REPORT OF SUBSURFACE EXPLORATION
FOR KINNICKINNIC RIVER STABILITY ANALYSIS AND DREDGING STUDY
MILWAUKEE COUNTY, WISCONSIN

PREPARED FOR:

BARR ENGINEERING COMPANY

JUNE 9, 2006

CEC PROJECT #GD-06032

Prepared By:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

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APPENDIX

I. INTRODUCTION

The Wisconsin Department of Natural Resources (WDNR) has proposed sediment removal from a stretch of the Kinnickinnic River, from Becher Street to Kinnickinnic Avenue located in the City of Milwaukee, Wisconsin. As part of this initiative, the U.S. Army Corps of Engineers has determined that certain engineering aspects of the project warrant a subsurface geotechnical investigation to evaluate the stability of the seawalls and unprotected riverbanks along this section of the river prior to sediment removal. This determination will be provided by Barr Engineering Company (Barr) of Minneapolis, Minnesota.

Coleman Engineering Company (CEC) was retained by Barr to perform surveying, field drilling, geotechnical laboratory testing, sheet-pile wall surveying and parallel seismic surveying. These services included field drilling and sampling at boring locations provided by Barr, laboratory testing consisting of visual soil classifications and physical laboratory testing as deemed necessary to correctly classify the soils, surveying the dimensions and elevations of existing structures and boring locations along the river banks, seismic testing to identify the bottom of the existing sheet piles and preparing a summary report describing the activities associated with this project.

CEC is responsible for the above-noted services. Interpretation of the data and all other aspects are the responsibilities of others.

II. FIELD PROCEDURES

Field Drilling and Sampling

The drilling services required for this project consisted of six (6) soil borings located within the site area. At the direction of Barr, all six borings were to be drilled to a depth of fifty (50) feet. Actual completed depths for the six borings range from 42.2 feet to 53.8 feet deep. In addition, three (3) of the borings would be completed with 2 ½" PVC casing to facilitate the placement of a geophone below the surface for parallel seismic testing.

Drilling was completed by a CEC drill crew present on-site from April 18 to April 27, 2006, using 4¼ inch hollow-stem augers (HSA) powered by a Diedrich D-50 drill. Hollow-stem augers act as continuously-advanced steel casing to prevent soils from collapsing into the open borehole. The hollow augers were advanced to the sampling depth, and sampling tools were then lowered down through the augers to sample undisturbed soils below the tip of the augers. Drilling and field sampling were performed in accordance with ASTM D-1586, "Penetration Test and Split Barrel Sampling of Soils" with a 2-inch O.D. split spoon, and with ASTM D-1587, "Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes". One hundred (100) split-spoon samples and eight (8) thin-walled tube samples were obtained.

Soil cuttings generated from the test drilling were contained in 55-gallon drums and staged on site until they could be picked up for disposal. CEC retained the services of OSI of Milwaukee,

Wisconsin, a licensed waste disposal contractor, to effectuate appropriate disposal.

A field log was prepared for each boring during exploration which contained the work method, standard penetration test (SPT) data, samples recovered and the indication of the presence of various soil types/conditions. Pocket penetrometer and torvane tests were conducted and recorded in the field only for soil samples identified as lean clays (CL), the silts and organic silts (ML and OL) being observed to occur generally in a soft to very soft condition. The field logs were submitted to CEC's Iron Mountain laboratory along with the soil samples for evaluation of the subsurface information and preparation of the final boring logs. Rough field and final typed boring logs are presented in Appendix E.

Three (3) of the test borings (S-1, S-3 and S-5) were completed with 2 ½" PVC casing extending to the bottom of the borehole. This casing was grouted in place with neat cement grout to securely anchor the casing and provide a continuous connection to the borehole walls. The casing was filled with water to prevent it from floating out of the borehole before the grout set. The casing was abandoned upon completion of the seismic survey by filling with bentonite chips and cutting the casing off below grade before reclaiming the site.

Access to the test boring locations required that all property owners be notified in advance. Verbal notification was provided at least five days in advance of CEC being on site. Additionally, boring S-1 was located along a steep embankment just west of the Gillen Company parking area. This location required temporary removal of heavy ornamental chain and an elaborate system of cribbing with a drilling platform to safely access the site and complete the drilling. Photographs of this site are presented in the project photographic log in Appendix J.

Tie-back Survey

The tie-backs associated with anchoring the sheet pile wall were surveyed to document the existing condition of the sheet pile wall. Tie-backs were identified on the face of the wall and measurements were taken to locate the horizontal location as well as the vertical placement on the face of the wall. CEC Drawing No. H documenting the existing locations of tie-backs is presented in Appendix H.

Parallel Seismic Survey

After completion of the drilling, three test borings (S-1, S-3 and S-5) were selected for parallel seismic testing to establish the bottom of the sheet-pile wall. Within these borings, a geophone was lowered down each boring and the sheet-pile wall was struck smartly with a sledge hammer. The energy was received by the geophone, recorded, and plotted in order to determine the elevation of the base of the sheet-pile wall. A more detailed description of this activity as well as results of this investigation are included in Appendix I.

The boring locations were selected and established in the field by Barr with direction from the U.S.

Army Corps of Engineers. Figure 1 in Appendix A shows the project location, Figure 2 in Appendix B shows the individual boring locations.

III. LABORATORY PROCEDURES

All field samples collected were visually classified in accordance with ASTM D-2488, "Description and Identification of Soils (Visual-Manual Procedure)". Laboratory testing of collected soil samples was assigned by Barr under the direction of the U.S. Army Corps of Engineers and included tests for moisture content, Atterberg limits for cohesive soils, combined mechanical/hydrometer grain-size analyses, specific gravity, unit dry density, unconfined compression, and CIU triaxial compression with pore pressure. CEC retained the services of Soils Engineering Testing, Inc. (SET) of Bloomington, Minnesota to perform the requested CIU triaxial compression testing of particular undisturbed samples. SET also performed moisture content, dry density, Atterberg limits, and hydrometer grain-size analyses on these same samples. Individual test reports for all laboratory tests are included in Appendix G.

The final boring logs contain both factual and interpretive information. It should be emphasized that any recommendations are based only on the final boring logs. On the final boring logs, horizontal lines designating the interface between differing materials encountered represent approximate boundaries. The transition between soil layers is typically gradual.

IV. SITE CONDITIONS

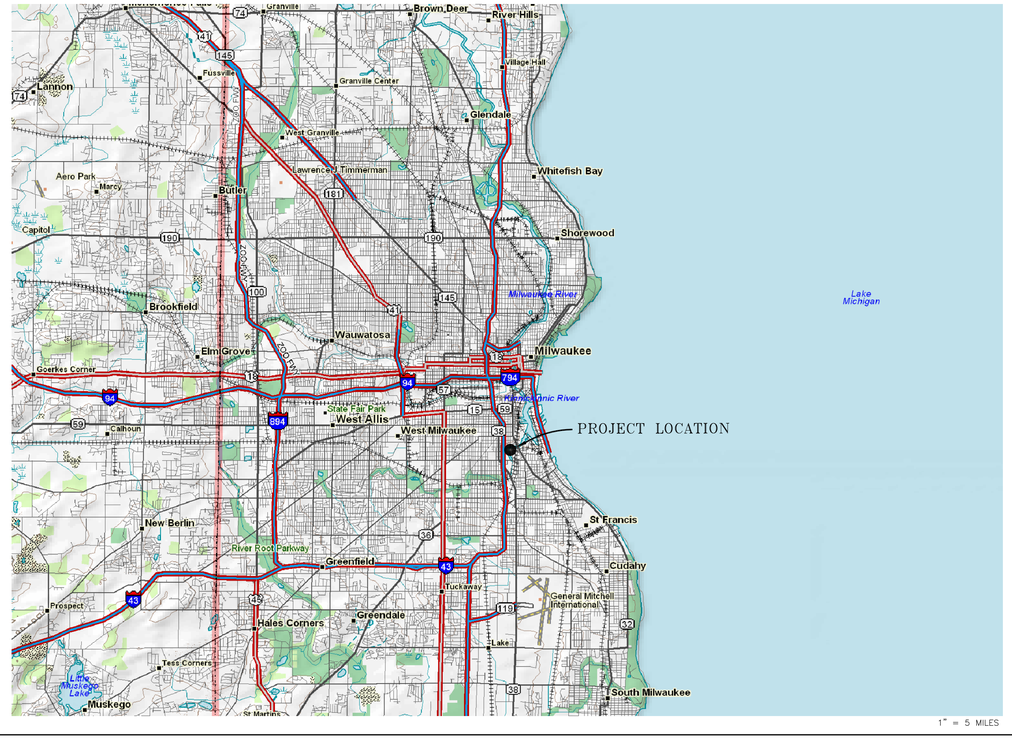
The predominant soil types disclosed throughout the area of investigation are cohesive soils including silt (ML), organic silt (OL), and clay (CL and CH). Some peat (Pt) was observed in the upper areas of Borings S-4 and S-6, and throughout the site are scattered thin seams of sand (SP-SM) and silty sand (SM). Borings S-1 and S-5 encountered probable bedrock between 42.2 and 46.5 feet deep. We recommend that you review the subsurface soil information presented on the respective boring logs for each section of the site for more in-depth site-specific data.

Groundwater was found between 4.2 feet and 10.1 feet deep. Long-term monitoring of groundwater was not part of the scope of this project; therefore, the water level information indicated on the final logs is accurate at the time of drilling only. Groundwater levels vary greatly depending on meltwater, runoff, time of year, amount of precipitation, and other factors, and are likely directly related to water elevations in the Kinnickinnic River. It should, therefore, be expected that different groundwater levels may be encountered at other times throughout the year.

* * * * * * * *

APPENDIX A

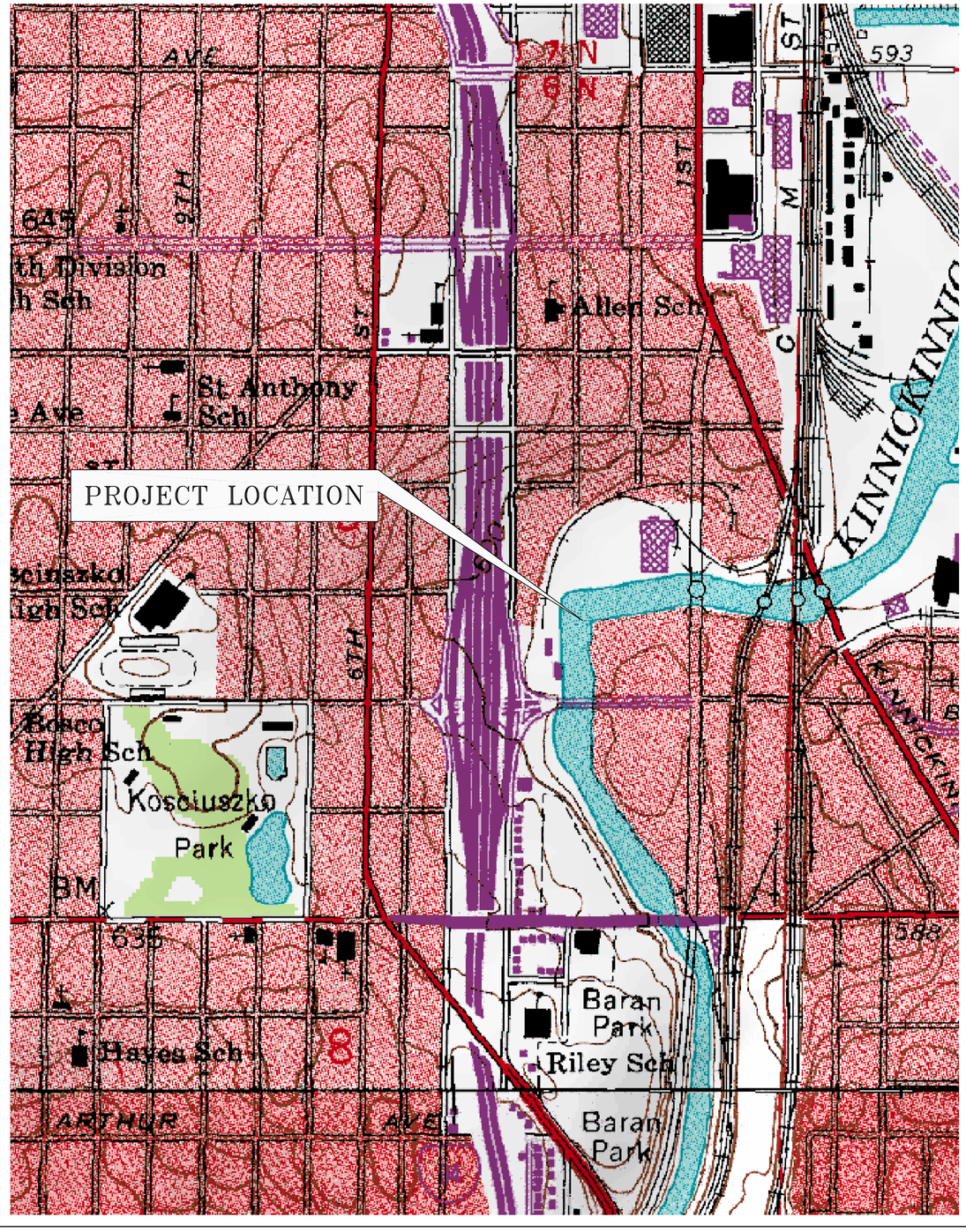
FIGURE 1: PROJECT LOCATION DRAWING



1" = 5 MILES

NORTH

GRAPHIC SCALE
0 1000 2000
(IN FEET)



COLEMAN ENGINEERING CO.
635 CIRCLE DRIVE – IRON MOUNTAIN, MICHIGAN 49801 (906) 774-3440
OFFICE ALSO LOCATED AT: IRONWOOD, MICHIGAN 49938 (906) 932-5648

PROJECT LOCATION DRAWING
KINNICKINNIC RIVER
MILWAUKEE, WISCONSIN

NO.	DATE	REVISIONS	BY

SCALE	AS SHOWN
DATE	5/25/2006
CAD DRAWING	06032 LOC
CAD PROJECT	CAD06032
JOB NUMBER	GD-06032-A
DRAWN BY	MRK
CHECKED	WR
APPROVED	WR
SURVEYED BY	CEC I.M.
DATE	-

F1
DRAWING NO.

APPENDIX B

FIGURES 2: BORING LOCATION DRAWINGS

LEGEND

– TIE BACK LOCATION

– SOIL BORING LOCATION

NOTE: SURVEY SHOTS SPACING VARIES BASED ON CLIENTS RECOMMENDATIONS

NORTH

GRAPHIC SCALE

0 50 100

(IN FEET)

Northing	Easting	Elevation	Description
374318.9176	2558201.8369	583.44	sb3
373925.5661	2558060.9669	584.35	sb1
374531.3752	2558287.9594	584.00	sb2
374570.8415	2559190.0498	588.96	sb6
374346.0639	2558936.6630	585.42	sb4
374322.5602	2558940.7706	586.16	sb4
374044.5713	2557858.1109	583.02	sb5

MILWAUKEE MARINE PARCEL 426

PARKING

COMMERCIAL HEAT TREATING PARCEL 425

AREA UNDER CONSTRUCTION

CONC. PAD

OLD WOODEN WALL 78.4'+/-

CONCRETE WALL 112.4'

TO ABANDONED RAILWAY

SB-6

2654.69'
N 00-32-33 W

1' WIDE CONCRETE WALL 356.8'

15' WIDE WOODEN DECK OVER METAL STRUCTURE 270.2'

SB-2

AUL DAVIS
ESTORATION
LS 427 & 428

SHIP WRECK

KINNICKINNIC RIVER

S. FIRST ST. BRIDGE

METAL WALL 103'+/-

9' WIDE

1' WIDE CONC. WALL 153.6'

PARCEL 437
(DAN SKWARK, OWNER)

AREA UNDER CONSTRUCTION

SB-4

20'

CONC. BOAT RAMP

CONC. ABUT.

S. 1ST STREET

METAL WALL 221.2'

SB-3

OPEN STORAGE

EDWARD E. GILLEN CO.
PARCEL 432 & 433

LINCOLN WAREHOUSE
PARCEL 439

PARCEL 440
(BRIAN READ, OWNER)

GRAVEL STORAGE AREA

PARCEL 441
(GERRY STARR, OWNER)

MILWAUKEE
RCEL 429

336.3' TO BOX CULVERT OPENING

METAL WALL

DOCKS

SB-5

PEN
ORAGE

METAL WALL 417.6'

O.S.

RAITT CORPORATION
PARCEL 436

PARKING

PARKING

SB-1

C. HEADER OVER
BOX CULVERT

BRIDGE DECK

W. BECHER ST. BRIDGE

E. BECHER STREET

WALL

WALL

W

S

W

COLEMAN ENGINEERING CO.
635 CIRCLE DRIVE – IRON MOUNTAIN, MICHIGAN 49801 (906) 774-3440
OFFICE ALSO LOCATED AT: IRONWOOD, MICHIGAN 49938 (906) 932-5048

GROUND BORING LOCATION DRAWING
KINNICKINNIC RIVER
MILWAUKEE, WISCONSIN

NO.	DATE	REVISIONS	BY

SCALE	1"=50'
DATE	6/28/06
CAD DRAWING	06032 BORELOC
CAD PROJECT	CAD06032
JOB NUMBER	GD-06032-H
DRAWN BY	MRK
CHECKED	WR
APPROVED	WR
SURVEYED BY	CEC I.M.
DATE	-

F2

DRAWING NO.

APPENDIX C

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES (UNIFIED SOIL CLASSIFICATION SYSTEM)

COLEMAN ENGINEERING COMPANY

635 Circle Drive
Iron Mountain, Michigan 49801

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D-2487 – 83
(Based on 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 / Liquid limit – not dried < 0.75	OL	Organic clay[K,L,M,N]
					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 plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit – oven dried / Liquid limit – not dried < 0.75	OH	Organic clay[K,L,M,P]
					Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels 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

[D] Sands 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

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soils contains ≥ 15 % sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15 % gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29 % plus No. 200, add "with sand" or "with gravel", whichever is predominant.

[L] If soil contains ≥ 30 % plus No. 200, predominantly sand, add "sandy" to group name.

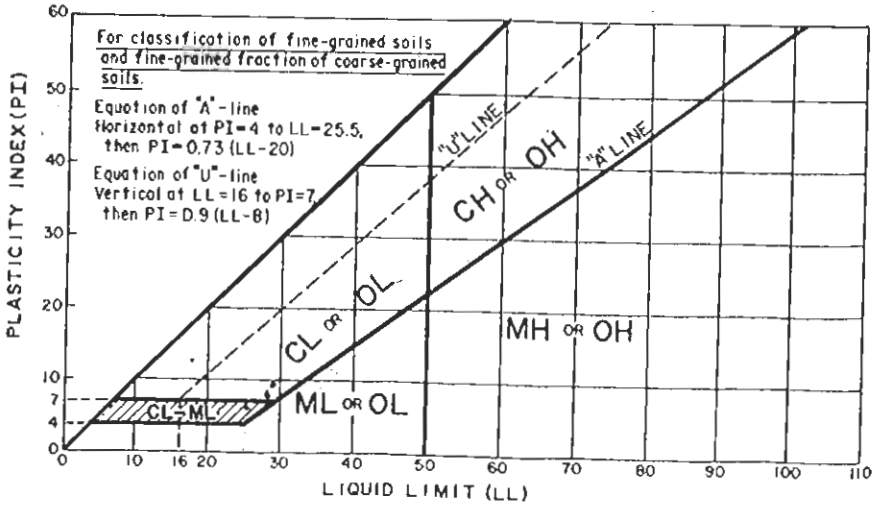
[M] If soil contains ≥ 30 % plus No. 200, predominately gravel, add "gravelly" to group name.

