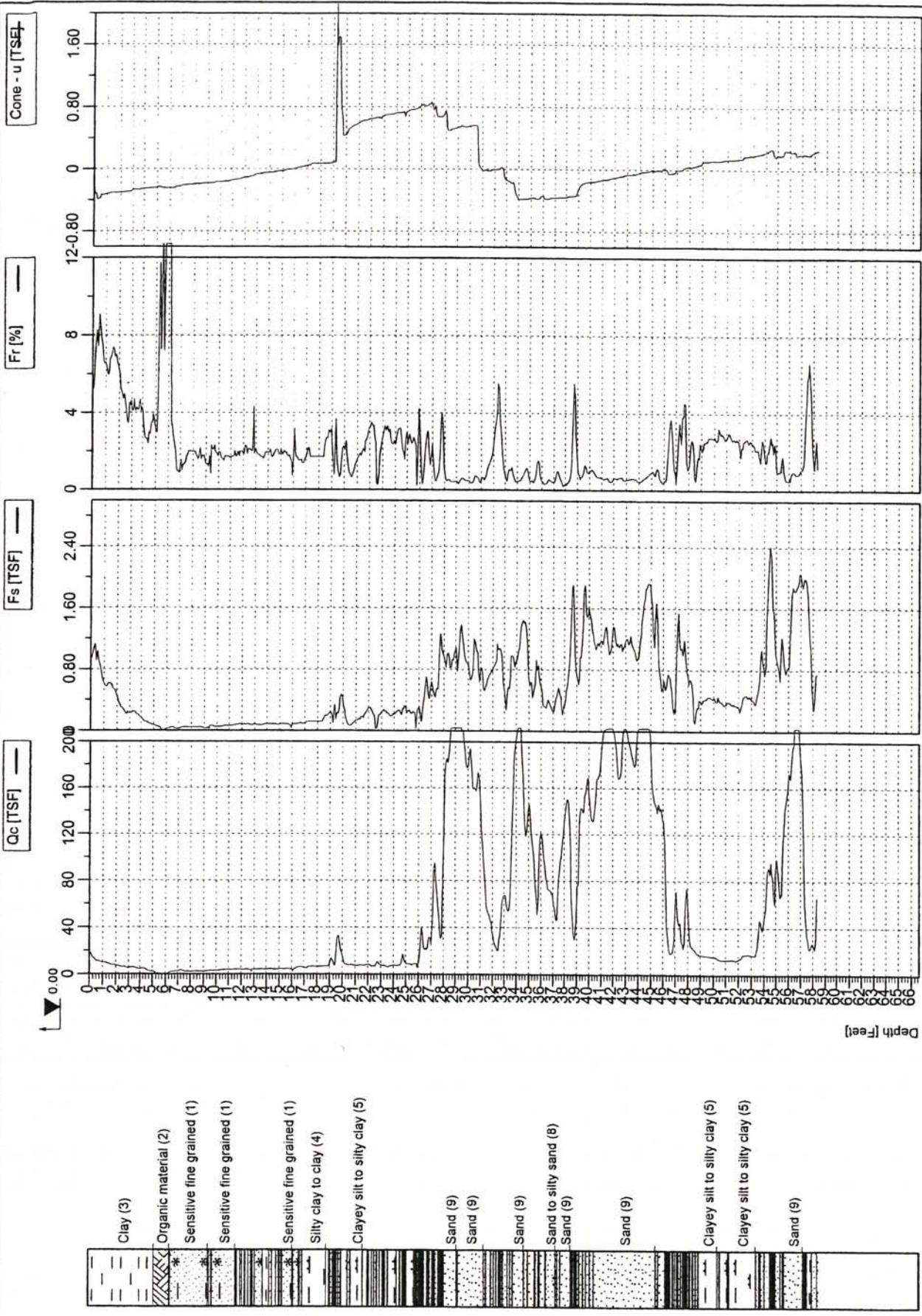
Depth [feet]



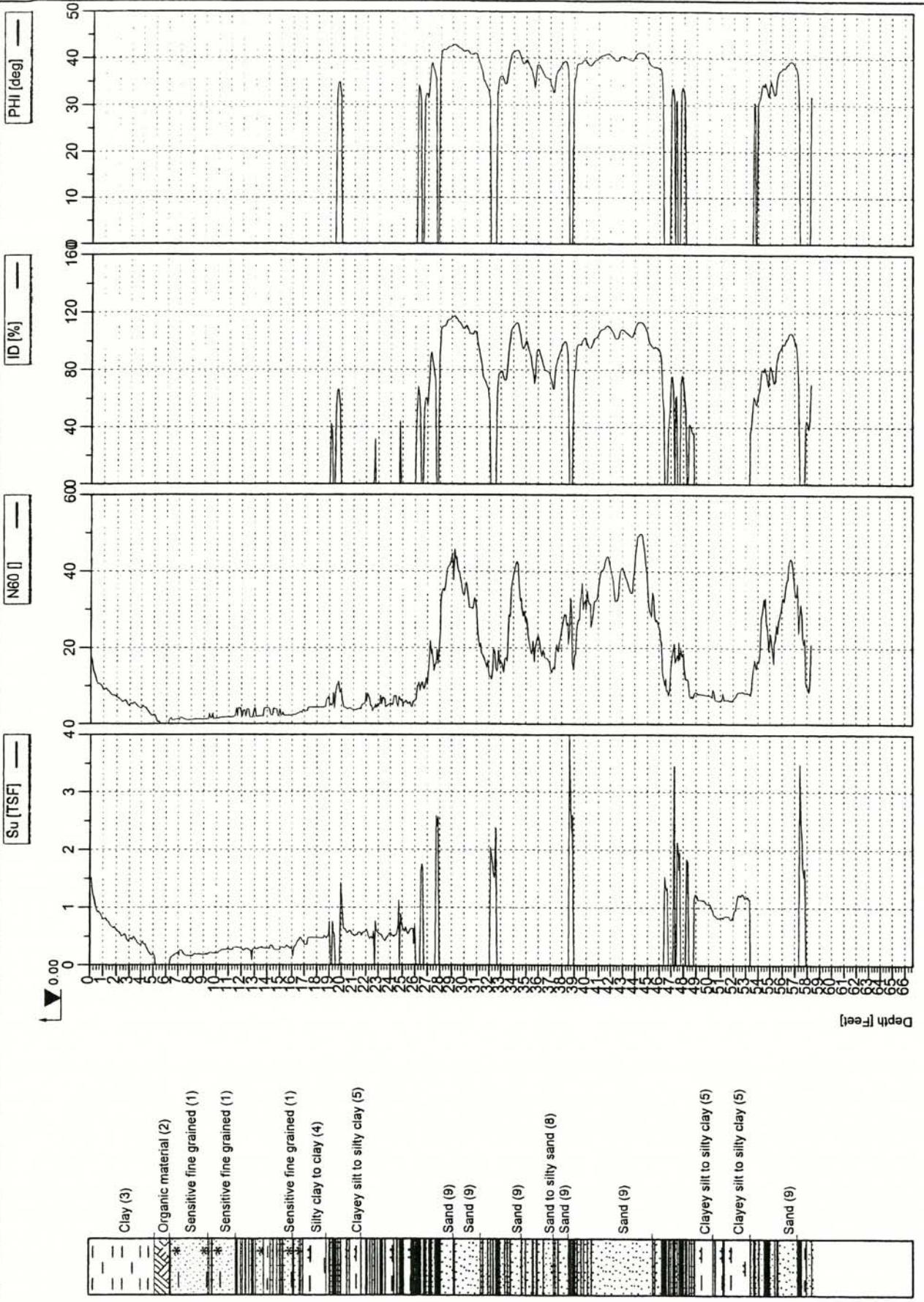
Terracon Cone No. 0
Tip area [cm²]: 10
Sieve area [cm²]: 150