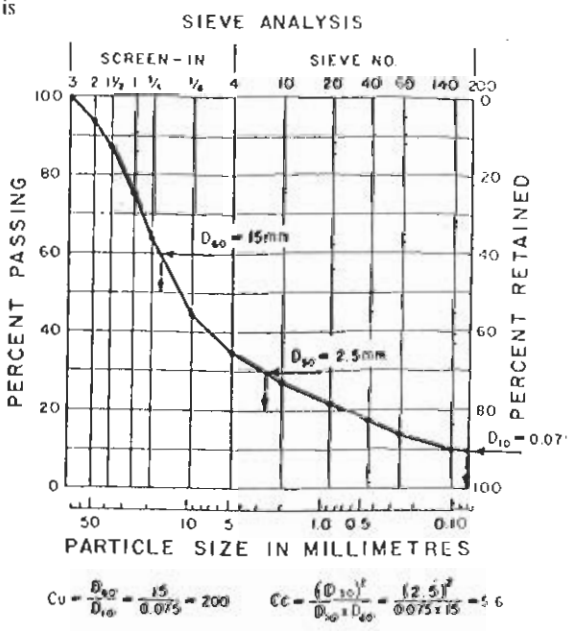
[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.





APPENDIX D

SOIL EXPLORATION-GENERAL NOTES AND LEGEND

SOIL EXPLORATION
General Notes and Legend

COLEMAN ENGINEERING COMPANY
635 CIRCLE DRIVE
IRON MOUNTAIN, MICHIGAN 49801
Telephone: (906)-774-3440 Fax: (906)-774-7776

Descriptive Soil Classification
ASTM D2487/2488

GRAINSIZE TERMINOLOGY

Soil Fraction		Particle Size	U.S. Standard Sieve Size
Boulders		Larger Than 12"	Larger than 12"
Cobbles		3" to 12"	3" to 12"
Gravel:	Coarse	3/4" to 3"	3/4" to 3"
	Fine	4.75mm to 3/4"	#4 to 3/4"
Sand:	Coarse	2.00mm to 4.75mm	#10 to #4
	Medium	0.42mm to 2.00mm	#40 to #10
	Fine	0.075mm to 0.42mm	#200 to #40
Silt		0.005mm to 0.075mm	Smaller than #200
Clay		Smaller than 0.005mm	Smaller than #200

Plasticity Characteristics differentiate between silt and clay

GENERAL TERMINOLOGY

Physical Characteristics
Color, moisture, grain shape, fineness, etc.
Major Constituents
Clay, silt, sand, gravel
Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
Glacial, alluvial, eolian, residual, etc.

RELATIVE DENSITY

Term	"N" Value
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Proportional Terms	Defining Range By Percentages of Weight
Trace	0%-5%
Some	5%-12%
With	12%-30%
-Y(ie. silty, sandy)	30%-50%

CONSISTENCY

Term	q_a (tons/sq.ft.)
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	Loss on Ignition
Non-Organic	Less than 4%
Organic Silt/Clay	4%-12%
Sedimentary Peat	12%-50%
Fibrous and Woody Peat	More than 50%

PLASTICITY

Term	Plastic Index
None to Slight	0-4
Slight	5-7
Medium	8-22
High to Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is typically driven 18" with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test. When driven 24" the "N" is the sum of the blows of the second and third 6" increment.

Symbols
DRILLING AND SAMPLING

RB-	Roller Bit
RC-	Rock Coring
RQD-	Rock Quality Designator
CW-	Clear Water
DM-	Drilling Mud
HSA-	Hollow Stem Auger
SSA-	Solid Stem Auger
HA-	Hand Auger
SPT-	Standard Penetration Test
2SS-	2" Diameter Split-Barrel Sample
3SS-	3" Diameter Split-Barrel Sample
2ST-	2" Diameter Shelby Tube Sample
3ST-	3" Diameter Shelby Tube Sample
PS-	3" Diameter Piston Tube Sample
AS-	Auger Sample
WS-	Wash Sample
NR-	No Recovery
VS-	Vane Shear Test
T-	Torvane Shear Test
BS-	Bag Sample
GS-	Grab Sample
q_a-	Penetrometer Reading, tsf
q_u-	Unconfined Strength, tsf

LABORATORY TEST

W-	Moisture Content, %
LL-	Liquid Limit, %
PL-	Plastic Limit, %
SL-	Shrinkage Limit, %
LI-	Loss on Ignition, %
DD-	Dry Density, pcf

WATER LEVEL MEASUREMENT

▽	Water Level During Drilling
▼	Water Level After Drilling
▽	Water Level at Time Shown 1
▼	Water Level at Time Shown 2
▽	Water Level at Time Shown 3
▼	Water Level at Time Shown 4
NW-	No Water Encountered
BCR-	Before Casing Removal
ACR-	After Casing Removal

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 1 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 373925.5661, E 2558060.9669
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-1
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 42.2
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 576.2
16. DATE HOLE: STARTED Apr 18, 06; COMPLETED Apr 18, 06
17. ELEVATION TOP OF HOLE: 584.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
582.9	1.5		FILL , topsoil, w gravel, asphalt, silt	0.5	0.0 1.5	2" SPT, 140# wt., 30" drop Coord. Reference: WI State Plane South Zone NAD 27 grid, Elev. Datum: IGLD 85 Sample 1, 0.0' - 1.5' 1-1-2 (3)
			FILL Soft, slightly plastic, medium brown sandy silt, trace gravel, trace asphalt chunks, trace roots, moist	0.6	1.5 3.0	Sample 2, 1.5' - 3.0' 1-1-1 (2)
581.2	3.2		3.2'	0.8	3.0 4.5	Sample 3, 3.0' - 4.5' 1-1-2 (3)
579.9	4.5		(ML) Very soft, slightly plastic, brown clayey SILT , trace sand, trace gravel, wet	0.3	4.5 6.0	Sample 4, 4.5' - 6.0' 1-1-2 (3)
578.4	6.0		(ML) Very soft, slightly plastic, brown clayey SILT , trace sand, trace gravel, wet	0.8	6.0 7.5	Sample 5, 6.0' - 7.5' 2-1-1 (2)
577.4	7.0		7.0'			
576.9	7.5		(OL) Very soft, slightly plastic, dark gray ORGANIC SILT ,some sand, trace gravel, trace wood, wet	1.0	7.5 9.0	Sample 6, 7.5' - 9.0' WOH-WOH-7 (7)
575.4	9.0		(OL) Very soft, slightly plastic, dark gray ORGANIC SILT , some sand, trace gravel, trace wood, wet	0.6	9.0 10.5	Sample 7, 9.0' - 10.5' 8-2-3 (5) Layer of wood at 10.1' to 10.2'
574.2	10.2		10.2'			
573.9	10.5		(SM) Loose, dark gray, SILTY SAND , fine to coarse, with gravel, trace organics, wet	1.3	10.5 12.0	Sample 8, 10.5' - 12.0' 1-1-1 (2)
572.4	12.0		10.5' (OH) ORGANIC SILT , highly plastic, with sand, some clay			
570.9	13.5		(OL) Very soft, slightly plastic, dark gray ORGANIC SILT , trace wood, wet	1.0	12.0 13.5	Sample 9, 12.0' - 13.5' 1-1-1 (2)
569.4	15.0		(OL) Very soft, slightly plastic, dark gray ORGANIC SILT , trace wood, wet	0.5	13.5 15.0	Sample 10, 13.5' - 15.0' 1-1-1 (2)
568.2	16.2		(OL) Very soft, slightly plastic, dark gray ORGANIC SILT , trace wood, wet 16.2'	1.0	15.0 16.5	Sample 11, 15.0' - 16.5' 2-2-6 (8)
567.9	16.5		(SP-SM) Loose, light brown fine to coarse SAND , some silt, trace gravel, wet	1.0	16.5 18.0	Sample 12, 16.5' - 18.0' 1-1-2 (3)
566.4	18.0		16.5' (OH) ORGANIC SILT , highly plastic, with sand, with clay			
565.5	18.9		(OL) Very soft, slightly plastic, greenish gray ORGANIC SILT , some shells, trace wood, wet 18.9'	1.0	18.0 19.5	Sample 13, 18.0' - 19.5' WOH-3-3 (6)
564.6	19.8		(SP-SM) Loose, light brown, fine to coarse SAND , some silt, trace gravel, trace organics, wet 19.8'	1.0		Sample 14, 19.5' - 21.0'

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 2 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 373925.5661, E 2558060.9669
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-1
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 42.2
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 576.2
16. DATE HOLE: STARTED Apr 18, 06; COMPLETED Apr 18, 06
17. ELEVATION TOP OF HOLE: 584.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
563.4	21.0		*(CL) Stiff, plastic, brown CLAY, trace gravel, trace sand, moist*		19.5 21.0	*2-3-4* *(7)* *pen.=1.25, torvane=1.2*
562.4	22.0					
560.9	23.5		*(CL) Very stiff, plastic brown CLAY, trace gravel, trace sand, moist*	*NR* *0.6*	*22.0* *23.5*	*Sample 15, 22.0' - 23.5'* *5-4-6* *(10)* *pen.=3.5, torvane=1.25 (small wheel)*
557.4	27.0					
555.1	29.3		*(CL) Very stiff, plastic brown CLAY, trace gravel, trace sand, moist*	*2.1*	*27.0* *29.3*	*Sample 16, 27.0' - 29.3'* *undisturbed* *pen.=1.75, torvane=3.1*
552.4	32.0					
550.9	33.5		*(CL) Very stiff, plastic brown CLAY, trace gravel, trace sand, moist*	*1.0*	*32.0* *33.5*	*Sample 17, 32.0' - 33.5'* *6-6-9* *(15)* *pen.=0.7, torvane=2.1*
547.4	37.0					
545.9	38.5		*(CL) Very stiff, plastic brown CLAY, trace gravel, trace sand, moist*	*1.1*	*37.0* *38.5*	*Sample 18, 37.0' - 38.5'* *1-2-50/0.3, bouncing* *(-)* *pen.=1.5, torvane=3.4*
						Driller's note: cobble/boulder 39.0' to 42.2'; hard drilling 39.0' to 42.2'

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 3 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 373925.5661, E 2558060.9669
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-1
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 42.2
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 576.2
16. DATE HOLE: STARTED Apr 18, 06; COMPLETED Apr 18, 06
17. ELEVATION TOP OF HOLE: 584.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
542.2	42.2		*End of Boring - Auger Drilling Refusal (Limestone)*			*Sample 19, 42.2' - 43.5' 50/0.0 - - sample of crushed bedrock from inside augers* *After 24 hours, water level 8.2'*

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 1 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374531.3881, E 2558287.7812
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-2
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 51.0
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 579.8
16. DATE HOLE: STARTED Apr 27, 06; COMPLETED Apr 27, 06
17. ELEVATION TOP OF HOLE: 584.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
583.6	0.4		GRAVEL 0.4'	0.6	0.0 2.0	2" SPT, 140# wt., 30" drop Coord. Reference: WI State Plane South Zone NAD 27 grid, Elev. Datum: IGLD 85 Sample 1, 0.0' - 2.0' 5-5-3-3 (8)
582.0	2.0		(FILL), dark brown, fine to coarse, silty sand, trace gravel, trace roots, loose, moist	1.2	2.0 4.0	Rock stuck in shoe Sample 2, 2.0' - 4.0' 6-3-3-4 (6)
580.0	4.0		FILL, medium dense, brown, fine to coarse sand, some gravel, some silt, wet at 5.4'	0.9	4.0 6.0	Sample 3, 4.0' - 6.0' 8-12-8-10 (20) Rock stuck in shoe Water at 4.2'
578.0	6.0		6.0'	1.0	6.0 8.0	Sample 4, 6.0' - 8.0' 7-9-8-9 (17)
577.0	7.0		(ML) Soft, slightly plastic, brown SILT, trace sand, trace gravel, wet 7.0'			
576.0	8.0		(SP-SM) Medium dense, dark black, fine to coarse SAND, some silt, trace gravel, trace wood, wet	1.1	8.0 10.0	Sample 5, 8.0' - 10.0' 8-6-4-3 (10)
574.0	10.0		(SP-SM) Medium dense, greenish-brown, fine to coarse SAND, some silt, trace gravel, wet	0.6	10.0 12.0	Sample 6, 10.0' - 12.0' 5-4-1-1 (5)
572.0	12.0		(SP-SM) Loose, grayish-brown, fine to coarse SAND, some silt, trace gravel, wet	1.3	12.0 14.0	Sample 7, 12.0' - 14.0' 1/1-1/1' (1)
570.8	13.2		13.2'			
570.0	14.0		(ML) Very soft, slightly plastic, dark brown SILT, trace gravel, trace sand, trace organics, wet	0.5	14.0 16.0	Sample 8, 14.0' - 16.0' WOH/1.5'-1 (-)
568.0	16.0		(ML) Very soft, slightly plastic, dark brown SILT, trace sand, trace wood, wet	1.4	16.0 18.0	Sample 9, 16.0' - 18.0' WOH/2' (-)
566.0	18.0		± 18.0'	2.1	18.0 20.3	Sample 10, 18.0' - 20.3' Undisturbed
565.5	18.5		(SP-SM) Medium dense, dark brown, fine to coarse SAND, some silt, wet 18.5'			
			(OH) ORGANIC SILT, gray-black, highly plastic, with sand, some clay			

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 2 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374531.3881, E 2558287.7812
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-2
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 51.0
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 579.8
16. DATE HOLE: STARTED Apr 27, 06; COMPLETED Apr 27, 06
17. ELEVATION TOP OF HOLE: 584.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
563.7	20.3		20.3'			
559.5	24.5		24.5'			
			(ML) Very soft, slightly to medium plastic, greenish-brown clayey SILT, trace sand, trace shells, wet	1.4	24.5 26.5	Sample 11, 24.5' - 26.5' 1/1-1-1 (1)
557.5	26.5					
			29.5'			
554.5	29.5		(OL) Very soft, non-plastic to slightly plastic, greenish-brown ORGANIC SILT, some wood, some shells, trace sand, wet	1.4	29.5 31.5	Sample 12, 29.5' - 31.5' 1-2/1-1 (1)
552.5	31.5					
549.5	34.5					
			(OL) Very soft, slightly plastic, greenish-brown ORGANIC SILT, some wood, trace shells, trace sand, wet	1.4	34.5 36.5	Sample 13, 34.5' - 36.5' WOH-1-2-1 (3)
547.5	36.5					
			(OL) Soft, slightly plastic, greenish-brown ORGANIC SILT, trace sand, trace fine gravel, trace shells, wet	2.1	36.5 38.8	Sample 14, 36.5' - 38.8' Undisturbed
545.2	38.8					
544.5	39.5					
			(OL) Very soft, non-plastic to slightly plastic,	1.4		Sample 15, 39.5' - 41.5'

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 3 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374531.3881, E 2558287.7812
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-2
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 51.0
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 579.8
16. DATE HOLE: STARTED Apr 27, 06; COMPLETED Apr 27, 06
17. ELEVATION TOP OF HOLE: 584.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
542.5	41.5		*greenish-brown ORGANIC SILT , some wood, trace shells, trace sand, wet*		39.5 41.5	*1-2-1-2* *(3)*
539.5	44.5		*44.5′*			
			(OL) ORGANIC SILT , sandy, with clay	*1.3*	44.5 46.5	*Sample 16, 44.5′ - 46.5′* *1-2-2-2* *(4)*
537.5	46.5					
534.5	49.5					
			(ML) Soft, slightly plastic, light brown SILT , trace wood, trace sand, wet	*1.3*	49.5 51.0	*Sample 17, 49.5′ - 51.0′* *WOH-1-2-1* *(3)*
533.8	50.2		*50.2′*			
533.2	50.8		*(SM) Very loose, grayish-brown, fine to coarse SAND , with silt, wet*			
533.0	51.0		*50.8′*			
			(ML) Very soft, slightly plastic, grayish-brown SILT , trace sand, trace wood, wet			
			END OF BORING			

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 1 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374318.9176, E 2558201.8369
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-3
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 51.5
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 18; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 574.4
16. DATE HOLE: STARTED Apr 19, 06; COMPLETED Apr 20, 06
17. ELEVATION TOP OF HOLE: 583.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOVERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
583.0	0.4		*(Fill) very dense, dark brown, fine to coarse* SAND *, gravel, with silt, trace asphalt, trace concrete, moist* 0.4'	0.3	0.0 1.5	*2" SPT, 140# wt., 30" drop* *Coord. Reference: WI State Plane South Zone* *NAD 27 grid, Elev. Datum: IGLD 85* *Sample 1, 0.0' - 1.5'* *50/0.4"* *(-)* *Note: Did not sample 1.5'-3.0' in concrete rubble*
580.8	2.6		*CONCRETE RUBBLE* 2.6'			
580.4	3.0		*(ML) very soft, slightly plastic, dark brown,* SILT *, trace gravel, trace sand, moist*			
			(ML) very soft, slightly plastic, dark brown, SILT *, trace gravel, trace sand, moist*	0.3	3.0 4.5	*Sample 2, 3.0' - 4.5'* *1-1-1* *(2)*
578.9	4.5		*(ML) very soft, slightly plastic, dark brown,* SILT *, trace gravel, trace sand, moist*	NR	4.5 6.0	*Sample 3, 4.5' - 6.0'* *1-2-2* *(4)* *Note: Pushed rock in shoe*
577.4	6.0		*(ML) very soft, slightly plastic, dark brown,* SILT *, trace gravel, trace sand, moist*	0.5	6.0 7.5	*Sample 4, 6.0' - 7.5'* *1-1-1* *(2)*
575.9	7.5		*(ML) soft, slightly plastic, dark brown,* SILT *, trace gravel, trace sand, moist* 8.5'	0.9	7.5 9.0	*Sample 5, 7.5' - 9.0'* *3-3-3* *(6)*
574.9	8.5		*(SM) loose, black, fine to coarse,* SILTY SAND *, trace gravel, trace organics, moist* 9.0'			
574.4	9.0		*(OL) soft, slightly plastic, dark greenish brown,* ORGANIC SILT *, trace sand, trace organics, wet*	1.0	9.0 10.5	*Sample 6, 9.0' - 10.5'* *4-2-3* *(5)*
572.9	10.5		*(OL) soft, slightly plastic, dark greenish brown,* ORGANIC SILT *, trace sand, trace organics, wet* 11.4'	1.3	10.5 12.0	*Sample 7, 10.5' - 12.0'* *17-11-9* *(20)*
572.0	11.4		*WOOD* 12.0'			
571.4	12.0		*(OL) soft, slightly plastic, dark greenish brown,* ORGANIC SILT *, trace gravel, trace sand, trace organics, wet*	1.0	12.0 13.5	*Sample 8, 12.0' - 13.5'* *4-3-3* *(6)*
569.9	13.5		*(OL) very soft, slightly plastic, dark greenish brown,* ORGANIC SILT *, trace gravel, trace sand, trace organics, wet*	0.9	13.5 15.0	*Sample 9, 13.5' - 15.0'* *2-2-2* *(4)*
568.4	15.0		*(OL) very soft, slightly plastic, dark greenish brown,* ORGANIC SILT *, trace gravel, trace sand, trace organics, wet*	0.6	15.0 16.5	*Sample 10, 15.0' - 16.5'* *2-2-2* *(4)*
566.9	16.5		*(OL) soft, slightly plastic, dark greenish brown,* ORGANIC SILT *, trace gravel, trace sand, trace organics, wet*	0.7	16.5 18.0	*Sample 11, 16.5' - 18.0'* *2-2-3* *(5)*
565.4	18.0		*(OL) soft, slightly plastic, dark greenish brown,* ORGANIC SILT *, sandy, with clay*	1.0	18.0 19.5	*Sample 12, 18.0' - 19.5'* *3-3-4* *(7)*
563.9	19.5		*(OL) soft, slightly plastic, dark greenish brown,*	1.0		*Sample 13, 19.5' - 21.0'*