		Ground level:	
Test no:	EC-1	Position:	APPROXIMATELY, STA 350+60
Client:	HAWKINS CONSTRUCTION CO.	Date:	6/27/01
Project:	WAHOO SOUTH BRIDGE	Scale:	1 : 140
		Page:	Fig: 1/1
		File:	5121-ec1.cpt





Test no: EC-2	Position: APPROXIMATELY, STA 352+48	Ground level: 1183.5
Client: HAWKINS CONSTRUCTION CO.	Date: 6/27/01	Scale: 1 : 140
Project: WAHOO SOUTH BRIDGE	Page: 1/1	Fig: 2-1
TERRACON PROJECT NO. 05015121		File: 5121-ec2.cpt



Test no:	EC-2	Position:	APPROXIMATELY, STA 352+48	Ground level:	1183.5
Client:	HAWKINS CONSTRUCTION CO.	Date:	6/27/01	Scale:	1 : 140
Project:	WAHOO SOUTH BRIDGE	Page:	1/1	Fig:	2-2
	TERRACON PROJECT NO. 0501515121	File:	5121-ec2.cpt		



Terracon Cone No: 0

Tip area [cm²]: 10
Sieve area [cm²]: 150

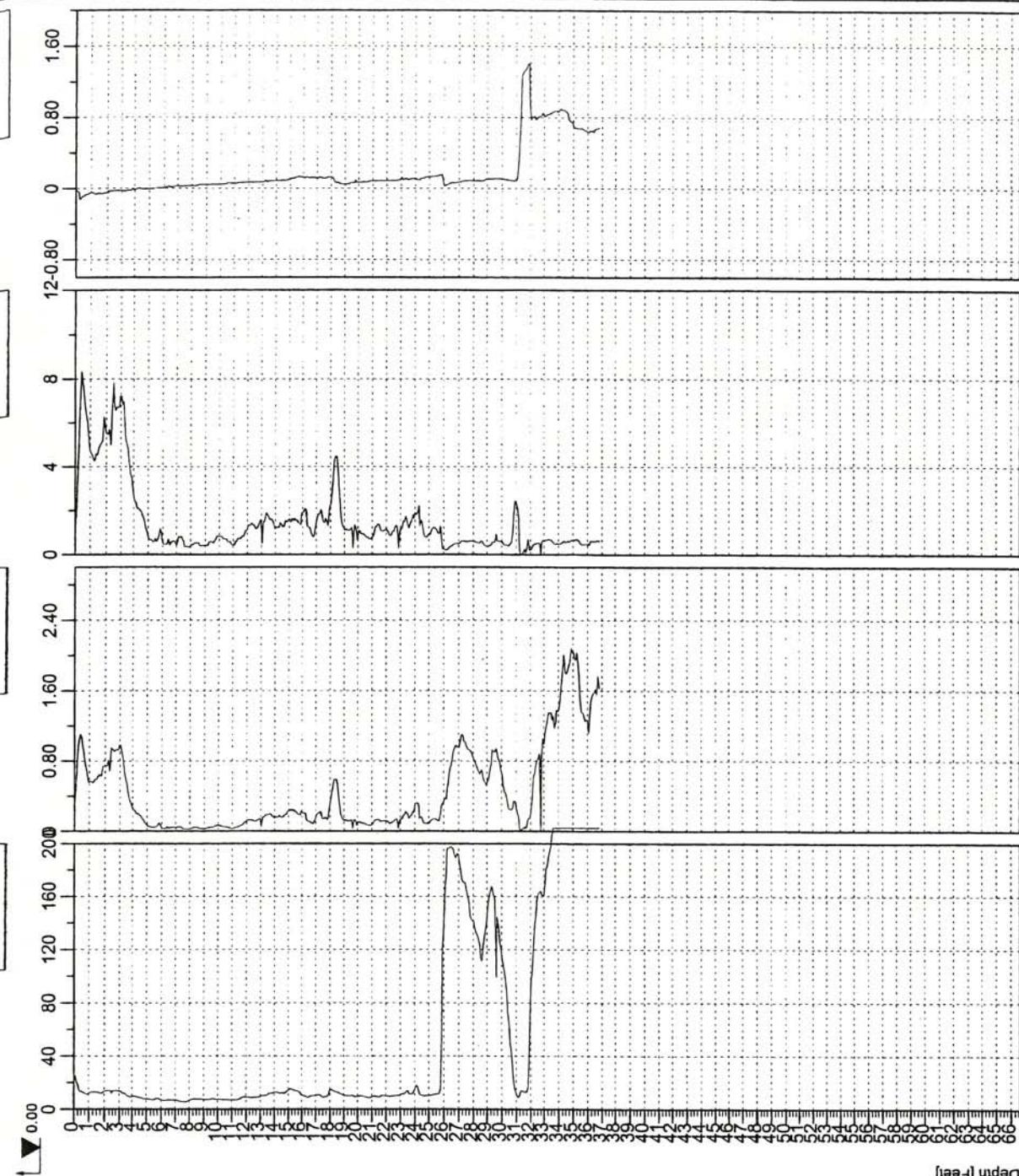
U2

Cone • u [TSF]

Fr [%]

Fs [TSF]

Qc [TSF]



Depth [Feet]

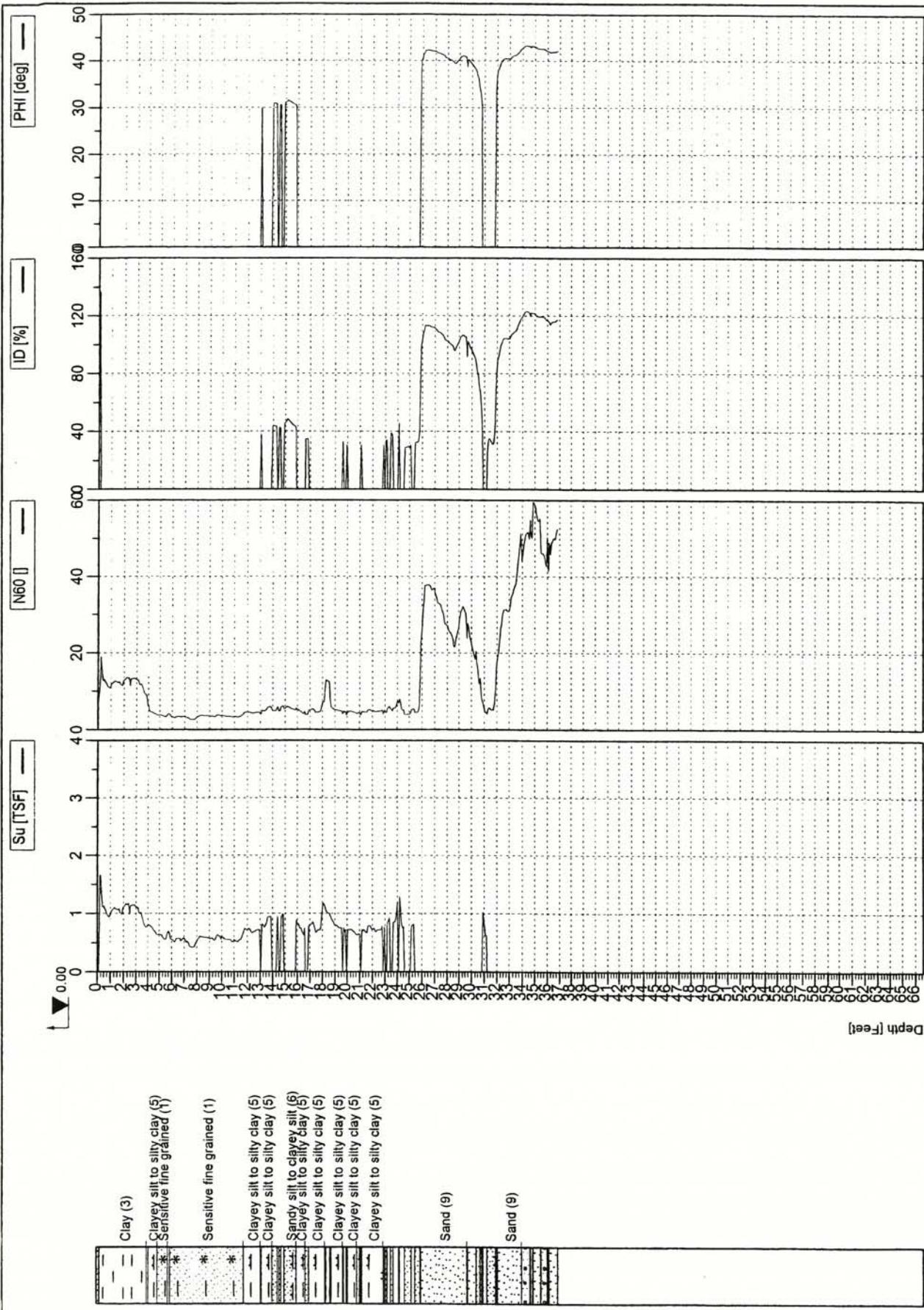


Terracon Cone No. 0
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Test no:	Position:	APPROXIMATELY, STA 354+09
EC-3		
Client:	HAWKINS CONSTRUCTION CO.	
Project:	WAHOO SOUTH BRIDGE	
	TERRACON PROJECT NO. 05015121	

Ground level:
1180.0

Date: 6/27/01 Scale: 1 : 140
Page: 1/1 Fig: 3-1
File: 5121-ec3.cpt



Test no: EC-3	Position: APPROXIMATELY, STA 354+09	Ground level: 1180.0
Client: HAWKINS CONSTRUCTION CO.	Date: 6/27/01	Scale: 1 : 140
Project: WAHOO SOUTH BRIDGE	Page: 1/1	Fig: 3-2
TERRACON PROJECT NO. 05015121	File: 5121-ec3.cpt	



Terracon Cone No: 0
Tip area [cm²]: 10
Sleeve area [cm²]: 150

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests^A

				Soil Classification		
				Group Symbol	Group Name ^B	
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well-graded gravel ^F	
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel ^F	
		Gravels with Fines More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F,G,H}	
			Fines classify as CL or CH	GC	Clayey gravel ^{F,G,H}	
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand ^I	
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand ^I	
		Sands with Fines More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G,H,I}	
			Fines Classify as CL or CH	SC	Clayey sand ^{G,H,I}	
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line ^J	CL	Lean-clay ^{K,L,M}	
			PI < 4 or plots below "A" line ^J	ML	Silt ^{K,L,M}	
	organic		Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}
			Liquid limit - not dried			Organic silt ^{K,L,M,O}
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay ^{K,L,M}	
			PI lots below "A" line	MH	Elastic Silt ^{K,L,M,P}	
	organic		Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K,L,M,P}
			Liquid limit - not dried			Organic silt ^{K,L,M,Q}
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat	

^ABased on the material passing the 3-in. (75-mm) sieve

^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^CGravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^DSands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^EIf soil contains $\geq 15\%$ sand, add "with sand" to group name.

^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^HIf fines are organic, add "with organic fines" to group name.

^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^JIf Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^KIf soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^LIf soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

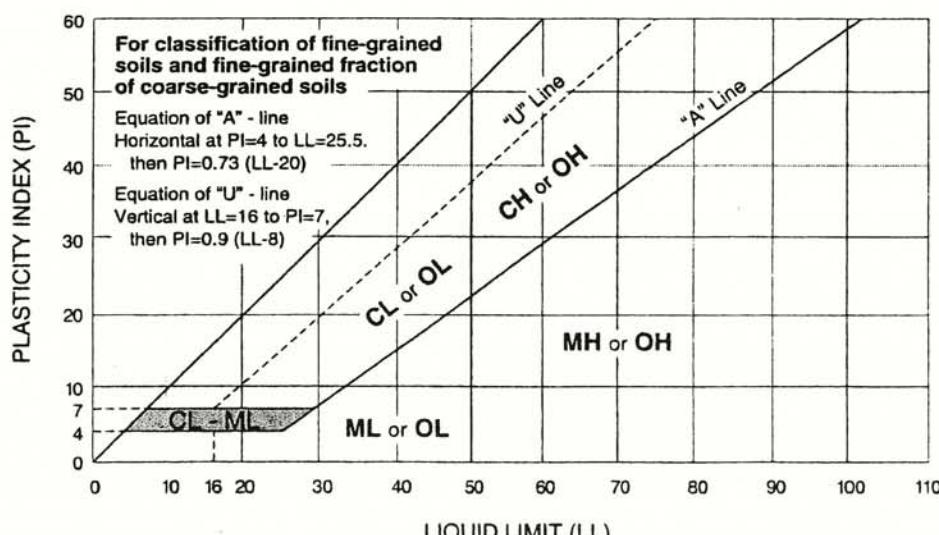
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