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 2 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374318.9176, E 2558201.8369
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-3
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 51.5
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 18; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 574.4
16. DATE HOLE: STARTED Apr 19, 06; COMPLETED Apr 20, 06
17. ELEVATION TOP OF HOLE: 583.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
562.4	21.0		*ORGANIC SILT , trace gravel, trace sandy, with clay, trace shells, wet*		*19.5 21.0*	*5-4-4 (8)*
559.9	23.5					
			(OL) soft, slightly plastic, dark greenish brown, ORGANIC SILT , trace gravel, trace sand, trace shells, wet	*1.1*	*23.5 25.0*	*Sample 14, 23.5' - 25.0' 7-7-4 (11)*
558.5	24.9		*24.9'*			
558.4	25.0		*(CL) very soft, medium plastic, medium brown, CLAY , trace gravel, trace sand, wet*			
			25.0'			
554.9	28.5		*(ML) medium stiff, non to slightly plastic, medium brown, SANDY SILT , trace wood, wet*	*NR 0.4*	*28.5 30.0*	*Sample 15, 28.5' - 30.0' 15-13-19 (32) Note: Went down twice with sampling spoon*
553.4	30.0					
549.9	33.5		*(CL) stiff, medium plastic, medium brown, SILTY CLAY , with sand, trace gravel, trace organics, wet*	*1.3*	*33.5 35.0*	*Sample 16, 33.5' - 35.0' 6-4-5 (9) Pen: 0.5 Tor: 1.0*
548.4	35.0					
544.9	38.5			*NR*	*38.5 40.8*	*Sample 17, 38.5' - 40.8' 3" Thin-walled tube Undisturbed*

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 3 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374318.9176, E 2558201.8369
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-3
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 51.5
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 18; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 574.4
16. DATE HOLE: STARTED Apr 19, 06; COMPLETED Apr 20, 06
17. ELEVATION TOP OF HOLE: 583.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
542.6	40.8					
542.4	41.0					
				NR	41.0 43.3	*Sample 18, 41.0' - 43.3'* *3" Thin-walled tube*
540.1	43.3					
539.9	43.5					
			(CL) very stiff, medium plastic, medium brown, CLAY , with silt, with sand, trace gravel, wet	1.3	43.5 45.0	*Sample 19, 43.5' - 45.0'* *2-2-5* *(7)* *Pen: 0.75* *Tor: 2.1*
538.4	45.0					
			(CL) very soft, medium plastic, medium brown, CLAY , some silt, trace gravel, wet	2.1	45.0 47.3	*Sample 20, 45.0' - 47.3'* *Pen: 0.75* *Tor: 1.9*
536.1	47.3					
534.9	48.5					
			(CL) stiff, medium plastic, medium brown, CLAY , some silt, some sand, trace gravel, wet	1.4	48.5 50.0	*Sample 21, 48.5' - 50.0'* *6-15-20* *(35)* *Pen: 1.2* *Tor: 1.75*
533.4	50.0					
531.9	51.5					
			END OF BORING			

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 1 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374346.0639, E 2558936.6630
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-4
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 51.0
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 579.0
16. DATE HOLE: STARTED Apr 26, 06; COMPLETED Apr 26, 06
17. ELEVATION TOP OF HOLE: 585.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
585.0	0.4		*TOPSOIL* 0.4′	1.1	0.0 2.0	*2″ SPT, 140# wt., 30″ drop* *Coord. Reference: WI State Plane South Zone* *NAD 27 grid, Elev. Datum: IGLD 85* *Sample 1, 0.0′ - 2.0′* *2-4-6-5* *(10)*
583.4	2.0		*(Fill) CONCRETE CHUNKS* 2.0′			
			(Fill) medium dense, yellowish brown, fine to coarse, silty sand, with broken concrete, trace roots, moist 3.3′	1.6	2.0 4.0	*Sample 2, 2.0′ - 4.0′* *8-9-5-6* *(14)*
582.1	3.3		*(ML) soft, slightly plastic, dark brown, SILT, some sand, trace roots, moist*			
581.4	4.0		*(ML) soft, slightly plastic, dark brown, SILT, some sand, trace roots, trace gravel, wet at 5.6′*	1.1	4.0 6.0	*Sample 3, 4.0′ - 6.0′* *7-8-3-2* *(11)*
579.4	6.0		*(ML) very soft, slightly plastic, medium brown, SILT, trace sand, trace wood, wet* 8.0′	0.4	6.0 8.0	*Sample 4, 6.0′ - 8.0′* *1-2-1-2* *(3)*
577.4	8.0		*(PT) very soft, non to slightly plastic, medium brown, PEAT, with silt, trace sand, some wood and roots, trace shells, wet*	1.1	8.0 10.0	*Sample 5, 8.0′ - 10.0′* *WOH/2′* *(0)*
575.4	10.0		*(PT) very soft, fibrous, medium brown, PEAT, some silt, trace sand, trace shells, wet*	1.2	10.0 12.0	*Sample 6, 10.0′ - 12.0′* *WOH/1.5′-2* *(0)*
573.4	12.0		*(PT) PEAT*	0.8	12.0 14.0	*Sample 7, 12.0′ - 14.0′* *WOH/1′-1-1* *(1)*
571.9	13.5		13.5′			
571.6	13.8		*(SP-SM) very loose, grayish brown, fine to coarse, SAND, some silt, wet* 13.8′			
			(PT) very soft, fibrous, medium brown to greenish-brown, PEAT, with silt, trace sand, some shells, wet	1.7	14.0 16.0	*Sample 8, 14.0′ - 16.0′* *WOH/1.5′-1* *(0)*
569.4	16.0		16.0′			
			(OL) very soft, slightly plastic, greenish brown, ORGANIC SILT, trace sand, some wood, trace shells, wet	1.8	16.0 18.0	*Sample 9, 16.0′ - 18.0′* *WOH/2′* *(0)*
567.4	18.0					
			(OL) very soft, slightly plastic, greenish brown, ORGANIC SILT, trace sand, trace wood, trace shells, wet	1.7	18.0 20.0	*Sample 10, 18.0′ - 20.0′* *WOH/1.5′-1* *(0)*
565.4	20.0					

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 2 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374346.0639, E 2558936.6630
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-4
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 51.0
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 579.0
16. DATE HOLE: STARTED Apr 26, 06; COMPLETED Apr 26, 06
17. ELEVATION TOP OF HOLE: 585.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
561.4	24.0					
561.0	24.4		*(OL) very soft, slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace wood, trace shells, wet* 24.4'	1.4	24.0 26.0	*Sample 11, 24.0' - 26.0' WOH/2' (0) Pen: 0.0 Tor: 0.4*
559.4	26.0		*(OL) very soft, medium plastic, greenish brown, ORGANIC SILT , trace wood, some shells, wet*			
557.1	28.3		*(CH) very soft, medium plastic, gray, FAT CLAY , some shells, trace organic material, wet*	2.3	26.0 28.3	*Sample 12, 26.0' - 28.3' 3" thin-walled tube Pen: 0.25 Tor: 1.25*
556.4	29.0					
554.4	31.0		*(OL) very soft, non to slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace wood, trace shells, wet*	1.0	29.0 31.0	*Sample 13, 29.0' - 31.0' WOH/1'-1-1 (1)*
551.4	34.0		34.0'			
549.4	36.0		*(SP-SM) very loose, grayish brown, fine to coarse, SAND , some silt, trace gravel, wet*	1.1	34.0 36.0	*Note: Hit gas pocket at 34.0'. Shut down until a gas meter brought on site. Readings from four-gas meter were 0 ppm Sample 14, 34.0' - 36.0' WOH-1-1-2 (2)*
546.4	39.0					
			(SM) loose, grayish brown, fine to coarse, SAND , some silt, trace gravel, wet	1.3 1.6	39.0 41.0	*Oxygen = 20.8%, all other gas readings 0.0 ppm Sample 15, 39.0' - 41.0'*

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 3 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374346.0639, E 2558936.6630
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-4
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 51.0
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 579.0
16. DATE HOLE: STARTED Apr 26, 06; COMPLETED Apr 26, 06
17. ELEVATION TOP OF HOLE: 585.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
545.3	40.1		40.1′			3-4-4-4
			(CL) very stiff, medium plastic, light brown, CLAY, trace silt, trace sand, trace gravel, wet		39.5 39.5	(8) Pen: 1.2 Tor: 2.5
544.4	41.0		± 41.0′			
			(CL) stiff, gray-brown, CLAY, sandy, slightly plastic	1.6	41.0 43.3	Sample 16, 41.0′ - 43.3′ Undisturbed Pen: 0.5 Tor: 1.1 Oxygen = 20.8%, all other gas readings 0.0 ppm
542.9	42.5		42.5′			
			(CL) stiff, medium plastic, gray brown, CLAY, sandy			
542.1	43.3					
541.4	44.0					
			(CL) stiff, medium plastic, light brown, CLAY, trace silt, trace sand, trace gravel, wet	1.7	44.0 46.0	Sample 17, 44.0′ - 46.0′ 5-4-5-4 (9) Pen: 0.5 Tor: 1.75
539.4	46.0					
536.4	49.0					
			(CL) very stiff, medium plastic, light brown, CLAY, trace silt, trace sand, wet	1.5	49.0 51.0	Oxygen = 20.8%, all other gas readings 0.0 ppm Sample 18, 49.0′ - 51.0′ 3-4-4-5 (8) Pen: 1.1 Tor: 3.1
534.4	51.0		51.0′			
			End of Boring			Note: Water level 6.4′ after 12 hours

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 1 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374044.5713, E 2557858.1109
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-5
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 46.5
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 14; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 577.8
16. DATE HOLE: STARTED Apr 25, 06; COMPLETED Apr 25, 06
17. ELEVATION TOP OF HOLE: 583.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
582.4	0.6		*CONCRETE* 0.6′	1.0	0.0 2.0	*2″ SPT, 140# wt., 30″ drop* *Coord. Reference: WI State Plane South Zone* *NAD 27 grid, Elev. Datum: IGLD 85* *Sample 1* *Hand dug 2.0′ to check for electric lines to marina lights*
581.0	2.0		*(Fill) dark black, fine to coarse, silty sand, some gravel, some man-made bolts, trace roots, moist*			
579.0	4.0		*(Fill) dense, dark black, fine to coarse, silty sand, trace concrete, trace gravel, trace wood and roots, moist*	1.6	2.0 4.0	*Sample 2, 2.0′ - 4.0′* *7-10-15-14* *(25)*
			(Fill) very dense, black, fine to coarse, silty sand, trace gravel, trace wood, wet at 5.2′	1.2	4.0 6.0	*Sample 3, 4.0′ - 6.0′* *11-33-27-9* *(60)*
577.0	6.0		*(Fill) loose, black, fine to coarse, silty sand, trace gravel, trace brick, wet* 7.1′	1.4	6.0 8.0	*Sample 4, 6.0′ - 8.0′* *5-2-2-1* *(4)*
575.9	7.1		*(OL) very soft, slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace wood, trace shells, wet*			
575.0	8.0		*(OL) very soft, slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace wood, trace shells, trace gravel, wet*	1.8	8.0 10.0	*Sample 5, 8.0′ - 10.0′* *1-woh-woh-1* *(0)*
573.0	10.0		*(OL) very soft, slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace wood and roots, trace shells, trace gravel, wet*	1.2	10.0 12.0	*Sample 6, 10.0′ - 12.0′* *1-1-1-1* *(2)*
571.0	12.0		*(OL) soft, slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace gravel, trace wood and roots, trace shells, wet*	1.2	12.0 14.0	*Sample 7, 12.0′ - 14.0′* *9-6-2-2* *(8)*
569.0	14.0		*(OH) very soft, slightly plastic, gray, ORGANIC CLAY , with sand and shells, some peat and wood*	1.7	14.0 16.3	*Sample 8, 14.0′ - 16.3′* *Undisturbed* *3″ Thin-walled tube*
566.7	16.3					
566.5	16.5		*(OL) very soft, slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace wood and roots, trace shells, wet*	1.8	16.5 18.5	*Sample 9, 16.5′ - 18.5′* *woh-woh-1-1* *(1)*
564.5	18.5		*(OL) very soft, slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace wood and roots, trace shells, wet*	0.7	18.5 20.5	*Sample 10, 18.5′ - 20.5′* *1-1-1-1* *(2)*

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 2 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374044.5713, E 2557858.1109
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-5
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 46.5
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 14; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 577.8
16. DATE HOLE: STARTED Apr 25, 06; COMPLETED Apr 25, 06
17. ELEVATION TOP OF HOLE: 583.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
562.5	20.5					
559.0	24.0		(OL) very soft, slightly plastic, greenish brown, ORGANIC SILT, trace wood and roots, trace shells, wet	1.8	24.0 26.0	Sample 11, 24.0' - 26.0' woh-woh-2-2 (2)
557.0	26.0					
554.0	29.0		(OL) soft, slightly plastic, greenish brown, ORGANIC SILT, trace sand, trace wood and roots, trace shells, wet	1.7	29.0 31.0	Sample 12, 29.0' - 31.0' 2-2-3-5 (5)
552.0	31.0					
549.0	34.0		(OL) soft, slightly plastic, greenish brown, ORGANIC SILT, with sand, with clay, trace wood, trace shells, wet	1.3	34.0 36.0	Sample 13, 34.0' - 36.0' 2-3-3-3 (6)
547.0	36.0					
544.0	39.0		(OL) soft, slightly plastic, greenish brown, ORGANIC SILT, some sand, trace wood, trace shells, wet	1.4	39.0 41.0	Sample 14, 39.0' - 41.0' 2-2-5-16 (7)

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 3 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374044.5713, E 2557858.1109
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-5
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 46.5
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 14; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 577.8
16. DATE HOLE: STARTED Apr 25, 06; COMPLETED Apr 25, 06
17. ELEVATION TOP OF HOLE: 583.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
542.6	40.4		40.4'			
542.2	40.8		(SP-SM) loose, grayish brown, fine to coarse, SAND, some silt, trace gravel, wet			
542.0	41.0		40.8' WOOD 41.0'			
539.0	44.0		(SP-SM) very dense, grayish brown, SAND, fine to coarse, some silt, trace gravel, wet	1.0	44.0 46.0	Sample 15, 44.0' - 46.0' 32-34-50/.3' (-)
537.8	45.2		45.2' LIMESTONE, weathered			
537.0	46.0					
536.5	46.5		46.5' Auger Refusal and End of Boring			

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 1 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374570.8415, E 2559190.0498
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-6
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 53.8
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 576.0
16. DATE HOLE: STARTED Apr 21, 06; COMPLETED Apr 24, 06
17. ELEVATION TOP OF HOLE: 589.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
588.5	0.5		TOPSOIL 0.5'	0.6	0.0 1.5	2" SPT, 140# wt., 30" drop Coord. Reference: WI State Plane South Zone NAD 27 grid, Elev. Datum: IGLD 85 Sample 1, 0.0' - 1.5' 1-1-1 (2)
587.5	1.5		(ML) very soft, slightly plastic, dark brown, SILT, trace gravel, trace sand, trace organics, moist			
			(ML) very soft, slightly plastic, dark brown, SILT, trace gravel, trace sand, trace organics, moist	0.8	1.5 3.0	Sample 2, 1.5' - 3.0' 3-5-3 (8)
586.0	3.0		(ML) very soft, slightly plastic, dark brown, SILT, trace gravel, trace sand, trace organics, moist 4.2'	0.9	3.0 4.5	Sample 3, 3.0' - 4.5' 3-3-3 (6)
584.8	4.2		(SM) loose, medium brown, fine to coarse, SILTY SAND, trace gravel, moist 4.5'	NR 0.3	4.5 6.0 4.8 4.8	Sample 4, 4.5' - 6.0' 3-3-4 (7)
584.5	4.5		(ML) soft, slightly plastic, medium brown, SILT, trace gravel, trace sand, moist			
583.0	6.0		(ML) soft, slightly plastic, medium brown, SILT, trace gravel, trace sand, moist 7.0'	0.9	6.0 7.5	Sample 5, 6.0' - 7.5' 4-4-5 (9)
582.0	7.0		(SP-SM) loose, light brown, fine to coarse, SAND, some silt, trace gravel, trace roots, moist	1.0	7.5 9.0	Sample 6, 7.5' - 9.0' 6-5-4 (9)
581.5	7.5		(SP-SM) loose, light brown, fine to coarse SAND, some silt, trace gravel, trace roots, moist			
580.0	9.0		(SP-SM) very loose, light brown, fine to coarse, SAND, some silt, trace gravel, trace roots, moist 10.1'	1.1	9.0 10.5	Sample 7, 9.0' - 10.5' 2-2-1 (3)
578.9	10.1		(PT) black, PEAT, silty 10.5'			
578.5	10.5		(SM) loose, grayish brown, fine to coarse, SILTY SAND, trace gravel, trace organics, wet	1.2	10.5 12.0	Sample 8, 10.5' - 12.0' 2-1-2 (3)
577.0	12.0		(ML) very soft, slightly plastic, grayish brown, SANDY SILT, trace gravel, trace organics, wet	1.4	12.0 13.5	Sample 9, 12.0' - 13.5' 2-1-1 (2) Note: Water level after 48 hrs.: 13.0
575.5	13.5		(ML) very soft, slightly plastic, grayish brown, SANDY SILT, trace gravel, trace wood and organics, wet 14.7'	1.6	13.5 15.5	Sample 10, 13.5' - 15.5' woh-1-2-3 (3)
574.3	14.7		(SM) very loose, grayish brown, fine to coarse, SILTY SAND, trace gravel, trace organics, wet			
573.5	15.5		(SP-SM) very loose, light brown, fine to coarse, SAND, some silt, trace gravel, wet	0.9	15.5 17.5	Sample 11, 15.5' - 17.5' 1-2-1-2 (3)
571.5	17.5		(SP-SM) loose, light brown, fine to coarse, SAND, some silt, trace gravel, trace wood, wet	0.9	17.5 19.5	Sample 12, 17.5' - 19.5' 3-2-2-3 (4)
569.5	19.5		(SP-SM) loose, light brown, fine to coarse,	1.4		Sample 13, 19.5' - 21.5'