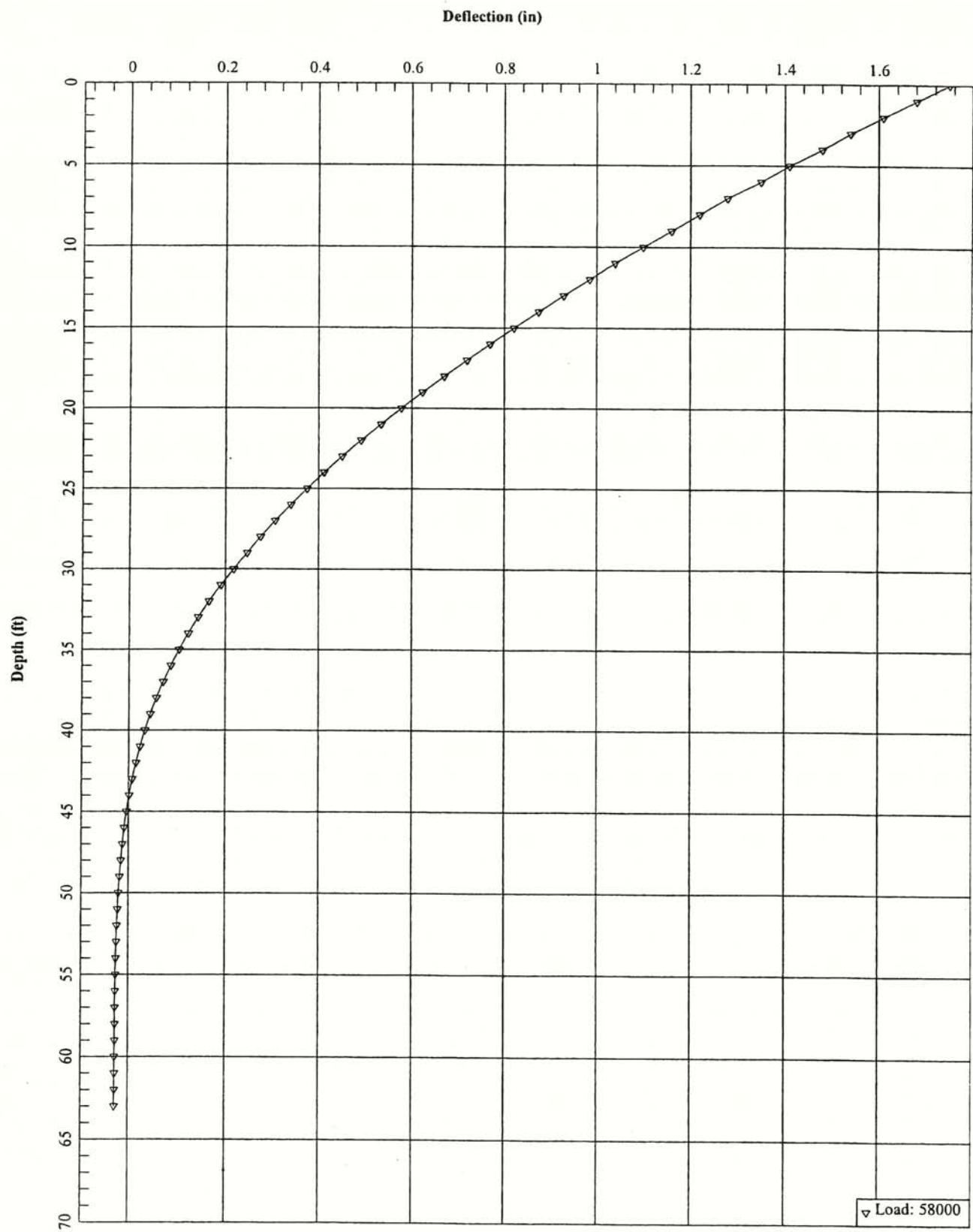
^NPI ≥ 4 and plots on or above "A" line.

^OPI < 4 or plots below "A" line.

^PPI plots on or above "A" line.

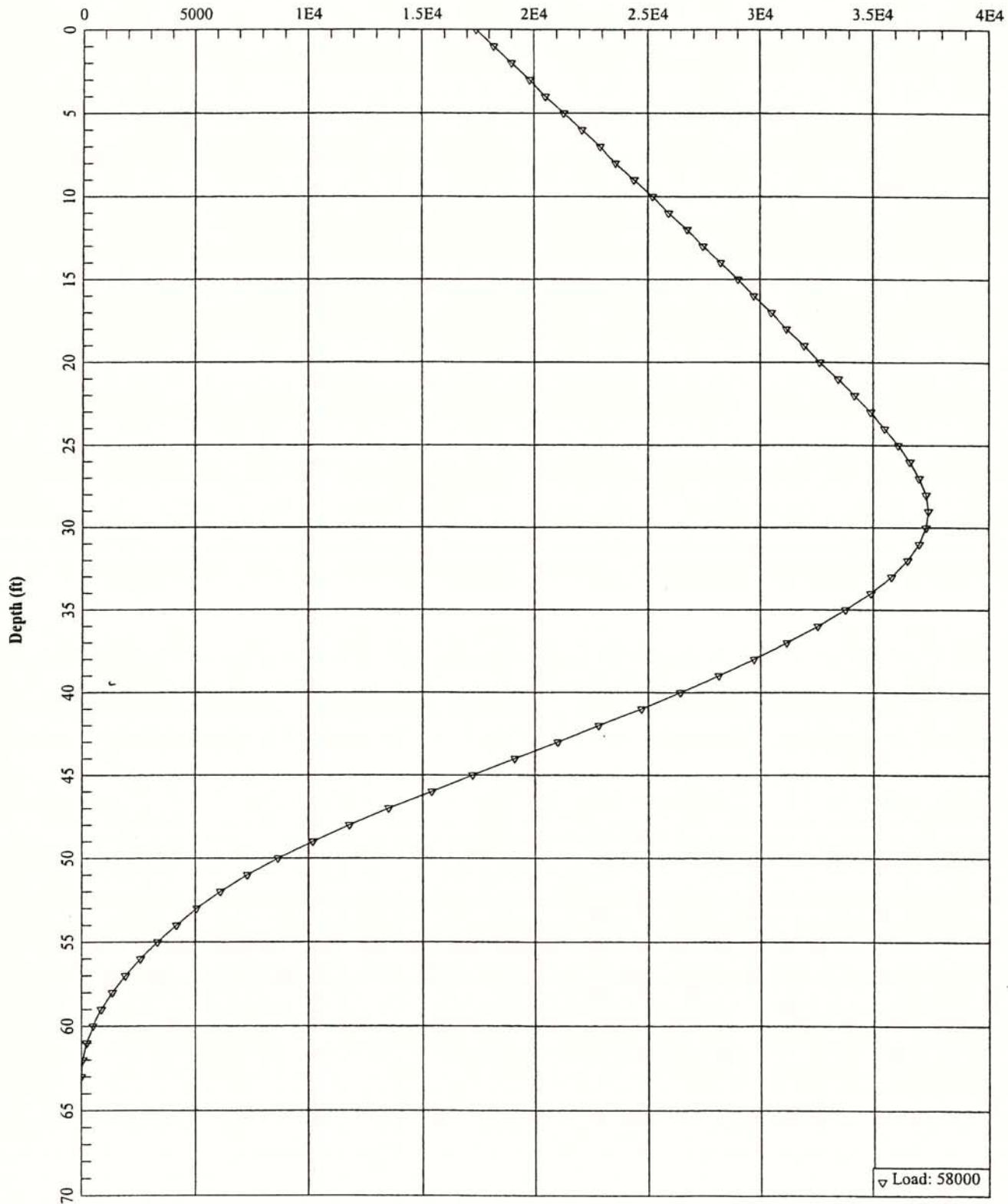
^QPI plots below "A" line.