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 2 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374570.8415, E 2559190.0498
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-6
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 53.8
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 576.0
16. DATE HOLE: STARTED Apr 21, 06; COMPLETED Apr 24, 06
17. ELEVATION TOP OF HOLE: 589.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOV-ERY e	SAMPLE INTERVAL - f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SAND , some silt, trace gravel, trace clay, wet		19.5 21.5	3-2-2-3 (4)
567.5	21.5					
564.5	24.5					
			(SP-SM) loose, light brown, fine to coarse, SAND , some silt, trace gravel, wet	1.5	24.5 26.5	*Sample 14, 24.5' - 26.5'* *2-1-1-2* *(2)*
562.7	26.3		*26.3'*			
562.5	26.5		*(ML) very soft, non to slightly plastic, grayish brown, SANDY SILT , trace gravel, wet*			
			26.5'			
559.5	29.5					
			(SP-SM) very loose, grayish brown, fine to coarse, SAND , some silt, trace gravel, wet	1.5	29.5 31.5	*Sample 15, 29.5' - 31.5'* *1-1-2-2* *(3)*
557.5	31.5					
554.5	34.5					
			(SP-SM) very loose, grayish brown, fine to coarse, SAND , some silt, trace gravel, wet	1.8	34.5 36.5	*Sample 16, 34.5' - 36.5'* *3-2-2-2* *(4)* *Pen: 0.25* *Tor: 0.5*
553.3	35.7		*35.7'*			
553.1	35.9		*(OL) soft, slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace shells, wet*			
553.0	36.0					
552.5	36.5		*35.9'*			
			(SP-SM) very loose, grayish brown, fine to coarse, SAND , some silt, trace gravel, wet	1.3	36.5 38.8	*Sample 17, 36.5' - 38.8'* *3" thin-walled tube undisturbed*
552.0	37.0		*36.0'*			
			(OL) soft, slightly plastic, greenish brown, ORGANIC SILT , trace sand, trace shells, wet			
			±36.5'			
			(SP) brown, fine to coarse, SAND , trace silt, wet			
550.3	38.7		*±37.0'*			
			(SC) brown, fine to coarse, CLAYEY SAND , wet			
549.5	39.5		*±38.7'*			
			(OH) soft, medium, plastic, greenish brown,	1.1		*Sample 18, 39.5' - 41.5'*

DRILLING LOG

DIVISION: Great Lakes and Ohio River

INSTALLATION: Detroit

SHEET 3 OF 3 SHEETS

1. PROJECT: Kinnickinnic River Stability Analysis and Dredging Study
2. LOCATION (Coordinates or Station): N 374570.8415, E 2559190.0498
3. DRILLING AGENCY: Coleman Engineering Co.
4. HOLE NO. (As shown on drawing title and file number): S-6
5. NAME OF DRILLER: Randy Ochs
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED 0.0 DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 0
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 53.8
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 85
12. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 576.0
16. DATE HOLE: STARTED Apr 21, 06; COMPLETED Apr 24, 06
17. ELEVATION TOP OF HOLE: 589.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	SAMPLE RECOVERY e	SAMPLE INTERVAL f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
547.5	41.5		*ORGANIC SILT, some clay, moist*		39.5 41.5	*1-1-2-3* *(3)*
544.5	44.5					
			(OL) soft, slightly plastic, greenish brown, ORGANIC SILT, trace sand, trace gravel, trace shells, moist	*1.0*	44.5 46.5	*Sample 19, 44.5′ - 46.5′* *1-2-3-5* *(5)*
542.5	46.5					
539.5	49.5					
			(OL) soft, slightly plastic, greenish brown, ORGANIC SILT, trace shells, moist	*1.5*	49.5 51.5	*Sample 20, 49.5′ - 51.5′* *2-2-4-5* *(6)*
537.5	51.5					
			(OL) soft, slightly plastic, greenish brown, ORGANIC SILT, trace shells, trace wood, moist	*2.0*	51.5 53.8	*Sample 21, 51.5′ - 53.8′* *3″ thin-walled tube* *undisturbed*
537.0	52.0		± 52.0′			
			(CL) soft, very plastic, greenish brown, CLAY, wet			
536.0	53.0		± 53.0′			
535.2	53.8		53.8′			
			End of Boring			

APPENDIX E

ROUGH AND FINAL BORING LOGS

Hole No. S-1

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 1 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and title number): S-1
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL [X] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 42.2
10. SIZE AND TYPE OF BIT: 4¼" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER: 8.2'
16. DATE HOLE: STARTED 4-18-06; COMPLETED 4-18-06
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Craig S. Redner

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
		SS	(F-11) Topsoil, w gravel, asphalt, & silt	0.5	1	1-1-2 (3) Sample 1 0.0-1.5
		SS	(F-11) soft, slightly plastic, medium brown sandy silt, trace gravel, trace asphalt chunks, trace roots, moist	0.6	2	Sample 2 1.5-3.0 1-1-1 (2)
			(F-11) 3.0			
		SS	(ML) Very soft, slightly plastic, brown, clayey silt, trace sand, trace gravel, wet	0.8	3A 3B	Sample 3 3.0-4.5 1-1-2 (3)
	5	SS	(ML) Very soft, slightly plastic, brown, clayey silt, trace sand, trace gravel wet	0.3	4	Sample 4 4.5-6.0 1-1-2 (3)
		SS	(ML) very soft, slightly plastic, brown clayey silt, trace sand, trace gravel, wet 7.0	0.8	5A 5B	Sample 5 6.0-7.5. 2-1-1 (2)
		SS ▽ 9.2	(OL) very soft, slightly plastic, dark gray, organic silt, some sand, trace gravel, trace wood, wet	1.0	6	Sample 6 7.5-9.0 WOH-WOH-7 (7)
	10	SS	(OL) very soft, slightly plastic, dark gray, organic silt, some sand, trace gravel, trace wood, wet 10.2	0.6	7A 7B	Sample 7 9.0-10.5 8-2-3 (5) Layer of wood @ 10.1-10.2
			(SM) loose, dark gray, silty sand, f-c, with gravel, trace organics, wet 10.5			
		SS	(OL) very soft, slightly plastic, dark gray, organic silt, trace wood, wet	1.3	8	Sample 8 10.5-12.0 1-1-1 (2)
		SS	(OL) very soft, slightly plastic, dark gray, organic silt, trace wood, wet	1.0	9	Sample 9 12.0-13.5 1-1-1 (2)
		SS	(OL) very soft, slightly plastic, dark gray, organic silt, trace wood, wet	0.5	10	Sample 10 13.5-15.0 1-1-1 (2)
	15	SS	(OL) very soft, slightly plastic, dark gray, organic silt, trace wood, wet	1.0	11A 11B	Sample 11 15.0-16.5 2-2-6 (8)
			(SM) loose, light brown, f-c, sand, some silt, trace gravel, wet 16.5			
		SS	(OL) very soft, slightly plastic, greenish gray, organic silt, some shells, trace wood, wet	1.0	12	Sample 12 16.5-18.0 1-1-2 (3)
		SS	(OL) very soft, slightly plastic, greenish gray, organic silt, some shells, trace wood, wet 18.9	1.0	13A 13B	Sample 13 18.0-19.5 WH-3-3 (6)
		SS	(SM) loose, light brown, f-c, sand, some silt, trace gravel, trace organics, wet 19.8	1.0	14A	Sample 14 19.5-21.0 2-3-4 (7)
	20		(CL) stiff, plastic, brown clay, trace gravel, trace sand, moist			

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PROJECT: Kinnickinnic River — HOLE NO. S-1

Hole No. S-1

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 2 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: COLEMAN ENGINEERING CO.
4. HOLE NO. (As shown on drawing title and title number): S-1
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL [X] INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 42.2
10. SIZE AND TYPE OF BIT: 4¼" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: 8.2
16. DATE HOLE: STARTED 4-18-06; COMPLETED 4-18-06
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Craig S. Redmen

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20	SS	(CL) stiff, plastic, brown, clay, trace gravel, trace sand, moist		14B	Sample 14 19.5-21.0 1.25 pen Tor = 1.2
		SS	(CL) very stiff, plastic, brown, clay, trace gravel, trace sand, moist	NR 0.6	15	Sample 15 22.0-23.5 5-4-6 (10) pen = 35 Tor = 1.25 small wheel
	25					
		3" ST	(CL) very stiff, plastic, brown, clay, trace gravel, trace sand, moist	2.1	16	pen = 1.75 Torvane = 3.1 Sample 16 27.0-29.3 Undisturbed
	30					
		SS	(CL) stiff, plastic, brown, clay, trace gravel, trace sand, moist	1.0	17	Sample 17 32.0-33.5 6-6-9 (15) pen = 0.7 Tor = 2.1
	35					
		SS	(CL) very stiff, plastic, brown, clay, trace gravel, trace sand, moist	1.1	18	Sample 18 37.0-38.5 1-2-50/3 Bouncing pen = 1.5 Tor = 3.4 Driller's note - cobbles & Boulder @ 39.0-42.2 Hard drilling 39.0-42.2
	40					

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PROJECT: Kinnickinnic River | HOLE NO. S-1

Hole No. S-1

DRILLING LOG	DIVISION: GREAT LAKES & OHIO RIVER	INSTALLATION: DETROIT DISTRICT	SHEET 3 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and file number): S-1
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: (VERTICAL) INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 42.2
10. SIZE AND TYPE OF BIT: 4¼" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER: 4.2
16. DATE HOLE: STARTED 4-18-06; COMPLETED 4-18-06
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Craig S. Redmen

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
40						Sample 19, 42.2-43.5
					19	Sample of crushed bedrock from inside augers
						50/0
			42.2			
			Auger Refusal on Limestone			
			EOB 42.2			
						after 24 hrs - water Level 8.2'
	45					
	50					
	55					
	60					

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PROJECT: Kinnickinnic River — HOLE NO.: S-1

Hole No. S-2

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 1 OF 3 SHEETS

1. PROJECT KINNICKINNIC RIVER		10. SIZE AND TYPE OF BIT 4½" HSA	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) 1985 IGLD	
3. DRILLING AGENCY COLEMAN ENGINEERING Co.		12. MANUFACTURER'S DESIGNATION OF DRILL DIEDRICH D50	
4. HOLE NO. (As shown on drawing title and file number) S-2		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 15 / UNDISTURBED 2
5. NAME OF DRILLER RANDY OCHS		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE VERTICAL ☒ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 4.2	
		16. DATE HOLE STARTED 4-27-06	COMPLETED 4-27-06
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING	%
9. TOTAL DEPTH OF HOLE 21.0		19. SIGNATURE OF INSPECTOR Craig S. Rinker	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			gravel 0.4			Sample 1 0.0-2.0
			(Fill) Loose, dark brown, f-c, silty sand, trace gravel, trace roots, moist	0.6	1	5-5-3-3 (8)
						Rock stuck in shoe
			(Fill) soft, slightly plastic, brown, silt, with gravel, with sand, moist	1.2	2	Sample 2 2.0-4.0 6-3-3-4 (6)
	5		(Fill) medium dense, brown, f-c, sand, some gravel, some silt, wet @ 5.4	0.9	3	Sample 3 4.0-6.0 8-12-8-10 (20)
			6.0			Rock stuck in shoe
			(ML) soft, slightly plastic, brown, silt, trace sand, trace gravel, wet		4A	Sample 4 6.0-8.0
			7.0			7-9-8-9
			(SM) medium dense, dark black, f-c, sand, some silt, trace gravel, trace wood, wet	1.0	4B	(17)
			(SM) medium dense, greenish brown, f-c, SAND, some silt, trace gravel, wet	1.1	5	Sample 5 8.0-10.0 8-6-4-3 (10)
	10		(SM) loose, grayish brown, f-c, sand, some silt, trace gravel, wet	0.6	6	Sample 6 10.0-12.0 5-4-1-1 (5)
			(SM) very loose, grayish brown, f-c, sand, some silt, trace gravel, wet	1.3	7A	Sample 7 12.0-14.0 1-1-1-1 (2)
			13.2			
			(ML) very soft, slightly plastic, dark brown, silt, trace gravel, trace sand, trace organics, wet		7B	
	15		(ML) very soft, slightly plastic, dark brown, silt, trace sand, trace wood, wet	0.5	8	Sample 8 14.0-16.0 WOH (-)
			(ML) very soft, slightly plastic, dark brown, sandy silt, trace wood, wet	1.4	9	Sample 9 16.0-18.0 WOH 2' (8)
			(SM) medium dense, dark Brown, f-c, sand, some silt, wet	18.0		
			(ML) very soft, slightly plastic, dark brown, silt, trace sand, trace organics, wet	18.5		Sample 10 18.0-20.3 Undisturbed
			(OL) SOFT, moderately plastic, very dark Brown, organic silt, wet	2.0 2.1	10	
	21					

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PROJECT Kinnickinnic River | HOLE NO. S-2

Hole No. S-2

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 2 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and file number): S-2
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL ☒ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT: 4¼ HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: — UNDISTURBED:
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE — STARTED: 4-27-06 — COMPLETED:
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Gary S. Reitmeier

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20				10	Sample 10 18.0-20.3
			22.0±			
	25		(ML) Very soft, slightly to non plastic, greenish brown, clayey silt, trace sand, trace shells, wet	1.4	11	Sample 11 24.5-26.5 1-1-1 (2)
			▼ 28.0			
	30		(OL) Very soft, non to slightly plastic, greenish, brown, organic silt, some wood, some shells, trace sand, wet	1.4	12	Sample 12 29.5-31.5 1-2-1 (3)
	35		(OL) very soft, slightly plastic, greenish brown, organic silt, some wood, trace shells, trace sand, wet	1.4	13	Sample 13 34.5-36.5 WOH-1-2-1 (3)
	3" 37		(OL) soft, slightly plastic, greenish brown, organic silt, trace sand, trace shells, wet Trace fine gravel	12.1	14	Sample 14 36.5-38.8 Undisturbed
	40					Sample 15 39.5-41.5

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PROJECT: Kinnickinnic River — HOLE NO. S-2

12.7 from Deck X 5.2 from steel plate X Hole No. S-2

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 3 OF 3 SHEETS

1. PROJECT KINNICKINNIC RIVER	10. SIZE AND TYPE OF BIT 4 1/4" HSA
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) 1985 IGLD
3. DRILLING AGENCY COLEMAN ENGINEERING Co.	12. MANUFACTURER'S DESIGNATION OF DRILL DIEDRICH D50
4. HOLE NO. (As shown on drawing title and title number) S-2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER RANDY OCHS	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE VERTICAL [X] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE STARTED 4-27-06 / COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40		(CL) very soft, non to slightly plastic, greenish brown, organic silt, some wood, trace shells, trace sand, wet	1.4	15	Sample 15 39.5-41.5 1-2-1-2 (3)
			43.0±			
	45		(ML) soft, slightly plastic, light brown, silt, trace wood, trace sand, wet	1.3	16	Sample 16 44.5-46.5 1-2-2-2 (4)
			±48.0			
	50		50.1 (SM) very loose, grayish brown, f-c, sand, with silt, wet 50.8 (ML) very soft, slightly plastic, grayish brown, silt, trace sand, trace wood, wet	1.3	17A 17B	Sample 17 49.5-51.0 WOH-1-2-1 (3)
			EOB 51.0			
	55					water @ 4.2

Hole No. S-3

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 1 OF 3 SHEETS
1. PROJECT KINNICKINNIC RIVER		10. SIZE AND TYPE OF BIT 4¼ HSA	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) 1985 IGLD	
3. DRILLING AGENCY COLEMAN ENGINEERING CO.		12. MANUFACTURER'S DESIGNATION OF DRILL DIEDRICH D50	
4. HOLE NO. (As shown on drawing title and title number) S-3		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21	UNDISTURBED 1
5. NAME OF DRILLER RANDY OCHS		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE VERTICAL ☒ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER = 9.0	
		16. DATE HOLE STARTED 4-19-06	COMPLETED 4-20-06
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE 51.5		19. SIGNATURE OF INSPECTOR Craig S. Reiden	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
		CS	(Fill) very dense, dark brown, f-c sand, gravel, with silt, trace asphalt, trace concrete, moist 0.4	0.3	1	Sample 1 0.0-1.5 50/4
			Concrete 2.6			Did not sample 1.5-3.0 - in concrete rubble
		SS	(ML) very soft, slightly plastic, dark brown, silt, trace gravel, trace sand, moist	0.3	2	Sample 2 3.0-4.5 1-1-1 (2)
	5	SS	(ML) very soft, slightly plastic, dark brown, silt, trace gravel, trace sand, moist	NR Pushed Rock	3	Sample 3 4.5-6.0 1-2-2 (4) pushed rock in shoe
		SS	(ML) very soft, slightly plastic, dark brown, silt, trace gravel, trace sand, moist	0.5	4	Sample 4 6.0-7.5 1-1-1 (2)
		SS	(ML) soft, slightly plastic, dark brown, silt, trace gravel, trace sand, moist 8.5	0.9	5A	Sample 5 7.5-9.0 3-3-3 (6)
			(SM) loose, black, f-c, silty sand, trace gravel, trace organics, moist 9.0		5B	
	10	SS	(OL) soft, slightly plastic, dark greenish brown, organic silt, trace sand, trace organics, wet	1.0	6	Sample 6 9.0-10.5 4-2-3 (5)
		SS	(OL) soft, slightly plastic, dark greenish brown, organic silt, trace sand, trace organics, wet 11.4	1.3	7A	Sample 7 10.5-12.0 17-10-9 (20)
			wood 12.0		7B	
		SS	(OL) soft, slightly plastic, dark greenish brown, organic silt, trace gravel, trace sand, trace organics, wet	1.0	8	Sample 8 12.0-13.5 4-3-3 (6)
	15	SS	(OL) very soft, slightly plastic, dark greenish brown, organic silt, trace gravel, trace sand, trace organics wet	0.9	9	Sample 9 13.5-15.0 2-2-2 (4)
		SS	(OL) very soft, slightly plastic, dark greenish brown, organic silt, trace gravel, trace sand, trace organics wet	0.6	10	Sample 10 15.0-16.5 2-2-2 (4)
		SS	(OL) soft, slightly plastic, dark greenish brown, organic silt, trace gravel, trace sand, trace organics, wet	0.7	11	Sample 11 16.5-18.0 2-2-3 (5)
		SS	(OL) soft, slightly plastic, dark greenish brown, organic silt, trace gravel, trace sand, trace organics, wet	1.0	12	Sample 12 18.0-19.5 3-3-4 (7)
	20	SS	(OL) soft, slightly plastic, dark greenish brown, organic silt, trace gravel, trace sand, trace organics, wet	1.0	13	Sample 13 19.5-21.0 5-4-4 (8)

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PROJECT Kinnickinnic River

HOLE NO. S-3

Jon Hansen 952-832-2758 Hole No. S-3

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 2 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and file number): S-3
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL [X] INCLINED [ ] DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 51.5
10. SIZE AND TYPE OF BIT: 4¼" HSA
11. DATUM FOR ELEVATION SHOWN (USN or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 4-19-06; COMPLETED 4-20-06
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Craig S. Reiden