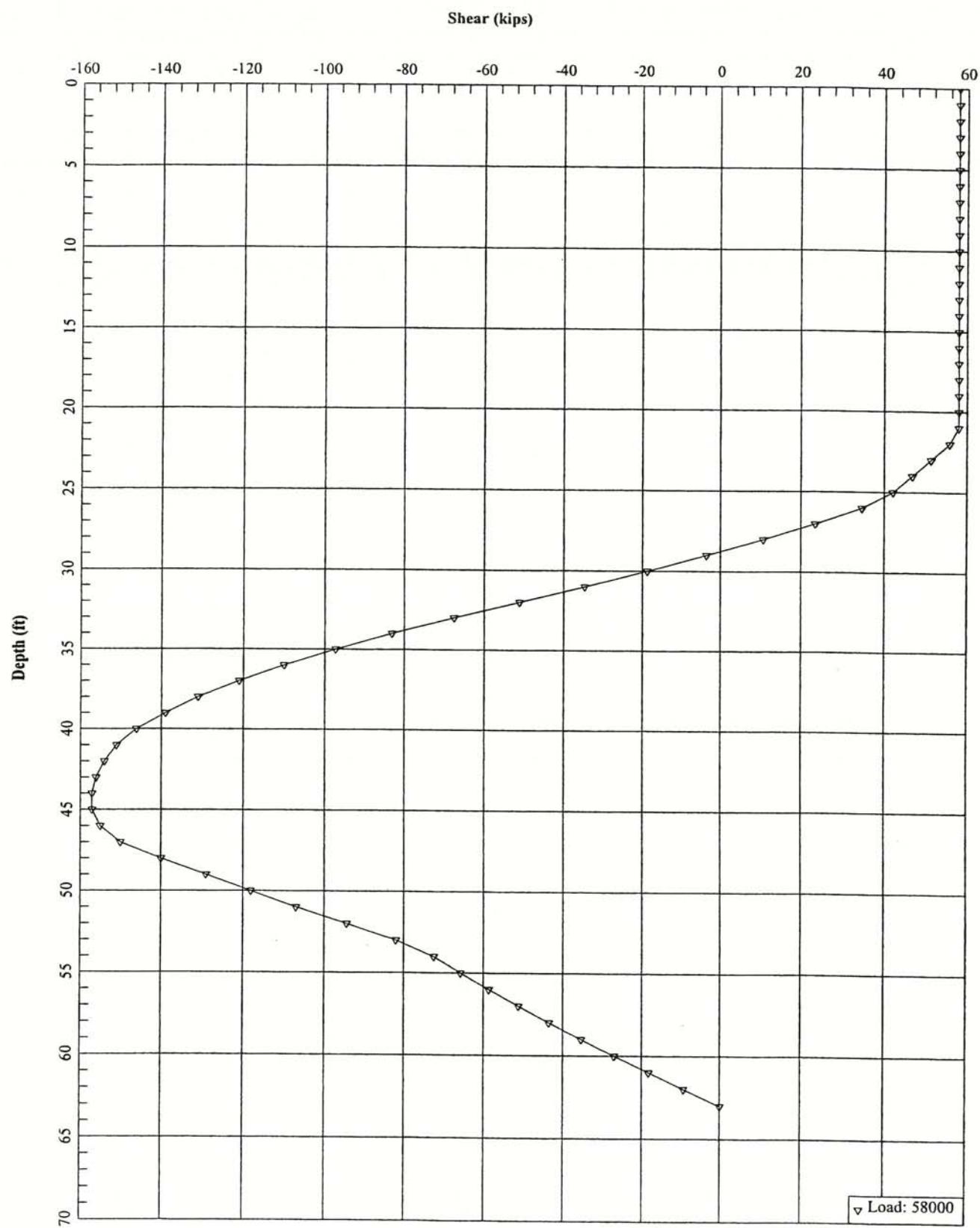


05015121 Wahoo South Bridge, Hwy 77, 66 inch Diameter Drilled Shaft, 22' Scour

Bending Moment (in-kips)



05015121 Wahoo South Bridge, Hwy 77, 66 inch Diameter Drilled Shaft, 22' Scour



05015121 Wahoo South Bridge, Hwy 77, 66 inch Diameter Drilled Shaft, 22' Scour

SUMMARY OF TEST BORINGS

(8810)

STRUCTURE NO.: S077 09211

PROJ. LOCATION: WAHOO BYPASS

DATE: 12-15-98 PROJECT NO.: F-77-2(1037)

SEC. LOCATION: 9 T14N R7E

HOLE NO.: 001 EXAMINED BY: WENZL

WATER LEVEL: 2.8M AFTER: 24 HRS ELEV.: 360.38M C.L. STA. 350+41.5M N.B. RDWZ

STRUCTURE: WAHOO CREEK COTTONWOOD CREEK U.P.R.R. COUNTY: SAUNDERS

COMMENT:

DEPTH	DESCRIPTION OF MATERIAL	ASTM D1585 PENETRATION TEST				
		FROM	TO	BLOWS PER 6"		
0.0	TOP SOIL.	2.6	3.1	0	0	1
4.5	0.9 CLAY, SILTY, CONTAINS SANDY LAYERS BELOW 7.3.	4.1	4.6	0	0	1
7.9	8.5 SAND, FINE-COURSE, SILTY, CONTAINS CLAYEY LAYERS.	5.6	6.1	0	0	1
10.6	9.8 CLAY, VERY SILTY, CONTAINS SAND SEAMS, CONTAINS VERY FINE SILTY SAND AT 11.9, CONTAINS SMALL STONES BELOW 12.8.	7.2	7.6	0	1	2
13.1	17.4 GRAVEL, SLIGHTLY SILTY, CONTAINS SAND AND SMALL STONES, CONTAINS LAYER OF SILT FROM 19.5-20.1.	8.7	9.1	2	2	4
14.2	25.2 T.D. NOTE: POSSIBLE BOULDER AT 25.1.	10.2	10.7	1	1	1
16.3		11.7	12.2	7	5	6
17.8		13.3	13.7	3	4	4
19.4		14.8	15.2	1	1	2
20.9		16.3	16.8	1	3	4
22.4		17.8	18.3	10	19	15
23.9		19.4	19.8	3	2	2
25.1		20.9	21.3	6	8	9
		22.4	22.9	8	13	16
		23.9	24.4	5	5	5
		25.1	25.2	44	*	*

SUMMARY OF TEST BORINGS

STRUCTURE NO.: S077 09211

PROJ. LOCATION: WAHOO BYPASS

DATE: 01-28-99 PROJECT NO.: F-77-2(1037)

SEC . LOCATION: 9 T14N R7E

HOLE NO.: 002 EXAMINED BY: WENZL

WATER LEVEL: NOT AFTER: TAKEN ELEV.: 360.33M C.L. STA. 350+79.5M S.B. RDWA

STRUCTURE: WAHOO CREEK COTTONWOOD CREEK U.P.R.R.

COMMENT: WATER

DEPTH	DESCRIPTION OF MATERIAL	ASTM D1585 PENETRATION TEST					
		FROM	TO	BLOWS PER 6"			

0.0	SIMILAR TO HOLE#1 (ABUT. #1).	25.5	25.9	8	7	9
24.4	GRAVEL, CONTAINS SAND AND NUMEROUS SMALL STONES AND ROCKS, CONTAINS LAYERS OF SILT AND SILTY CLAY BETWEEN 26.2 AND 27.4.	27.0	27.4	5	6	6
27.7	DAKOTA; SHALE, DRY, GRAY.	28.5	28.8	28	66	*
33.3	T.D.	30.0	30.2	85	*	*
		31.5	31.8	37	47	*
		33.1	33.3	43	37	*

SUMMARY OF TEST BORINGS

STRUCTURE NO.: S077 09211

PROJ. LOCATION: WAHOO BYPASS

DATE: 02-03-99 PROJECT NO.: F-77-2(1037)

SEC. LOCATION: 9 T14N R7E

HOLE NO.: 003 EXAMINED BY: WENZL

WATER LEVEL: NOT AFTER: TAKEN ELEV.: 359.82M C.L. STA. 352+80.0M S.B. RDW

STRUCTURE: WAHOO CREEK COTTONWOOD CREEK U.P.R.R. COUNTY: SAUNDERS

COMMENT:

DEPTH	DESCRIPTION OF MATERIAL	ASTM D1585 PENETRATION TEST				
		FROM	TO	BLOWS PER 6"		
0.0	TOP SOIL.	2.6	3.1	1	1	1
0.9	CLAY, SILTY.	4.1	4.6	1	1	1
8.2	SAND, FINE-VERY COURSE, CONTAINS GRAVEL GRAINS.	5.6	6.1	0	1	1
9.8	GRAVEL, CONTAINS SAND, CONTAINS FINE-COURSE SAND LAYERS, CONTAINS SILTY CLAY SEAMS, CONTAINS SMALL STONES ON LOWER PORTION.	7.2	7.6	1	2	2
14.3	CLAY, VERY SILTY, BLACK.	10.2	10.7	3	6	10
16.5	GRAVEL, CONTAINS SAND, CONTAINS SMALL STONES BELOW 17.9.	11.7	12.2	9	12	12
18.9	SILT, CONTAINS VERY FINE SAND.	13.3	13.7	9	10	13
20.4	GRAVEL, CONTAINS SAND AND SMALL STONES.	14.8	15.2	1	2	3
22.6	SANDSTONE, VERY FINE-GRAINED ON UPPER PORTION, THEN MED-COURSE GRAINED.	16.3	16.8	3	10	10
24.4	T.D.	17.8	18.3	9	15	28
		19.4	19.8	1	3	5
		20.9	21.3	14	16	18
		22.4	22.9	23	28	32
		23.9	24.4	15	25	28

SUMMARY OF TEST BORINGS

STRUCTURE NO.: S077 09211

PROJ. LOCATION: WAHOO BYPASS

DATE: 02-09-99 PROJECT NO.: F-77-2(1037)

SEC. LOCATION: 9 T14N R7E

HOLE NO.: 004 EXAMINED BY: WENZL

WATER LEVEL: NOT AFTER: TAKEN ELEV.: 359.58M C.L. STA. 353+46.0M N.B. RDW

STRUCTURE: WAHOO CREEK COTTONWOOD CREEK U.P.R.R. COUNTY: SAUNDERS

COMMENT:

DEPTH	DESCRIPTION OF MATERIAL	ASTM D1585 PENETRATION TEST				
		FROM	TO	BLOWS PER 6"		
0.0	SIMILAR TO HOLE #3 (PIER #6).	25.5	25.9	10	9	1
22.3	DAKOTA; SANDSTONE, CONTAINS TRACES OF SHALE ON LOWER PORTION.	27.0	27.3	23	58	1
25.9	DAKOTA; SHALE, DRY, GRAY, PARTLY MOTTLED WITH MAROON.	28.5	28.9	20	33	38
30.3	T.D.	30.0	30.3	33	70	1

SUMMARY OF TEST BORINGS

STRUCTURE NO.: S077 09211

PROJ. LOCATION: WAHOO BYPASS

DATE: 02-04-99 PROJECT NO.: F-77-2(1037)

SEC. LOCATION: 9 T14N R7E

HOLE NO.: 005 EXAMINED BY: WENZL

WATER LEVEL: NOT AFTER: TAKEN ELEV.: 359.85M C.L. STA. 354+17.0M S.B. RDW

STRUCTURE: WAHOO CREEK COTTONWOOD CREEK U.P.R.R. COUNTY: SAUNDERS

COMMENT:

DEPTH	DESCRIPTION OF MATERIAL	ASTM D1585 PENETRATION TEST				
		FROM	TO	BLOWS PER 6"		
354	0.0 TOP SOIL.	2.6	3.1	2	2	:
	0.9 CLAY, VERY SILTY.	4.1	4.6	0	1	:
52.6	7.3 SAND, FINE-VERY COURSE, CONTAINS GRAVEL GRAINS, SILTY, CONTAINS SILTY CLAY LENSES.	5.6	6.1	1	1	1
49.8	10.1 SAND, VERY FINE-MEDIUM, CONTAINS GRAVEL GRAINS, CONTAINS TRACES OF CLAY.	7.2	7.6	1	2	2
17.1	12.8 GRAVEL, CONTAINS SAND AND SMALL STONES AND TRACES OF SILTY CLAY.	8.7	9.1	2	3	3
44	15.9 CLAY, SILTY.	10.2	10.7	8	12	14
13.1	16.8 GRAVEL, CONTAINS SAND AND TRACES OF SILTY CLAY, CONTAINS SMALL STONES BELOW 18.3, CONTAINS STONES AND ROCKS BELOW 20.1.	11.7	12.2	5	7	9
55	21.9 GRAVEL, FERRUGINOUS, CONTAINS SAND.	13.3	13.7	11	14	17
24.4	T.D.	14.8	15.2	5	8	10
		16.3	16.8	1	3	6
		17.8	18.3	9	9	11
		19.4	19.8	18	26	26
		20.9	21.3	12	19	19
		22.4	22.9	10	18	22
		23.9	24.4	8	7	12

SUMMARY OF TEST BORINGS

STRUCTURE NO.: S077 09211

PROJ. LOCATION: WAHOO BYPASS

DATE: 12-28-98 PROJECT NO.: F-77-2(1037)

SEC. LOCATION: 9 T14N R7E

HOLE NO.: 006 EXAMINED BY: WENZL

WATER LEVEL: NOT AFTER: TAKEN ELEV.: 360.00M C.L. STA. 355+01.0M N.B. RDWA

STRUCTURE: WAHOO CREEK COTTONWOOD CREEK U.P.R.R. COUNTY: SAUNDERS

COMMENT:

ASTM D1585 PENETRATION TEST
FROM TO BLOWS PER 6"

DEPTH	DESCRIPTION OF MATERIAL	2.6	3.1	0	1	1
0.0	TOP SOIL.					
1.2	CLAY, SILTY, CONTAINS SANDY AND GRAVELEY AREAS BELOW 8.2.	4.1	4.6	0	0	1
9.5	SAND, CONTAINS GRAVEL LAYERS, CONTAINS SILTY, SANDY, CLAY LAYER AT 12.2.	5.6	6.1	0	0	0
12.8	GRAVEL, CONTAINS SAND AND SMALL STONES, FERRUGINOUS.	7.2	7.6	0	1	1
20.1	SANDY, VERY FINE-FINE, COMPACT, TAN.	8.7	9.1	1	1	1
21.9	SAND AND GRAVEL, COMPACT, FERRUGINOUS.	10.2	10.7	2	5	12
24.4	T.D.	11.7	12.2	9	13	8
		13.3	13.7	5	5	7
		14.8	15.2	6	9	10
		16.3	16.8	8	12	13
		17.8	18.3	5	8	8
		19.4	19.8	5	6	8
		20.9	21.3	13	19	21
		22.4	22.9	22	26	28
		23.9	24.4	16	18	21

SUMMARY OF TEST BORINGS

STRUCTURE NO.: S077 09211

PROJ. LOCATION: WAHOO BYPASS

DATE: 01-27-99 PROJECT NO.: F-77-2(1037)

SEC. LOCATION: 9 T14N R7E

HOLE NO.: 007 EXAMINED BY: WENZL

WATER LEVEL: NOT AFTER: TAKEN ELEV.: 359.96M C.L. STA. 355+43.00M N.B. RD

STRUCTURE: WAHOO CREEK COTTONWOOD CREEK U.P.R.R. COUNTY: SAUNDERS

COMMENT:

DEPTH	DESCRIPTION OF MATERIAL	ASTM D1585 PENETRATION TEST					
		FROM	TO	BLOWS PER 6"			
0.0	SIMILAR TO HOLE #6 (PIER 12).	25.5	25.9	8	18	21	
22.3	SAND, FINE-VERY COURSE, CONTAINS FINE GRAVEL, FERRUGINOUS.	27.0	27.4	13	13	21	
29.3	DAKOTA; SHALE, DRY, GRAY.	28.5	29.0	15	18	21	
33.4	T.D.	30.0	30.3	27	59		
		31.5	31.8	30	81		
		33.1	33.4	25	53		

SUMMARY OF TEST BORINGS

STRUCTURE NO.: S077 09211

PROJ. LOCATION: WAHOO BYPASS

DATE: 12-14-98 PROJECT NO.: F-77-2(1037)

SEC. LOCATION: 9 T14N R7E

HOLE NO.: 008 EXAMINED BY: WENZL

WATER LEVEL: 2.9M AFTER: 48 HRS ELEV.: 360.10M C.L. STA. 355+81M S.B. RDWAY

STRUCTURE: WAHOO CREEK COTTONWOOD CREEK U.P.R.R. COUNTY: SAUNDERS

COMMENT:

DEPTH	DESCRIPTION OF MATERIAL	ASTM D1585 PENETRATION TEST				
		FROM	TO	BLOWS PER 6"		
0.0	TOP SOIL.	2.6	3.1	1	1	2
3.5	1.2 CLAY, SILTY, CONTAINS SAND LAYERS BELOW 5.5.	4.1	4.6	1	2	2
5.3	6.7 SAND, VERY FINE-MEDIUM, FAIRLY CLEAN, CONTAINS CLAY SEAMS.	5.6	6.1	3	4	1
5.1	8.2 GRAVEL, CONTAINS CONSIDERABLE AMOUNT OF SAND, CONTAINS CLAY SEAMS, SLIGHTLY SILTY, CONTAINS VERY SILTY SANDY CLAY LAYER AT 11.9.	7.2	7.6	3	7	6
7.9	12.2 SAND, VERY FINE-MEDIUM, CONTAINS SILTY CLAY LAYERS.	8.7	9.1	4	4	5
11.7		10.2	10.7	4	3	3
12.9	16.5 GRAVEL, CONTAINS SAND.	11.7	12.2	3	2	8
16.3		13.3	13.7	9	16	19
17.1	17.4 SAND, VERY FINE-MED FINE, CONTAINS LAYERS OF COURSE GRAVEL AND SMALL STONES, CONTAINS OCCASIONAL CLAY SEAMS.	14.8	15.2	4	9	9
17.8		16.3	16.8	6	13	17
20.4	20.4 SAND, FINE-COURSE, FERRUGINOUS.	19.4	19.8	5	18	24
20.9	21.3 T.D.	20.9	21.3	13	17	17