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20	SS	(OL) soft, slightly plastic, dark greenish brown, organic silt, trace gravel, trace sand, trace shells, wet	13		Sample 13 19.5-21.0 5-4-4 (8)
		SS	(OL) soft, slightly plastic, dark green brown, organic silt, trace gravel, trace sand, trace shells, wet 24.9	14A 14B	1.1	Sample 14 23.5-25.0 7-7-4 (11)
	25		(CL) Very soft, medium plastic, medium brown, clay, trace gravel, trace sand, wet ±26.9			
		SS	(ML) medium stiff, non to slightly plastic, medium brown, sandy silt, trace wood, wet	15	NR 0.4	Sample 15 28.5-30.0 15-13-19 (32) went down twice w/ spoon
	30		±34.7			
		SS	(CL) stiff, medium plastic, medium brown, silty clay, with sand, trace gravel, trace organics, wet	16	1.3	Sample 16 33.5-35.0 6-4-5 (9) pen = 0.5 tor = 1.0
	35					
		3" ST		17	NR	Sample 17 38.5-40.8 3" Shelby Tube Undisturbed
	40					

Hole No. S-3

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 3 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and file number): S-3
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL [X] INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 51.5
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TUM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 4-19-06; COMPLETED 4-20-06
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Craig S. Reidner

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40	3" ST		17	NR	Sample 17 38.5-40.5
		3" ST		18	NR	Sample 18 41.0-43.0
		SS	(CL) very stiff, medium plastic, medium brown, clay, with silt, with sand, trace gravel, wet	19	1.3	Sample 19 43.5-45.0 2-2-5 (7) pen = 0.75 Tor = 2.1
	45		very soft (CL) very stiff, medium plastic, medium brown, clay, some silt, some sand, trace gravel, wet			
		3" ST		20	2.1	Sample 20 45.0-47.3 pen 0.75 Tor = 1.9
		SS	(CL) stiff, medium plastic, medium brown, clay, some silt, some sand, trace gravel, wet	21	1.4	Sample 21 48.5-50.0 6-15-20 (35) pen = 1.2 Torvane = 1.75
	50		EOB · 51.5			
	55					
	60					

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PROJECT: Kinnickinnic River | HOLE NO. S-3

Hole No.: S-4

DRILLING LOG	DIVISION: GREAT LAKES & OHIO RIVER	INSTALLATION: DETROIT DISTRICT	SHEET 1 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and file number): S-4
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL [X] INCLINED [ ] DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 51.0
10. SIZE AND TYPE OF BIT: 4¼" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER: 6.4
16. DATE HOLE: STARTED 4-26-06; COMPLETED 4-26-06
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Craig S. Rendue

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Topsoil 0.4		1A	Sample 1 0.0-2.0 2-4-6-5 (10)
			(Fill) concrete chunks,	1.1	1B	
			(Fill) medium dense, yellowish brown, fr. silty sand, with broken concrete, trace roots, moist 3.3	1.6	2A	Sample 2 2.0-4.0 2-9-5-6 (14)
			(ML) soft, slightly plastic, dark brown, silt, some sand, trace roots, moist		2B	
	5		(ML) soft, slightly plastic, dark brown, silt, some sand, trace roots, trace gravel, wet @ 5.6	1.1	3	Sample 3 4.0-6.0 7-8-3-2 (11)
			(ML) very soft, slightly plastic, med. brown, silt, trace sand, trace wood, wet 8.0	0.4	4	Sample 4 6.0-8.0 1-2-1-2 (3)
			(PT) very soft, non to slightly plastic, med. brown, Peat, with silt, trace sand, some wood + roots, trace shells, wet	1.1	5	Sample 5 8.0-10.0 WOH WOH WOH WOH 2' (0)
	10		(PT) very soft, fibrous, med. brown, Peat, some silt, trace sand, trace shells, wet	1.2	6	Sample 6 10.0-12.0 WOH WOH WOH 1.5-2 (0)
			(PT) Peat	0.8	7A	Sample 7 12.0-14.0 WOH WOH 1'-1-1 (1)
			Sand very loose, greyish brown, f-c, sand, some silt, wet 13.5	1.3	7B	
			(PT) very soft, fibrous, med brown, Peat, with silt, trace sand, some shells, wet sample greater from brown to greenish brown 16.0		7C	
	15			1.7	8	Sample 8 14.0-16.0 WOH WOH WOH 1.5-1 (0)
			(OL) very soft, slightly plastic, greenish brown, organic silt, trace sand, some wood, trace shells, wet	1.8	9	Sample 9 16.0-18.0 WOH WOH WOH WOH 2' (0)
			(OL) very soft, slightly plastic, greenish brown, organic silt, trace sand, trace wood, trace shells, wet	1.7	10	Sample 10 18.0-20.0 WOH WOH WOH 1.5-1 (0)

Hole No. S-4

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 2 OF 3 SHEETS

1. PROJECT KINNICKINNIC RIVER		10. SIZE AND TYPE OF BIT 4¾" HSA	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) 1985 IGLD	
3. DRILLING AGENCY COLEMAN ENGINEERING Co.		12. MANUFACTURER'S DESIGNATION OF DRILL DIEDRICH D-50	
4. HOLE NO. (As shown on drawing title and title number) S-4		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 21 / UNDISTURBED 2
5. NAME OF DRILLER RANDY OCHS		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE VERTICAL [X] INCLINED [ ] DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE STARTED 4-26-06	COMPLETED 4-26-06
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE 51.0		19. SIGNATURE OF INSPECTOR Craig S. Reidmen	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20					
			(OL) very soft, slightly plastic, greenish brown, organic silt, trace sand, trace wood, trace shells, wet			
	25		(OL) very soft, medium plastic, greenish brown, clayey organic silt, trace wood, some shells, wet	1.4	11A	Sample 11 24.0-26.0 WOH → WOH → WOH → 2' (0) pen = 0.0 TOR = 0.4
					11B	
		3" ST	(OL) very soft, medium plastic, greenish brown, clayey organic silt, trace wood, trace shells, wet	2.3	12	26.0 - 28.3 3" Shelby Tube pen = 0.25 TOR = 1.25
			± 28.6			
	30		(OL) very soft, non to slightly plastic, greenish brown, organic silt, trace sand, trace wood, trace shells, wet	1.0	13	Sample 13 29.0 - 31 WOH → WOH → 1'-1-1 (1)
			± 32.5			Hit gas pocket @ 34.0. Shut down until a gas meter brought on site. Readings from gas meter were 0
			(SM) very loose, grayish brown, f-c, sand, some silt, trace gravel, wet	1.1	14	Sample 14 34.0 - 36.0 WOH - 1-1-2 (2)
	35					
						O_2 = 20.8 0.0 and others
			(SM) loose, grayish brown, f-c, sand, some silt, trace gravel, wet	1.3	15A	Sample 15 39.0-41.0 3-4-4-4 (8)
	40					

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PROJECT: Kinnickinnic River | HOLE NO. S-4

Hole No.: S-4

DRILLING LOG	DIVISION: GREAT LAKES & OHIO RIVER	INSTALLATION: DETROIT DISTRICT	SHEET 3 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and title number): S-4
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL [X] INCLINED [ ] ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 51.0
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 4-26-06; COMPLETED 4-26-06
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Craig E. Reuther

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40	SS	(CL) very stiff, medium plastic, light brown, clay, trace silt, trace sand, trace gravel, wet	1.6	1SA	Sample 15 39.0 - 41.0 3-4-4-4 (8) pen = 1.2 Tor = 2.5
			(SC) loose, grayish Br. clayey sand, fine, wet 41.0'		1S3	
		3"ST	(CL) Stiff, medium plastic, light brown, clay, trace silt, trace sand, trace gravel, wet 42.5'	1.6	16	Sample 16 41.0 - 43.3 undisturbed pen = 0.5 Tor = 1.1
						O_2 = 20.8 000 ppm others
	45	SS	(CL) Stiff, medium plastic, light brown, clay, trace silt, trace sand, trace gravel, wet	1.7	17	Sample 17 44.0 - 46.0 5-4-5-6 (9) pen = 0.5 Tor = 1.75
						O_2 = 20.8 000 ppm others
	50	SS	(CL) very stiff, med plastic, light brown, clay trace silt, trace sand, wet	1.5	18	Sample 18 49.0 - 51.0 3-4-4-5 (8) pen = 1.1 Tor = 3.1
			EOB 51.0			
						water level @ 6.4' after 12 hrs
	55					
	60					

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PROJECT: Kinnickinnic River

HOLE NO.: S-4

Hole No. S-5

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 1 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and file number): S-5
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL [X] INCLINED [ ] _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 46.5
10. SIZE AND TYPE OF BIT: 4¼" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED 20
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER: ±5.2
16. DATE HOLE: STARTED 4-25-06; COMPLETED 4-25-06
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Craig S. Redner

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			concrete 0.4			Sample 1 Hand dug 2.0 to check for electric to Marina Lights
			(Fill) dark black, silty sand, some gravel, some manmade bolts, trace roots, moist	1	1	
			(Fill) dense, dark black, f-c, silty sand, trace concrete, trace gravel, trace wood & roots, moist	1.6	2	Sample 2 2.0-4.0 7-10-15-14 (25)
	5		(Fill) very dense, black, f-c, silty sand, trace gravel, trace wood, wet @ 5.2	1.2	3	Sample 3 4.0-6.0 11-33-27-9 (60)
			(Fill) loose, black, f-c, silty sand, Trace gravel trace brick, wet 7.1	1.4	4A	Sample 4 6.0-8.0 5-2-2-1 (4)
			(OL) very soft, slightly plastic, greenish brown, organic silt, trace sand, trace wood, trace shells, wet		4B	
			(OL) very soft slightly plastic, greenish brown, Organic silt, trace sand, trace wood, Trace shells, trace gravel, wet	1.8	5	Sample 5 8.0-10. 1-WOH-WOH (0)
	10		(OL) very soft, slightly plastic, greenish brown, organic silt, trace sand, trace wood & roots, trace shells, trace gravel, wet	1.2	6	Sample 6 10.0-12.0 1-1-1-1 (2)
			(OL) soft, slightly plastic, greenish brown Organic silt, trace sand, trace gravel, trace wood roots, trace shells wet	1.2	7	Sample 7 12.0-14.0 9-6-3-2 (8)
	15	3" ST	(OL) very soft, slightly plastic, greenish brown, organic silt, trace sand, trace gravel, trace wood & roots, trace shells, wet	1.7	8	Sample 8 14.6-16.3 undisturbed
			(OL) very soft, slightly plastic, greenish brown, organic silt, trace sand, trace wood roots, trace shells, wet	1.8	9	Sample 9 16.5-18.5 WOH-WOH-1-1 (1)
			(OL) very soft, slightly Plastic, greenish brown, organic silt, trace sand, trace wood & roots, trace shells, wet	0.7	10	Simple 10 18.5-20.5 1-1-1-1 (2)
	20					

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PROJECT: Kinnickinnic River HOLE NO. S-5

Hole No. S-5

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 2 OF 3 SHEETS
1. PROJECT KINNICKINNIC RIVER		10. SIZE AND TYPE OF BIT 4¼" HSA	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TUM or MSL) 1985 IGLD	
3. DRILLING AGENCY COLEMAN ENGINEERING CO.		12. MANUFACTURER'S DESIGNATION OF DRILL DIEDRICH D50	
4. HOLE NO. (As shown on drawing title and title number) S-5		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1	UNDISTURBED 20
5. NAME OF DRILLER RANDY OCHS		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: VERTICAL ☒ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 4-25-06	COMPLETED 4-25-06
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE 46.5		19. SIGNATURE OF INSPECTOR Craig Reiche	

ELEVATION a	DEPTH	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20				10	
	25		(OL) very soft, slightly plastic, greenish brown, organic silt, trace wood & roots, trace shells, wet	1.8	11	Sample 11 24.0-26.0 WOH-WOH-2-2 (2)
	30		(OL) soft, slightly plastic, greenish brown, organic silt, trace sand, trace wood & roots, trace shells, wet	1.7	12	Sample 12 29.0-30.0 2-2-3-5 (5)
	35		(OL) soft, slightly plastic, greenish brown, organic silt, trace sand, trace wood, trace shells, wet	1.3	13	Sample 13 34.0-36.0 2-3-3-3 (6)
	40		(OL) soft, slightly plastic, greenish brown, organic silt, some sand, trace wood, trace shells, wet	1.4	14A	Sample 14 39.0-40.0 2-2-5-16 (7)

Hole No. S-5

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 3 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING CO.
4. HOLE NO. (As shown on drawing title and title number): S-5
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL ☒ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 46.5
10. SIZE AND TYPE OF BIT: 4¼" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED 20
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 4-25-06; COMPLETED 4-25-06
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Craig S. Reidner

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40		(OL) 40.4		14A	Sample 14 39.0-41.0
			(SM) loose, grayish brown, f-c, sand, some silts, trace gravel, wet 40.8		14B	2-2-5-11 (7)
			wood		14C	
			(SM) very dense, grayish brown, f-c, sand, some silt, trace gravel, wet			
	45			1.0	15A	sample 15 44.0-46.0
			weathered limestone 45.2			32-34-50/3
					15B	
			46.5			
			EOB 46.5 Auger Refusal			
	50					
	55					
	60					

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PROJECT: Kinnickinnic River

HOLE NO. S-5

Hole No. S-6

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 1 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and file number): S-6
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL [X] INCLINED [ ] ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 53.8
10. SIZE AND TYPE OF BIT: 4 1/4" HSA
11. DATUM FOR ELEVATION SHOWN (TSM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 17 / 9; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER: 10-1
16. DATE HOLE: STARTED 4-21-06; COMPLETED 4-24-06
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Craig L Redmer

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
		SS	Topsoil (ML) very soft, slightly plastic, dark brown, silt, trace gravel, trace sand, trace organics, moist	0.6	1	Sample 1 0.0-1.5 1-1-1 (2)
		SS	(ML) very soft, slightly plastic, dark brown, silt, trace gravel, trace sand, trace organics, moist	0.8	2	Sample 2 1.5-3.0 3-5-3 (8)
		SS	(ML) very soft, slightly plastic, dark brown, silt, trace gravel, trace sand, trace organics, moist 4.2 (SM) loose, med. brown, f-c, silty sand, trace gravel, moist 4.5	0.9	3A 3B	Sample 3 3.0-4.5 3-3-3 (6)
5		SS	(ML) soft, slightly plastic, med brown, silt, trace gravel, trace sand, moist	NR 0.3	4	Sample 4 4.5-6.0 3-3-4 (7)
		SS	(ML) soft, slightly plastic, med brown, silt, trace gravel, trace sand, moist 7.0 (SM) loose, light brown, f-c, sand, some silt, trace gravel, trace roots, moist	0.9	5A 5B	Sample 5 6.0-7.5 4-4-5 (9)
		SS	(SM) loose, light brown, f-c, sand, some silt, trace gravel, trace roots, moist	1.0	6	Sample 6 7.5-9.0 6-5-4 (9)
10		SS	(SM) very loose, light brown, f-c, sand, some silt, trace gravel, trace roots, moist 10.1 (PT) Peat, Black, silty 10.5	1.1	7A 7B	Sample 7 9.0-10.5 2-2-1 (3)
		SS	(SM) loose, grayish brown, f-c, silty sand, trace gravel, trace organics, wet 12.0	1.2	8	Sample 8 10.5-12.0 2-1-2 (3)
48 hrs. ▽		SS	(ML) very soft, slightly plastic, grayish brown, sandy silty trace gravel, trace organics, wet	1.4	9	Sample 9 12.0-13.5 2-1-1 (2) water level after 48 hrs. = 13.0
15			(SM) very soft, slightly plastic, grayish brown, sandy silt, trace gravel, trace wood organics, wet 14.7 (SM) very loose, grayish brown, f-c, silty sand, trace gravel, trace organics, wet	1.0	10A 10B	Sample 10 13.5-15.5 WH-1-2-3 (3)
		SS	(SM) very loose, light brown, f-c, sand, some silt, trace gravel, wet	0.9	11	Sample 11 15.5-17.5 1-2-1-2 (3)
			(SM) loose, light brown, f-c, sand, some silt, trace gravel, trace wood, wet	0.9	12	Sample 12 17.5-19.5 3-2-2-3 (4)
20			(SM) loose, light brown, f-c, sand, some silt, trace gravel, wet	1.4	13	Sample 13 19.5-21.5 3-2-2-3 (4)

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Kinnickinnic River

HOLE NO. S-6

Hole No. S-6

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 2 OF 3 SHEETS

1. PROJECT: KINNICKINNIC RIVER
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: COLEMAN ENGINEERING Co.
4. HOLE NO. (As shown on drawing title and title number)
5. NAME OF DRILLER: RANDY OCHS
6. DIRECTION OF HOLE: VERTICAL [X] INCLINED [ ] ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 53.8
10. SIZE AND TYPE OF BIT: 4¼ HSA
11. DATUM FOR ELEVATION SHOWN (TUM or MSL): 1985 IGLD
12. MANUFACTURER'S DESIGNATION OF DRILL: DIEDRICH D50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 27; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 4-21-06; COMPLETED 4-24-06
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Craig S. Renken

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20		(SM) Loose, light brown, f-c, sand, some silt, trace gravel, wet	1.4	13	Sample 13 19.5-21.5 3-2-2-3 (4)
	25		(SM) Loose, light brown, f-c, sand, some silt, trace gravel, wet	1.4	1.5	Sample 14 24.5-26.5 2-1-1-2 (2)
			26.3 (ML) very soft, non to slightly plastic, grayish brown, sandy silt, trace gravel, wet	1.1/5		
			±28.0			
	30		(SM) very loose, grayish brown, f-c, sand, some silt, trace gravel, wet	15	1.5	Sample 15 29.5-31.5 1-1-2-2 (3)
	35		(SM) very loose, grayish brown, f-c, sand, some silt, trace gravel, wet	1.6A	1.8	Sample 16 34.5-36.5 3-2-2-2 (4) pen=0.25 tor=0.5
			35.9 (SC) soft, slightly plastic, greenish brown, organic silt, trace sand, trace shells, wet	1.6B		
			36.8 (SM) very loose, grayish brown, f-c, sand, some silt, trace gravel, wet	1.6C		
			(OL) soft, slightly plastic, greenish brown, organic silt, trace sand, trace shells, wet ±36.5	1.6D		" "
			(SM) brown, f-c, sand, some silt, wet ±37.0			Sample 17 36.5-38.8 3" Shelby Tube Undisturbed
			(OL) very soft, slightly plastic, greenish brown, organic silt, with sand, trace shells, wet	17	1.3	
			(SC) brown, F-C Clayey sandy wet ±38.7			
			±39.2			
	40		(CL)	1.8		Sample 18 39.5-41.5 1-1-2-3 (3)

ENG FORM 1836 (MAR 71) PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Kinnickinnic River

HOLE NO. S-6

Hole No. S-6

DRILLING LOG	DIVISION GREAT LAKES & OHIO RIVER	INSTALLATION DETROIT DISTRICT	SHEET 3 OF 3 SHEETS

1. PROJECT KINNICKINNIC RIVER		10. SIZE AND TYPE OF BIT 4¼" MSA	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) 1985 IGLD	
3. DRILLING AGENCY COLEMAN ENGINEERING Co.		12. MANUFACTURER'S DESIGNATION OF DRILL DIEDRICH D50	
4. HOLE NO. (As shown on drawing title and file number) S-6		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 27 / UNDISTURBED 2
5. NAME OF DRILLER RANDY OCHS		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE VERTICAL ☒ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 13.0'	
		16. DATE HOLE	STARTED 4-21-06 / COMPLETED 4-24-06
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE 53.8		19. SIGNATURE OF INSPECTOR Craig S. Reidner	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40	SS	(CL) soft, medium plastic, light greenish brown, clay, trace silt, trace sand, moist	1.1	18	Sample 18 39.5-41.5 1-1-2-3 (3) Tor = 2.0 Pen = 0.5
			143.0			
	45	SS	(OL) soft, slightly plastic, greenish brown, organic silt, trace sand, trace gravel, trace shells, moist	1.0	19	Sample 19 44.5-46.5 1-2-3-5 (5)
	50	SS	(OL) soft, slightly plastic, greenish brown, organic silt, trace shells, moist	1.5	20	Sample 20 49.5-51.5 2-2-4-5 (6)
		3" ST	(OL) soft, slightly plastic, greenish brown, organic silt, trace shells, trace wood, moist	52.0		Sample 21 51.5-53.8 3" ST Undisturbed
			(CL) soft, very plastic, greenish brown, clay, wet	2.0	21	
				53.0		
			EOB. 53.8			
	55					
	60					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT Kinnickinnic River HOLE NO. S-6

APPENDIX F

FIELD REPORT NOTES

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-17-06	JOB NO. GD-06032
PROJECT KIVVICKINNIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. CO	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. ° at AM / ° at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 1 Page 1 of 1

Purpose of site visit: COLEMAN ENGINEERING Co. (CEC) mobilized for the Kinnickinnic River project today. The day began at 6:30 AM, with the loading of equipment and the drill rig. The drill crew left at 8:45 AM and arrived in Milwaukee, Wisconsin at 2 PM. Utility clearance then took place and the crew examined the site.

Services completed: Utilities were cleared and the drill rig was unloaded at Boring B-1. The semi was parked, and the crew ended the day at 7:15 PM.

Outcome of the site visit or services completed:

Other observations, additional services requested or next scheduled visit:

COPY TO:

FIELD REPORT

SIGNED Craig Redner

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-18-06	JOB NO. GD-06032
PROJECT KIVICKINIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. CO	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. ° at AM / ° at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 2 Page 1 of 1

Purpose of site visit: The drill crew was on-site at 6:30 Am. They built the drilling platform for Boring B-1 and held their first on-site safety meeting. After fetching fuel & supplies, the setup of the drill began, at 12:15 PM. Drilling of Boring B-1 began, at 12:45pm.

Services completed: Drilling of Boring B-1 began at 12:45 PM and continued until auger drilling refusal was encountered at 6pm. Refusal occurred at 42.2' deep in B-1

The crew completed all records, packed up, and left the site at 7:15 pm

Outcome of the site visit or services completed:

Other observations, additional services requested or next scheduled visit:

COPY TO: _____

FIELD REPORT

SIGNED Craig Reidner

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-19-06	JOB NO. GD-06032
PROJECT KIVVICKINNIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. Co	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. °at AM / °at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 3 Page 1 of 1

Purpose of site visit: The crew began the day at 6:30AM by getting cement, starting the rig & having their daily safety meeting. Starting at 7:30AM the well was installed to 42.2' deep and the casing was grouted in. This was completed at 9AM after which the crew packed equipment, loaded up the drill, took apart the platform, and cleaned up the site. At 12:45PM the crew moved to Boring B-3. After completing all preparations to drill, the crew began drilling B-3 at 2:45PM. At 5:15PM the boring was 25' deep. At this time the crew began packing up, cleaning the site, & completing records. The crew ended the day at 6PM.

Services completed:

Outcome of the site visit or services completed:

Other observations, additional services requested or next scheduled visit:

COPY TO: _____

_____

FIELD REPORT

SIGNED Craig Redner

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-20-06	JOB NO. GD-06032
PROJECT KINNICKINNIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. Co	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. ° at AM / ° at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 4 Page 1 of 1

Purpose of site visit: The crew began the day at 7AM by picking up cement and cleaning up the site & parking lot at B-1. By 8AM they began drilling preparations and conducted the daily safety meeting. Drilling of B-3 resumed at 8:30 AM and was completed at noon. The PVC pipe was installed to 51.5 feet deep. At 2PM the crew began packing & cleaning up, including removal of soil cuttings. By 3:30pm the crew began cutting the trees around Boring B-6. This was completed at 5:30pm, after which the records were completed, and the crew ended the day at 6pm.

Services completed:

Outcome of the site visit or services completed:

Other observations, additional services requested or next scheduled visit:

COPY TO: _____

FIELD REPORT

SIGNED Craig Redner

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-21-06	JOB NO. GD-06032
PROJECT KIVVICKINNIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. CO	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. ° at AM / ° at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 5 Page 1 of 1

Purpose of site visit: The day began at 7:30 AM with the crew picking up equipment, preparing to move, and conducting the daily Safety meeting. At 8:30 AM they moved all equipment to Boring B-6 and made all preparations to drill. Drilling of B-6 began at 9 am, and by 10:15 AM the boring had been advanced 13.5'. At this point the crew secured the rig for the weekend cleaned up, and packed up. They left the site at 11 AM & arrived in Iron Mountain by 3:30 pm. Here they stowed equipment, secured the samples in the laboratory, & completed all records, ending the week at 4 pm.

Services completed:

Outcome of the site visit or services completed:

Other observations, additional services requested or next scheduled visit:

COPY TO:

FIELD REPORT

SIGNED Craig Redine

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-24-06	JOB NO. GD-06032
PROJECT KIVVICKINNIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. Co	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. ° at AM / ° at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 6 Page 1 of 1

Purpose of site visit: The crew began the day at 6:45 Am. They loaded supplies & equipment, & at 7:15 Am departed for Milwaukee, arriving about 11:30 Am. They completed their on-site safety meeting & completed all preparations to resume drilling B-6. Drilling commenced at 12:15pm and continued to 3:30 pm,

Services completed: at which point the boring had been advanced to 51.5'. The soil at this point was an organic silt, so the question was put to Barr as to whether the boring should be terminated in this type of material. It was determined that one more sample was needed. This was drilled & collected between 4 PM & 4:45 PM, after which the augers were

Outcome of the site visit or services completed: withdrawn and the crew packed up & cleaned the site. Records were completed and the crew left the site at 6:00 PM.

Other observations, additional services requested or next scheduled visit:

COPY TO: _____

FIELD REPORT

SIGNED Craig Redner

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-25-06	JOB NO. GD-06032
PROJECT KIVVICKINNIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. CO	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. ° at AM / ° at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 7 Page 1 of 1

FIELD REPORT

Purpose of site visit: The crew began the day at 7:00AM by picking up supplies, conducting the daily safety meeting and moving over to Boring B-5. The setup to drill was complete at 10:30AM. Boring B-5 was drilled and sampled from 10:30AM to 5:00PM, and was advanced to 46.5', terminated at weathered bedrock.

Services completed: The crew packed up, cleaned up, completed all recordKeeping, & left the site at 6:30PM

Outcome of the site visit or services completed:

Other observations, additional services requested or next scheduled visit:

COPY TO:

SIGNED Craig Redin

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-26-06	JOB NO. GD-06032
PROJECT KIVVICKINNIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. CO	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. ° at AM / ° at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 8 Page 1 of 1

Purpose of site visit: The crew began the day at 7:30AM. They pulled augers & grouted the pipe at Boring 5, held the daily safety meeting, packed up the equipment & drill & cleaned the site. At 9:45AM they moved to Boring 4, talked to the landowner cleared brush & limb's to access the boring, and set up on the boring

Services completed: Drilling of B-4 commenced at 11:15AM and continued to about 1:30PM, when a gas pocket was reached at about 34.0' deep. The rig was shutdown and CEC & Barr were notified of the situation. A PID meter was obtained, in order to check the concentration of methane in the borehole. Once cleared after gas testing, drilling resumed at 4:45PM

Outcome of the site visit or services completed: Soon by 6:30PM the boring was completed to 51.0' deep. The crew packed up & cleaned up, completed recordkeeping, and left the site at 7:30PM

Other observations, additional services requested or next scheduled visit:

COPY TO: _____

FIELD REPORT

SIGNED Craig Reidner

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-27-06	JOB NO. GD-06032
PROJECT KIVVICKINNIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. Co	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. ° at AM / ° at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 9 Page 1 of 1

Purpose of site visit: The crew began the day at 6:45AM by picking up cement having the daily safety meeting, grouting B-4, and cleaning up. At 8:45AM they moved over to Boring B-2 and prepared to drill. Drilling of B-2 began at 9:30AM and by 11AM the boring was 20.3' deep. After picking up more cement for grouting, they resumed drilling at 11:15AM and completed B-2 to 51.0' deep by 1PM. The afternoon was spent packing up, grouting the boring, packing samples, and cleaning up the site. After returning rented equipment & completing all records, the crew ended the day at 6PM

Services completed:

Outcome of the site visit or services completed:

Other observations, additional services requested or next scheduled visit:

COPY TO: _____

FIELD REPORT

SIGNED Craig Reddick

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

DATE 4-28-06	JOB NO. GD-06032
PROJECT KINNICKINNIC RIVER STABILITY/DREDGE STUDY	
LOCATION MILWAUKEE, WISCONSIN	
CONTRACTOR COLEMAN ENG. Co	OWNER U.S. ARMY CORPS OF ENG.
WEATHER	TEMP. °at AM / °at PM
PRESENT AT SITE CEC	

TO: BARR ENGINEERING Co.
4700 W. 77th St.
EDINA, MINN 55435-4803

Report No. 10 Page 1 of 1

Purpose of site visit: The crew left Milwaukee at 11:45Am and returned to Iron Mountain at 4:15 Pm. Equipment was stowed the samples were secured in the CEC laboratory all records were completed, and the crew ended the day at 4:45Pm

Services completed:

Outcome of the site visit or services completed:

Other observations, additional services requested or next scheduled visit:

COPY TO:

FIELD REPORT

SIGNED Craig Reidner

APPENDIX G

LABORATORY TEST RESULTS

Geotechnical Samples for Analysis

Boring	Sample #	Bottom Depth [ft]	Type	Recovery [ft] (und.)	Moisture Content	Grain Size	Atterberg Limits	Dry Density	Unconfined Compression	Specific Gravity	CIU Triaxial Compression w/ Pore Pressure
S-1	8	12.0	SS		x	x	x			x (OL)	
S-1	9	13.5	SS					x			
S-1	10	15.0	SS		x						
S-1	12	18.0	SS		x	x	x				
S-1	14	21.0	SS		x						
S-1	16	28.5	Und.	2.1		x	x	x			x
S-1	17	33.5	SS		x			x			
S-1	18	38.5	SS		x			x			
S-2	10	20.0	Und.	2		x	x	x	x	x (ML)	
S-2	14	38.5	Und.	2.1			x	x	x		
S-2	16	46.5	SS		x	x					
S-3	9	15.0	SS		x						
S-3	12	19.5	SS	POOR SAMPLE CONSISTENCY (WATERY) COULD NOT RUN DRY DENSITY TESTS AT S-3							
S-3	13	21.0	SS		x	x					
S-3	16	35.0	SS		x		x				
S-3	20	47.0	Und.	2.1			x	x	x		
S-4	6	12.0	Peat		x						
S-4	12	28.0	Und.	2.3		x	x	x			x
S-4	16	43.0	Und.	1.6		x	x	x	x		
S-5	8	16.5	Und.	1.7		x	x	x			x
S-5	13	36.0	SS		x	x				x (OL)	
S-6	13	21.5	SS			x					
S-6	17	38.5	Und.	1.3	SAND & GRAVEL IN SHELBY UNABLE TO PERFORM PROPOSED TESTS						
S-6	18	41.5	SS							x (CL)	
S-6	21	54.0	Und.	2.0			x	x	x		
				Total	12	11	11	11	5	4	3
				Budgeted	12	12	12	12	6	0	3

Inorganic Silt (ML)
Organic Silt (OL)
Till (CL)

SS=Split Spoon
Und.=Undisturbed

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (OH) ORGANIC SILT, gray-black, high plasticity, with sand, some clay

Boring No: S-1
Sample No: 8
Depth: 10.5-12.0
Date Received: 4/18/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.51
Starting Time: 9:31:00

% of Original Sample Used For Hydrometer Analysis: 98.2 %
Weight of Sample Dispersed: 50.00 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
9:31:30	0.5	40	20	4	36	74.2	0.01426	9.7	0.0628	72.8
9:32:00	1.0	38	20	4	34	70.0	0.01426	10.1	0.0453	68.8
9:33:00	2.0	36	20	4	32	65.9	0.01426	10.4	0.0325	64.7
9:36:00	5.0	26	20	4	22	45.3	0.01426	12.0	0.0221	44.5
9:46:00	15.0	12	20	4	8	16.5	0.01426	14.3	0.0139	16.2
10:01:00	30.0	9	20	4	5	10.3	0.01426	14.8	0.0100	10.1
10:31:00	60.0	8	20	4	4	8.2	0.01426	15.0	0.0071	8.1
11:31:00	120.0	7	20	4	3	6.2	0.01426	15.2	0.0051	6.1
13:31:00	240.0	6	20	4	2	4.1	0.01426	15.3	0.0036	4.0
8:12:00	1361.0	5	20	4	1	2.1	0.01426	15.5	0.0015	2.0

Form #: 0422B
Revision Date: 1/17/05

Tested By: R Backlund Date: 5/11/06
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (OH) ORGANIC SILT, gray-black, high plasticity, with sand, with clay

Boring No: S-1
Sample No: 12
Depth: 16.5-18.0
Date Received: 4/18/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.69
Starting Time: 9:19:00

% of Original Sample Used For Hydrometer Analysis: 97.9 %
Weight of Sample Dispersed: 50.00 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
9:19:30	0.5	41	20	4	37	74.0	0.01348	9.6	0.0591	72.4
9:20:00	1.0	38	20	4	34	68.0	0.01348	10.1	0.0428	66.6
9:21:00	2.0	36	20	4	32	64.0	0.01348	10.4	0.0307	62.7
9:24:00	5.0	32	20	4	28	56.0	0.01348	11.1	0.0201	54.8
9:34:00	15.0	27	20	4	23	46.0	0.01348	11.9	0.0120	45.0
9:49:00	30.0	22	20	4	18	36.0	0.01348	12.7	0.0088	35.2
10:19:00	60.0	18	20	4	14	28.0	0.01348	13.3	0.0063	27.4
11:19:00	120.0	15	20	4	11	22.0	0.01348	13.8	0.0046	21.5
13:19:00	240.0	12	20	4	8	16.0	0.01348	14.3	0.0033	15.7
8:08:00	1369.0	9	20	4	5	10.0	0.01348	14.8	0.0014	9.8

Form #: 0422B
Revision Date: 1/17/05

Tested By: R Backlund Date: 5/11/06
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
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Telephone: (906) 774-3440 Fax: (906) 774-7776

PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (CL) LEAN CLAY, brownish gray, a few silt laminations

Boring No: S-1
Sample No: 16
Depth: 27.0' - 29.3'
Date Received: 4/18/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.74
Starting Time: 8:51:00

% of Original Sample Used For Hydrometer Analysis: 99.5 %
Weight of Sample Dispersed: 40.54 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
8:53:00	2.0	32	23	6.3	26	62.8	0.01426	11.1	0.0336	62.4
8:56:00	5.0	27	23	6.3	21	50.6	0.01426	11.9	0.0220	50.3
9:06:00	15.0	23	23	6.3	17	40.8	0.01426	12.5	0.0130	40.6
9:25:00	34.0	20	23	6.3	14	33.5	0.01426	13.0	0.0088	33.3
9:51:00	60.0	19	23	6.3	13	31.0	0.01426	13.2	0.0067	30.9
13:01:00	250	16	23	6.3	10	23.7	0.01426	13.7	0.0033	23.6
8:51:00	1440	14	23	6.3	8	18.8	0.01426	14.0	0.0014	18.7

Form #: 0422B
Revision Date: 1/17/05

Tested By: J. Whelan (SET) Date: 5/16/06
Submitted By: Date:

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PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (OH) ORGANIC SILT, gray-black, high plasticity, with sand, some clay

Boring No: S-2
Sample No: 10
Depth: 18.0-20.3
Date Received: 4/27/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.51
Starting Time: 9:14:00

% of Original Sample Used For Hydrometer Analysis: 99.6 %
Weight of Sample Dispersed: 50.00 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
9:14:30	0.5	40	20	3	37	76.2	0.01426	9.7	0.0628	75.9
9:15:00	1.0	38	20	3	35	72.1	0.01426	10.1	0.0453	71.8
9:16:00	2.0	35	20	3	32	65.9	0.01426	10.6	0.0328	65.7
9:19:00	5.0	30	20	3	27	55.6	0.01426	11.4	0.0215	55.4
9:29:00	15.0	18	20	3	15	30.9	0.01426	13.3	0.0134	30.8
9:44:00	30.0	12	20	3	9	18.5	0.01426	14.3	0.0098	18.5
10:14:00	60.0	10	20	3	7	14.4	0.01426	14.7	0.0071	14.4
11:14:00	120.0	8	20	3	5	10.3	0.01426	15.0	0.0050	10.3
13:14:00	240.0	6	20	3	3	6.2	0.01426	15.3	0.0036	6.2
8:17:00	1383.0	5	20	3	2	4.1	0.01426	15.5	0.0015	4.1

Form #: 0422B
Revision Date: 1/17/05

Tested By: R Backlund Date: 5/10/06
Submitted By: Date:

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PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (OL) ORGANIC SILT, gray-black, sandy, with clay

Boring No: S-2
Sample No: 16
Depth: 44.5-46.5
Date Received: 4/27/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.51
Starting Time: 9:02:00

% of Original Sample Used For Hydrometer Analysis: 99.8 %
Weight of Sample Dispersed: 50 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
9:02:30	0.5	32	20	3	29	59.7	0.01	11.1	0.0672	59.6
9:03:00	1.0	27	20	3	24	49.4	0.01426	11.9	0.0492	49.3
9:04:00	2.0	23	20	3	20	41.2	0.01426	12.5	0.0357	41.1
9:07:00	5.0	19	20	3	16	33.0	0.01426	13.2	0.0232	32.9
9:17:00	15.0	15	20	3	12	24.7	0.01426	13.8	0.0137	24.7
9:32:00	30.0	13	20	3	10	20.6	0.01426	14.2	0.0098	20.6
10:02:00	60.0	11	20	3	8	16.5	0.01426	14.7	0.0071	16.4
11:02:00	120.0	10	20	3	7	14.4	0.01426	14.7	0.0050	14.4
13:02:00	240.0	8	20	3	5	10.3	0.01426	15.0	0.0036	10.3
8:15:00	1393.0	7	20	3	4	8.2	0.01426	15.2	0.0015	8.2

Form #: 0422B
Revision Date: 1/17/05

Tested By: R Backlund Date: 5/10/06
Submitted By: Date:

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PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (OL) ORGANIC SILT, gray-black, sandy, with clay

Boring No: S-3
Sample No: 13
Depth: 19.5-21.0
Date Received: 4/20/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.51
Starting Time: 8:50:00