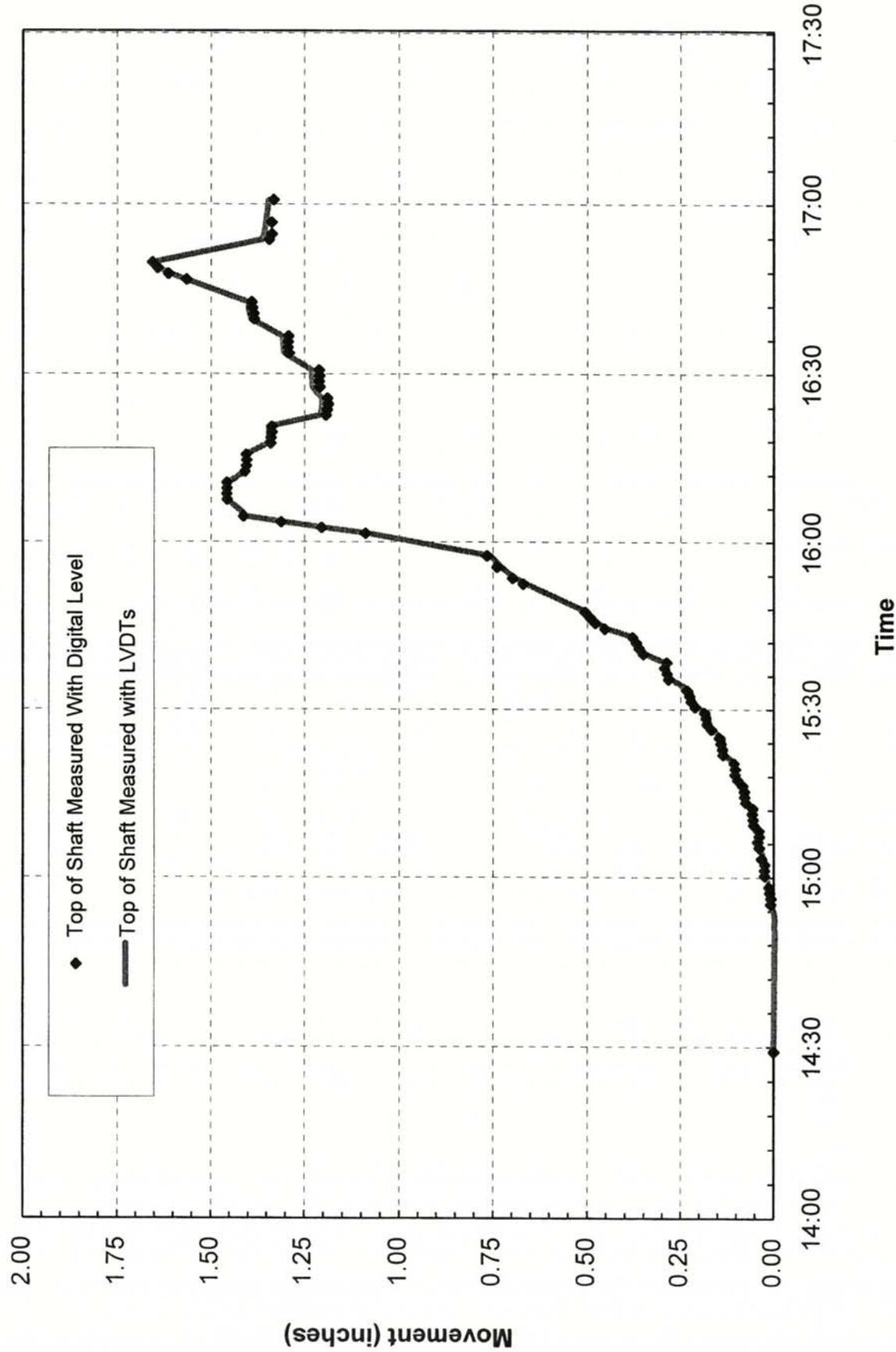
APPENDIX G

COMPARISON TOP OF SHAFT MOVEMENT



Comparison Of Top Of Shaft Movement

Wahoo South Connector - Wahoo, Nebraska - Production Test Shaft 1



APPENDIX H

POST TEST GROUTING PROCEDURE



POST-TEST GROUTING PROCEDURES FOR PRODUCTION DRILLED SHAFTS TESTED WITH AN OSTERBERG CELL

During the O-cell™ test the shaft breaks, on a horizontal plane, separating the upper section above the O-cell™ (upper side-shear) from the lower section below the O-cell™ (combined end bearing and lower side shear). This creates an annular space, the size of which depends on the shaft/O-cell™ geometry and the expansion of the O-cell™.

When a production shaft has been tested, the engineer may want to include the end bearing component from the lower section in order to obtain sufficient capacity of the production shaft. In such cases the contractor will be required to grout the O-cell™ and the annular space around the O-cell™ in order to allow load transfer to the lower side shear and end bearing.

POST-TEST GROUTING OF OSTERBERG CELLS

- a) The grout shall consist of Portland cement and water only, **NO SAND**. The grout shall be fluid and pumpable. An initial mix consisting of 4 to 6 gallons of water per 95-lb bag of cement is recommended. Adjust water to obtain desired consistency.
- b) The mixing shall be thorough to ensure that there are no lumps of dry cement. Pass the grout through a window screen mesh before pumping.
- c) Connect the grout pump outlet to one hydraulic line of the O-cell™. Open the other line and establish a flow of water through the system.
- d) Pump the grout through the O-cell™ hydraulic line while collecting the effluent from the bleed line. Monitor characteristics of effluent material and when it becomes equivalent to the grout being pumped, stop pumping.
- e) Take three samples of the grout for compression testing @ 28 days, if required.

Recommended pre-mixed amount of grout for grouting of O-cell™:

O-cell Diameter (Inches)	13	21	26	34
Grout Volume (Cubic Feet)	4	7	9	13

POST-TEST GROUTING OF ANNULAR SPACE AROUND OSTERBERG CELLS

- a) Prepare a fluid grout mix consisting of Portland cement and water only, **NO SAND**. The mixing procedures should be as outlined for grouting the O-cells™. The quantity of grout should be at least three (3) times the theoretical volume required to fill the annular space and grout pipes.
- b) Pump water and establish a flow through each of the PVC grout pipes (two or three per shaft).
- c) Pump the fluid grout through one of the PVC pipes until the grout is observed flowing from the second grout pipe or until 1.5 times the theoretical volume has been pumped.
- d) If no return of grout is observed from the second grout pipe, transfer the pump to the second pipe and pump grout through it until 1.5 times the theoretical volume has been pumped.
- e) If higher strength grout is deemed necessary, immediately proceed with pumping the higher strength grout (which may be a sand mix). The pumping procedures for this grout will be the same as described above for the initial cement-water grout. **The entire grouting operation must be completed before the set time for the initial grout has elapsed.**
- f) Take three (3) samples of each type of grout for compression testing @ 28 days.

Recommended pre-mix amount of grout for grouting of annular space:

Shaft Diameter (Feet)	2	3	4	5	6	7	8	9
Grout Volume (Cubic Feet)	25	30	40	50	65	80	100	125