% of Original Sample Used For Hydrometer Analysis: 90.7 %
Weight of Sample Dispersed: 50.00 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
8:50:30	0.5	35	20	3	32	65.9	0.01426	10.6	0.0657	59.8
8:51:00	1.0	33	20	3	30	61.8	0.01426	10.9	0.0471	56.1
8:52:00	2.0	29	20	3	26	53.6	0.01426	11.5	0.0342	48.6
8:55:00	5.0	25	20	3	22	45.3	0.01426	12.2	0.0223	41.1
9:05:00	15.0	21	20	3	18	37.1	0.01426	12.9	0.0132	33.6
9:20:00	30.0	17	20	3	14	28.8	0.01426	13.5	0.0096	26.2
9:50:00	60.0	14	20	3	11	22.7	0.01426	14.0	0.0069	20.6
10:50:00	120.0	12	20	3	9	18.5	0.01426	14.3	0.0049	16.8
12:50:00	240.0	10	20	3	7	14.4	0.01426	14.7	0.0035	13.1
8:13:00	1403.0	8	20	3	5	10.3	0.01426	15.0	0.0015	9.3

Form #: 0422B
Revision Date: 1/17/05

Tested By: R Backlund Date: 5/10/06
Submitted By: Date:

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PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (CH) FAT CLAY, gray, with shells, trace organic matter

Boring No: S-4
Sample No: 12
Depth: 26.0-28.3
Date Received: 4/18/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.60
Starting Time: 10:32:00

% of Original Sample Used For Hydrometer Analysis: 100 %
Weight of Sample Dispersed: 62.39 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature °C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
10:34:00	2.0	58	23	6.3	52	83.7	0.01426	6.8	0.0263	83.7
10:37:00	5.0	53	23	6.3	47	75.6	0.01426	7.6	0.0176	75.6
10:47:00	15.0	46	23	6.3	40	64.3	0.01426	8.8	0.0109	64.3
11:02:00	30.0	42	23	6.3	36	57.8	0.01426	9.4	0.0080	57.8
11:32:00	60.0	37	23	6.3	31	49.7	0.01426	10.2	0.0059	49.7
14:32:00	240.0	30	23	6.3	24	38.4	0.01426	11.4	0.0031	38.4
10:32:00	1440.0	21	23	6.3	15	23.8	0.01426	12.9	0.0013	23.8

Form #: 0422B
Revision Date: 1/17/05

Tested By: J.Whelan (SET) Date: 5/16/06
Submitted By: Date:

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PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (CL) LEAN CLAY, gray-brown, sandy, low plasticity

Boring No: S-4
Sample No: 16
Depth: 41.0-43.3
Date Received: 4/26/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.74
Starting Time: 9:25:00

% of Original Sample Used For Hydrometer Analysis: 97.1 %
Weight of Sample Dispersed: 50.00 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
9:25:30	0.5	31	20	4	27	53.5	0.01329	11.2	0.0629	51.9
9:26:00	1.0	28	20	4	24	47.5	0.01329	11.7	0.0455	46.1
9:27:00	2.0	25	20	4	21	41.6	0.01329	12.2	0.0328	40.4
9:30:00	5.0	22	20	4	18	35.6	0.01329	12.7	0.0212	34.6
9:40:00	15.0	17	20	4	13	25.7	0.01329	13.5	0.0126	25.0
9:55:00	30.0	16	20	4	12	23.8	0.01329	13.7	0.0090	23.1
10:25:00	60.0	14	20	4	10	19.8	0.01329	14.0	0.0064	19.2
11:25:00	120.0	13	20	4	9	17.8	0.01329	14.2	0.0046	17.3
13:25:00	240.0	12	20	4	8	15.8	0.01329	14.3	0.0032	15.4
8:10:00	1365.0	10	20	4	6	11.9	0.01329	14.7	0.0014	11.5

Form #: 0422B
Revision Date: 1/17/05

Tested By: R Backlund Date: 5/11/06
Submitted By: Date:

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PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (OH) ORGANIC CLAY, gray, with sand and shells, some peat and wood

Boring No: S-5
Sample No: 8
Depth: 14.0-16.3
Date Received: 4/18/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.45
Starting Time: 10:37:00

% of Original Sample Used For Hydrometer Analysis: 95.3 %
Weight of Sample Dispersed: 60.72 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
10:39:00	2.0	38	23	6.3	32	54.8	0.01426	10.1	0.0320	52.2
10:42:00	5.0	33	23	6.3	27	46.2	0.01426	10.9	0.0211	44.0
10:52:00	15.0	26	23	6.3	20	34.1	0.01426	12.0	0.0128	32.5
11:07:00	30.0	22	23	6.3	16	27.1	0.01426	12.7	0.0093	25.9
11:37:00	60.0	18	23	6.3	12	20.2	0.01426	13.3	0.0067	19.3
14:37:00	240.0	12	23	6.3	6	9.9	0.01426	14.3	0.0035	9.4
10:37:00	1440.0	8	23	6.3	2	2.9	0.01426	15.0	0.0015	2.8

Form #: 0422B
Revision Date: 1/17/05

Tested By: J. Whelan (SET) Date: 5/16/06
Submitted By: Date:

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PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (OL) ORGANIC SILT, gray-black, with sand, with clay

Boring No: S-5
Sample No: 13
Depth: 34.0-36.0
Date Received: 4/25/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.69
Starting Time: 8:56:00

% of Original Sample Used For Hydrometer Analysis: 99.9 %
Weight of Sample Dispersed: 50.00 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
8:56:30	0.5	33	20	3	30	60.0	0.01348	10.9	0.0629	59.9
8:57:00	1.0	30	20	3	27	54.0	0.01348	11.4	0.0455	53.9
8:58:00	2.0	27	20	3	24	48.0	0.01348	11.9	0.0329	48.0
9:01:00	5.0	23	20	3	20	40.0	0.01348	12.5	0.0213	40.0
9:11:00	15.0	17	20	3	14	28.0	0.01348	13.5	0.0128	28.0
9:26:00	30.0	15	20	3	12	24.0	0.01348	13.8	0.0091	24.0
9:56:00	60.0	12	20	3	9	18.0	0.01348	14.3	0.0066	18.0
10:56:00	120.0	11	20	3	8	16.0	0.01348	14.7	0.0047	16.0
12:56:00	240.0	9	20	3	6	12.0	0.01348	14.8	0.0033	12.0
8:14:00	1398.0	7	20	3	4	8.0	0.01348	15.2	0.0014	8.0

Form #: 0422B
Revision Date: 1/17/05

Tested By: Ryan Backlund Date: 5/10/06
Submitted By: Date:

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PARTICLE-SIZE ANALYSIS OF SOILS - HYDROMETER

(ASTM D422)

Project Name: Kinnickinnic River Stability Analysis and Dredging Study — Job Number: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Remarks: (SP-SM) sand, brown, fine to coarse, some silt, trace clay

Boring No: S-6
Sample No: 13
Depth: 19.5-21.5
Date Received: 4/24/2006

Dispersing Agent: Sodium Hexametaphosphate

Amount: 125 ml @4%solution

Hydrometer Number: 152H
Specific Gravity (G): 2.68
Starting Time: 9:08:00

% of Original Sample Used For Hydrometer Analysis: 66.0 %
Weight of Sample Dispersed: 50.00 g.

Time	Elapsed Time Minutes (T)	Hydrometer Reading	Temperature ^{o} C	Correction (DR)	Corr. Hydrometer Reading (R)	Percent Soil in Suspension (P)	K, Values from Table III	L, Values from Table II	Calculated Grain Diameter, mm (d)	Percent of Total Sample C.G.D.
9:08:30	0.5	10	20	3	7	14.0	0.01352	14.7	0.0733	9.2
9:09:00	1.0	9	20	3	6	12.0	0.01352	14.8	0.0520	7.9
9:10:00	2.0	8	20	3	5	10.0	0.01352	15.0	0.0370	6.6
9:13:00	5.0	8	20	3	5	10.0	0.01352	15.0	0.0234	6.6
9:23:00	15.0	7	20	3	4	8.0	0.01352	15.2	0.0136	5.3
9:38:00	30.0	6	20	3	3	6.0	0.01352	15.3	0.0097	4.0
10:08:00	60.0	6	20	3	3	6.0	0.01352	15.3	0.0068	4.0
11:08:00	120.0	5	20	3	2	4.0	0.01352	15.5	0.0049	2.6
13:08:00	240.0	5	20	3	2	4.0	0.01352	15.5	0.0034	2.6
8:16:00	1388.0	5	20	3	2	4.0	0.01352	15.5	0.0014	2.6

Form #: 0422B
Revision Date: 1/17/05

Tested By: R Backlund Date: 5/10/06
Submitted By: Date:

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REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (OL) ORGANIC SILT, gray-black, with sand, with clay

Boring No. S-5

Sample No. 13

Remarks:

Depth: 34.0-36.0

Date Rec'd: 4/25/2006

MECHANICAL ANALYSIS PORTION OF HYDROMETER ANALYSIS

Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer	
3"	76.2				
2"	50.8				
1 1/2"	37.5				
1	25.4				
3/4	19.1		0.0	100.0	
1/2	12.7	0.00	0.0	100.0	
4M	4.76	0.07	0.0	100.0	
10M	2.00	0.26	0.1	99.9	
40M	0.42	0.72	1.4	98.6	**/*** 98.5
100M	0.149	4.95	9.9	88.7	**/*** 88.6
200M	0.074	6.61	13.2	75.4	**/*** 75.4
Pan					

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 0.33 gm = 0.1% %

Material passing No. 10 mesh: weight = 268.4 gm = 99.9% %

Weight of Total Sample = 268.73 gm

Form: D422A
Revision Date: 1/17/05

Tested By: R Backlund
Submitted By:

Date: 5/11/2006
Date:

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REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (OH) ORGANIC SILT, gray-black, high plasticity, Boring No. S-1

Shape: with sand, some clay Sample No. 8

Remarks: Depth: 10.5-12.0

Date Rec'd: 4/18/2006

MECHANICAL ANALYSIS PORTION OF HYDROMETER ANALYSIS

Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
3"	76.2			
2"	50.8			
1 1/2"	37.5			
1	25.4			
3/4	19.1		0.0	100.0
1/2	12.7	0.00	0.0	100.0
4M	4.76	0.61	0.5	99.5
10M	2.00	1.69	1.3	98.2
40M	0.42	0.91	1.8	98.2 **/*** 96.4
100M	0.149	2.79	5.6	92.6 **/*** 90.9
200M	0.074	4.49	9.0	83.6 **/*** 82.1
Pan				

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 2.3 gm = 1.8% %

Material passing No. 10 mesh: weight = 123.54 gm = 98.2% %

Weight of Total Sample = 125.84 gm

Form: D422A Tested By: R Backlund Date: 5/11/2006

Revision Date: 1/17/05 Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906) 774-3440 Fax: (906) 774-7776

REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (OH) ORGANIC SILT, gray-black, high plasticity, with sand, with clay

Boring No. S-1

Sample No. 12

Remarks:

Depth: 16.5-18.0

Date Rec'd: 4/18/2006

MECHANICAL ANALYSIS PORTION OF HYDROMETER ANALYSIS

Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
3"	76.2			
2"	50.8			
1 1/2"	37.5			
1	25.4			
3/4	19.1		0.0	100.0
1/2	12.7	0.00	0.0	100.0
4M	4.76	0.70	0.8	99.2
10M	2.00	1.19	1.3	97.9
40M	0.42	1.67	3.3	96.7 **/*** 94.6
100M	0.149	5.41	10.8	85.8 **/*** 84.0
200M	0.074	4.75	9.5	76.3 **/*** 74.7
Pan				

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 1.89 gm = 2.1% %

Material passing No. 10 mesh: weight = 89.23 gm = 97.9% %

Weight of Total Sample = 91.12 gm

Form: D422A
Revision Date: 1/17/05

Tested By: R Backlund
Submitted By:

Date: 5/11/2006
Date:

COLEMAN ENGINEERING COMPANY
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Telephone: (906) 774-3440 Fax: (906) 774-7776

REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (CL) LEAN CLAY, brownish gray, a few silt laminations

Boring No. S-1

Sample No. 16

Remarks:

Depth: 27.0' - 29.3'

Date Rec'd: 4/24/2006

MECHANICAL ANALYSIS
PORTION OF HYDROMETER ANALYSIS

Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
3"	76.2			
2"	50.8			
1 1/2"	37.5			
1	25.4			
3/4	19.1	0.0	0.0	100.0
1/2	12.7	0.0	0.0	100.0
4M	4.76	1.3	0.4	99.6
10M	2.00	0.2	0.1	99.5
40M	0.42	0.3	0.7	99.3 **/*** 98.8
100M	0.149	1.3	3.2	96.1 **/*** 95.6
200M	0.074	3.2	7.9	88.2 **/*** 87.7
Pan			0.0	

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 1.46 gm = 0.5% %

Material passing No. 10 mesh: weight = 316.94 gm = 99.5 %

Weight of Total Sample = 318.4 gm

Form: D422A
Revision Date: 1/17/05

Tested By: J. Whelan (SET) Date: 5/10/2006

Submitted By: Date:

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REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (OH) ORGANIC SILT, gray-black, high plasticity, with sand, some clay

Boring No. S-2

Sample No. 10

Remarks:

Depth: 18.0-20.3

Date Rec'd: 4/27/2006

	Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
	3"	76.2			
	2"	50.8			
	1 1/2"	37.5			
	1	25.4			
	3/4	19.1		0.0	100.0
	1/2	12.7	0.00	0.0	100.0
	4M	4.76	0.23	0.3	99.7
	10M	2.00	0.11	0.1	99.6
MECHANICAL ANALYSIS	**40M**	0.42	1.93	3.9	96.1 **/*** 95.8
PORTION OF HYDROMETER	**100M**	0.149	4.38	8.8	87.4 **/*** 87.0
ANALYSIS	**200M**	0.074	4.66	9.3	78.1 **/*** 77.7
	Pan				

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 0.34 gm = 0.4% %

Material passing No. 10 mesh: weight = 77.42 gm = 99.6% %

Weight of Total Sample = 77.76 gm

Form: D422A
Revision Date: 1/17/05

Tested By: R Backlund
Submitted By:

Date: 5/10/2006
Date:

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REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (OL) ORGANIC SILT, gray-black, sandy, with clay Boring No. S-2

Shape: Hardness: Sample No. 16

Remarks: Depth: 44.5-46.5

Date Rec'd: 4/27/2006

	Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
	3"	76.2			
	2"	50.8			
	1 1/2"	37.5			
	1	25.4			
	3/4	19.1		0.0	100.0
	1/2	12.7	0.00	0.0	100.0
	4M	4.76	0.00	0.0	100.0
	10M	2.00	0.63	0.2	99.8
MECHANICAL ANALYSIS	**40M**	0.42	1.38	2.8	97.2 **/*** 97.0
PORTION OF HYDROMETER ANALYSIS	**100M**	0.149	5.89	11.8	85.5 **/*** 85.3
	200M	0.074	8.66	17.3	68.1 **/*** 68.0
	Pan				

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 0.63 gm = 0.2% %

Material passing No. 10 mesh: weight = 284.84 gm = 99.8% %

Weight of Total Sample = 285.47 gm

Form: D422A Tested By: R Backlund Date: 5/10/2006

Revision Date: 1/17/05 Submitted By: Date:

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REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (OL) ORGANIC SILT, gray-black, sandy, with clay Boring No. S-3

Shape: Hardness: Sample No. 13

Remarks: Depth: 19.5-21.0

Date Rec'd: 4/20/2006

MECHANICAL ANALYSIS PORTION OF HYDROMETER ANALYSIS

Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
3"	76.2			
2"	50.8			
1 1/2"	37.5			
1	25.4			
3/4	19.1		0.0	100.0
1/2	12.7	3.52	2.7	97.3
4M	4.76	3.26	2.5	94.8
10M	2.00	5.28	4.1	90.7
40M	0.42	4.08	8.2	91.8 **/*** 83.3
100M	0.149	5.89	11.8	80.1 **/*** 72.6
200M	0.074	5.64	11.3	68.8 **/*** 62.4
Pan				

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 12.06 gm = 9.3% %

Material passing No. 10 mesh: weight = 118.1 gm = 90.7% %

Weight of Total Sample = 130.16 gm

Form: D422A Tested By: R Backlund Date: 5/10/2006

Revision Date: 1/17/05 Submitted By: Date:

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REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (CH) FAT CLAY, gray, with shells, trace organic matter

Boring No. S-4

Sample No. 12

Remarks:

Depth: 26.0' - 28.3'

Date Rec'd: 4/24/2006

MECHANICAL ANALYSIS
PORTION OF HYDROMETER ANALYSIS

Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
3"	76.2			
2"	50.8			
1 1/2"	37.5			
1	25.4			
3/4	19.1	0.0	0.0	100.0
1/2	12.7	0.0	0.0	100.0
4M	4.76	0.0	0.0	100.0
10M	2.00	0.0	0.0	100.0
40M	0.42	0.14	0.2	99.8
100M	0.149	0.23	0.4	99.4
200M	0.074	0.30	0.5	98.9
Pan		61.72	98.9	0.0

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 0.00 gm = 0.00 %

Material passing No. 10 mesh: weight = 0.00 gm = 100.0% %

Weight of Total Sample = 62.39 gm

Form: D422A
Revision Date: 1/17/05

Tested By: J.Whelan (SET)
Submitted By:

Date: 5/10/2006
Date:

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REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (CL) LEAN CLAY, gray-brown, sandy, low plasticity Boring No. S-4

Shape: Hardness: Sample No. 16

Remarks: Depth: 41.0-43.3

Date Rec'd: 4/26/2006

	Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
	3"	76.2			
	2"	50.8			
	1 1/2"	37.5			
	1	25.4			
	3/4	19.1		0.0	100.0
	1/2	12.7	0.00	0.0	100.0
	4M	4.76	1.14	0.8	99.2
	10M	2.00	3.00	2.1	97.1
MECHANICAL ANALYSIS	**40M**	0.42	2.06	4.1	95.9 **/*** 93.1
PORTION OF HYDROMETER	**100M**	0.149	7.52	15.0	80.8 **/*** 78.5
ANALYSIS	**200M**	0.074	7.71	15.4	65.4 **/*** 63.5
	Pan				

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 4.14 gm = 2.9% %

Material passing No. 10 mesh: weight = 140.74 gm = 97.1% %

Weight of Total Sample = 144.88 gm

Form: D422A Tested By: R Backlund Date: 5/11/2006

Revision Date: 1/17/05 Submitted By: Date:

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REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (OH) ORGANIC CLAY, gray, with sand and shells, some peat and wood

Boring No. S-5

Sample No. 8

Remarks:

Depth: 14.0' - 16.3'

Date Rec'd: 4/24/2006

	Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
	3"	76.2			
	2"	50.8			
	1 1/2"	37.5			
	1	25.4			
	3/4	19.1	0.0	0.0	100.0
	1/2	12.7	0.0	0.0	100.0
	4M	4.76	2.9	2.9	97.1
	10M	2.00	1.7	1.7	95.3
MECHANICAL ANALYSIS PORTION OF HYDROMETER ANALYSIS	**40M**	0.42	3.41	3.4	96.6 **/*** 92.0
	100M	0.149	4.22	4.3	92.3 **/*** 88.0
	200M	0.074	4.75	4.8	87.5 **/*** 87.1
	Pan		86.74	87.5	0.0

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 4.64 gm = 4.7 %

Material passing No. 10 mesh: weight = 94.48 gm = 95.3 %

Weight of Total Sample = 99.12 gm

Form: D422A
Revision Date: 1/17/05

Tested By: J. Whelan (SET) Date: 5/10/2006

Submitted By: Date:

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REPORT OF: PARTICLE-SIZE ANALYSIS OF SOILS - MECHANICAL

(ASTM D422)

Job Name: Kinnickinnic River Stability Analysis and Dredging Study C.E.C. Job #: GD-06032

Client: Barr Engineering Company

Address: 4700 West 77th Street, Edina, Mn 55435-4803

Soil Description: (SP-SM) SAND,brown, fine to coarse, some silt, trace clay

Boring No. S-6

Sample No. 13

Remarks:

Depth: 19.5-21.5

Date Rec'd: 4/24/2006

	Sieve Size	Grain Diameter (mm)	Weight Retained	Percent Retained	Percent Finer
	3"	76.2			
	2"	50.8			
	1 1/2"	37.5			
	1	25.4			
	3/4	19.1	0.00		100.0
	1/2	12.7	0.00		100.0
	4M	4.76	40.75	8.1	91.9
	10M	2.00	129.82	25.9	66.0
MECHANICAL ANALYSIS	**40M**	0.42	25.06	50.1	49.9 **/*** 32.9
PORTION OF HYDROMETER ANALYSIS	**100M**	0.149	13.85	27.7	22.2 **/*** 14.6
	200M	0.074	3.69	7.4	14.8 **/*** 9.8
	Pan				

***Percent Based on Total Sample**

Original Sample:

Material retained on No. 10 mesh: weight = 170.57 gm = 34.0% %

Material passing No. 10 mesh: weight = 331.26 gm = 66.0% %

Weight of Total Sample = 501.83 gm

Form: D422A
Revision Date: 1/17/05

Tested By: R Backlund
Submitted By:

Date: 5/10/2006
Date:

COLEMAN ENGINEERING COMPANY
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REPORT OF UNCONFINED COMPRESSION

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032

Client: Barr Engineering Co., 4700 West 77th St., Edina Mn 55435-4803 **Date:** 5/4/06

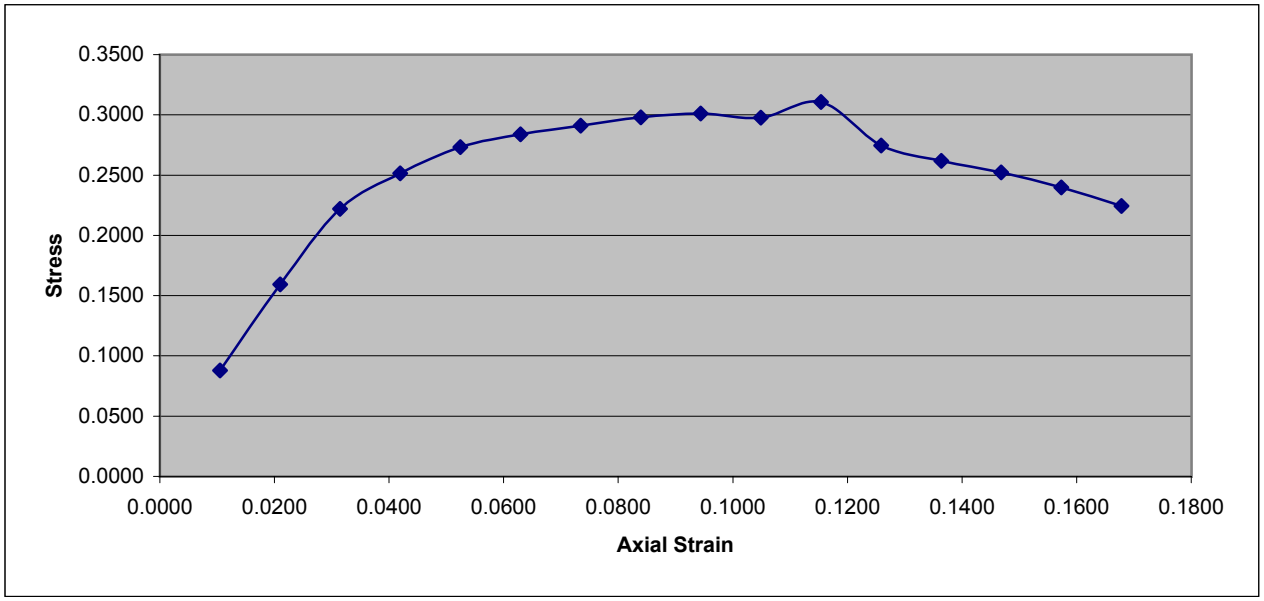
Boring No: S-2 **Sample No:** 10 **Depth:** 18.0'-20.3'

Test No.			1			
Type of Specimen			Thin Wall			
Initial	Water Content	w_o	80.6			
	Void Ratio	e_o	2.054			
	Saturation	S_o	100.0			
	Dry Density, lb/cu ft	γ_d	52.1			
Time to Failure, min		t_f	5.5			
Unconfined Compressive Strength, T/sq ft		q_u	0.31			
Undrained Shear Strength, T/sq ft		s_u				
Sensitivity Ratio		S_t				
Initial Specimen Diameter, in		D_o	2.82			
Initial Specimen Height, in		H_o	5.72			

Classification (OL)Organic Silt

LL	75.0	PL	36.0	PI	39.0	G_s	*2.55

Remarks: * Assumed Value



REPORT OF: UNCONFINED COMPRESSIVE STRENGTH

Client:	Barr Engineering Co	Date:	5/4/06
Project:	Kinnickinnic River Stabilty Analysis	Job No.	GD-06032

pan no.	63	Diameter (in./cm)	2.82	7.16	
wet soil + tare	1222.5	length (in./cm)		5.72	14.53
tare	340.6	area (sq.cm)		40.26	
dry soil	488.40	volume (cc)		585.0	
water	393.50	volume of solids (cc)		191.5	
moisture (%)	80.6	void ratio		2.054	
spec. gr. assumed	2.55	saturation (%)		100.0	
		dry density (pcf)		52.1	

Sample: Retest S-2, Sample #10 18.0'-20.3' USCS: (OL) Peat

elapsed time (min)	dial rdg (0.01 in)	change (0.01 in.)	load rdg (0.0001in.)	load (lbs.)	axial strain E	1-E	corrected area (scm)	qu(tsf)
0.5	1.94	0.06	24	7.7	0.0105	0.9895	40.69	0.0878
1.0	1.88	0.12	44	14.1	0.0210	0.9790	41.12	0.1592
1.5	1.82	0.18	62	19.8	0.0315	0.9685	41.57	0.2219
2.0	1.76	0.24	71	22.7	0.0420	0.9580	42.02	0.2514
2.5	1.70	0.30	78	25.0	0.0524	0.9476	42.49	0.2732
3.0	1.64	0.36	82	26.2	0.0629	0.9371	42.96	0.2840
3.5	1.58	0.42	85	27.2	0.0734	0.9266	43.45	0.2911
4.0	1.52	0.48	88	28.2	0.0839	0.9161	43.95	0.2980
4.5	1.46	0.54	90	28.8	0.0944	0.9056	44.46	0.3012
5.0	1.40	0.60	90	28.8	0.1049	0.8951	44.98	0.2977
5.5	1.34	0.66	95	30.4	0.1154	0.8846	45.51	0.3106
6.0	1.28	0.72	85	27.2	0.1259	0.8741	46.06	0.2746
6.5	1.22	0.78	82	26.2	0.1364	0.8636	46.62	0.2617
7.0	1.16	0.84	80	25.6	0.1469	0.8531	47.19	0.2523
7.5	1.10	0.90	77	24.6	0.1573	0.8427	47.78	0.2398
8.0	1.04	0.96	73	23.4	0.1678	0.8322	48.38	0.2245
8.5	0.98	1.02		0.0	0.1783	0.8217	49.00	0.0000
9.0	0.92	1.08		0.0	0.1888	0.8112	49.63	0.0000
9.5	0.86	1.14		0.0	0.1993	0.8007	50.28	0.0000
10.0	0.80	1.20		0.0	0.2098	0.7902	50.95	0.0000
10.5	0.74	1.26		0.0	0.2203	0.7797		
11.0	0.68	1.32		0.0	0.2308	0.7692		
11.5	0.62	1.38		0.0	0.2413	0.7587		
12.0	0.56	1.44		0.0	0.2517	0.7483		

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REPORT OF UNCONFINED COMPRESSION

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032

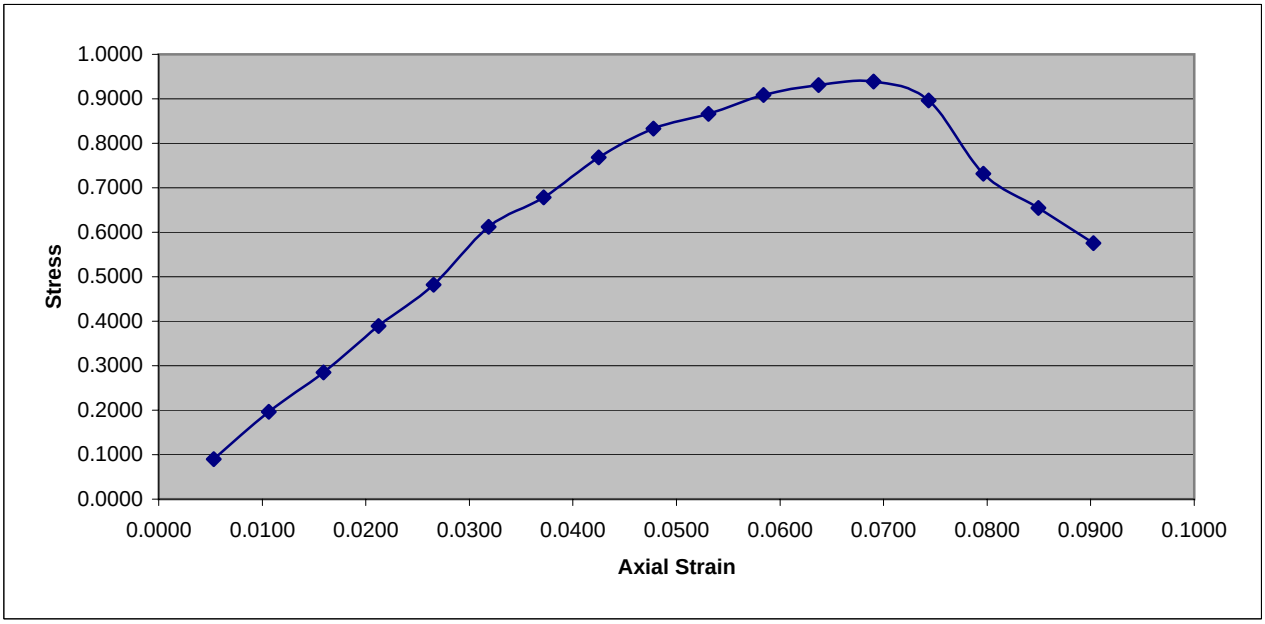
Client: Barr Engineering Co., 4700 West 77th St., Edina Mn 55435-4803 **Date:** 5/3/2006

Boring No: S-2 **Sample No:** 14 **Depth:** 36.5'-38.8'

Test No.			1			
Type of Specimen			3" TWT			
Initial	Water Content	w_o	41.9			
	Void Ratio	e_o	1.065			
	Saturation	S_o	102.3			
	Dry Density, lb/cu ft	γ_d	78.6			
Time to Failure, min		t_f	6.5			
Unconfined Compressive Strength, T/sq ft		q_u	0.94			
Undrained Shear Strength, T/sq ft		s_u				
Sensitivity Ratio		S_t				
Initial Specimen Diameter, in		D_o	2.85			
Initial Specimen Height, in		H_o	5.65			

Classification							
LL	49.5	PL	34.2	PI	15.3	G_s	*2.60

Remarks: * Assumed Value



REPORT OF: UNCONFINED COMPRESSIVE STRENGTH

Client: Barr Engineering Co
Project: Kinnickinnic River Stabilty Analysis

Date:
Job No. GD-06032

pan no.		65	Diameter (in./cm)	7.24	
wet soil + tare		1396.5	length (in./cm)	5.65	14.34
tare		341.6	area (sq.cm)	41.17	
dry soil		743.4	volume (cc)	590.4	
water		311.5	volume of solids (cc)	285.9	
moisture	(%)	41.9	void ratio	1.065	
spec. gr.	Assumed	2.60	saturation (%)	102.3	
			dry density (pcf)	78.6	
Sample:	S-2, Sample#14 36.5'-38.8'		USCS:		

elapsed time (min)	dial rdg (0.01 in)	change (0.01 in.)	load rdg (0.0001in.)	load (lbs.)	axial strain E	1-E	corrected area (scm)	qu(tsf)
0.5	1.97	0.03	25	8.0	0.0053	0.9947	41.39	0.0899
1.0	1.94	0.06	55	17.6	0.0106	0.9894	41.61	0.1967
1.5	1.91	0.09	80	25.6	0.0159	0.9841	41.84	0.2845
2.0	1.88	0.12	110	35.2	0.0212	0.9788	42.06	0.3891
2.5	1.85	0.15	137	43.8	0.0265	0.9735	42.29	0.4820
3.0	1.82	0.18	175	56.0	0.0319	0.9681	42.52	0.6123
3.5	1.79	0.21	195	62.4	0.0372	0.9628	42.76	0.6786
4.0	1.76	0.24	222	71.0	0.0425	0.9575	43.00	0.7683
4.5	1.73	0.27	242	77.4	0.0478	0.9522	43.24	0.8329
5.0	1.70	0.30	253	81.0	0.0531	0.9469	43.48	0.8659
5.5	1.67	0.33	267	85.4	0.0584	0.9416	43.72	0.9086
6.0	1.64	0.36	275	88.0	0.0637	0.9363	43.97	0.9306
6.5	1.61	0.39	279	89.3	0.0690	0.9310	44.22	0.9388
7.0	1.58	0.42	268	85.8	0.0743	0.9257	44.48	0.8966
7.5	1.55	0.45	220	70.4	0.0796	0.9204	44.73	0.7318
8.0	1.52	0.48	198	63.4	0.0850	0.9150	44.99	0.6548
8.5	1.49	0.51	175	56.0	0.0903	0.9097	45.25	0.5754
9.0	1.46	0.54		0.0	0.0956	0.9044	45.52	0.0000
9.5	1.43	0.57		0.0	0.1009	0.8991	45.79	0.0000
10.0	1.40	0.60		0.0	0.1062	0.8938	46.06	0.0000

COLEMAN ENGINEERING COMPANY
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Telephone: (906) 774-3440 Fax: (906) 774-7776

REPORT OF UNCONFINED COMPRESSION

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032

Client: Barr Engineering Co., 4700 West 77th St., Edina Mn 55435-4803 **Date:** 5/4/2006

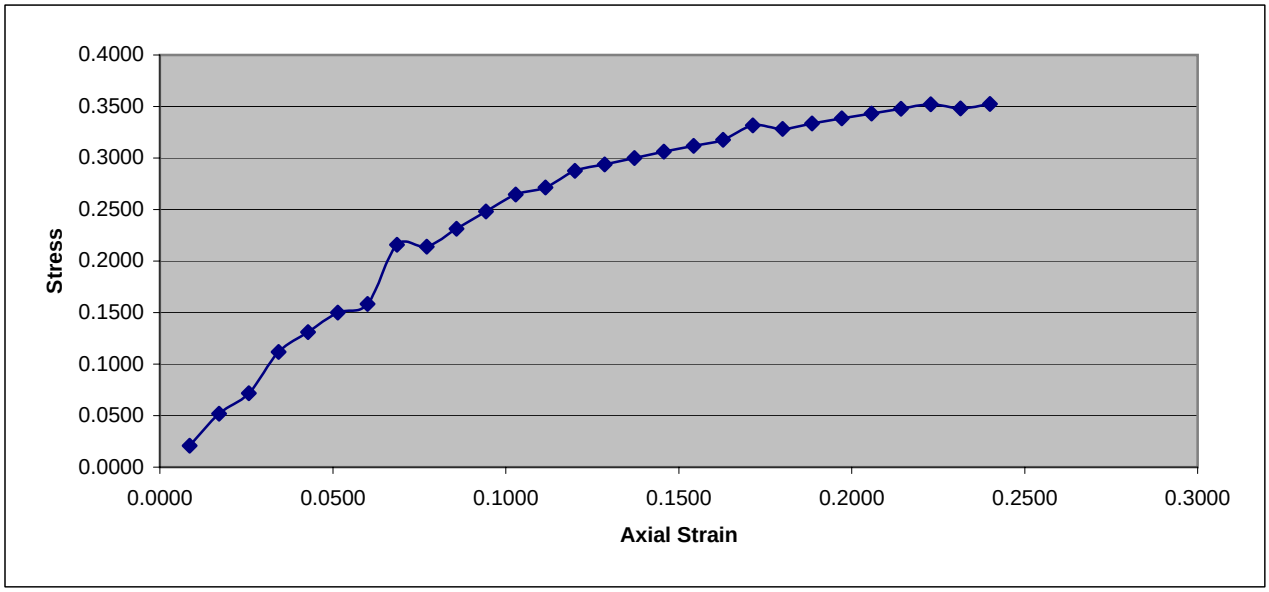
Boring No: S-3 **Sample No:** 20 **Depth:** 45.0'-47.3'

Test No.			1.0			
Type of Specimen			Thin Wall			
Initial	Water Content	w_o	24.4			
	Void Ratio	e_o	0.634			
	Saturation	S_o	105.9			
	Dry Density, lb/cu ft	7_d	105.0			
Time to Failure, min		t_f	9.0			
Unconfined Compressive Strength, T/sq ft		q_u	0.31			
Undrained Shear Strength, T/sq ft		s_u				
Sensitivity Ratio		S_t				
Initial Specimen Diameter, in		D_o	1.67			
Initial Specimen Height, in		H_o	3.50			

Classification (CL) Lean Clay

LL	29.1	PL	15.5	PI	13.7	G_s	*2.75

Remarks: * Assumed value



REPORT OF: UNCONFINED COMPRESSIVE STRENGTH

Client:	Barr Engineering Co	Date:	5/4/2006
Project:	Kinnickinnic River Stabilty Analysis	Job No.	GD-06032

pan no.	59	Diameter (in./cm)	1.67	4.24	
wet soil + tare	605.2	length (in./cm)		3.50	8.88
tare	342.6	area (sq.cm)		14.12	
dry soil	211.10	volume (cc)		125.4	
water	51.50	volume of solids (cc)		76.8	
moisture (%)	24.4	void ratio		0.634	
spec. gr.	2.75	saturation (%)		105.9	
		dry density (pcf)		105.0	

Sample: Retest S-3, Sample #20 45.0'-47.3' USCS: (CL) Clay

elapsed time (min)	dial rdg (0.01 in)	change (0.01 in.)	load rdg (0.0001in.)	load (lbs.)	axial strain E	1-E	corrected area (scm)	qu(tsf)
0.5	1.97	0.03	2	0.6	0.0086	0.9914	14.24	0.0209
1.0	1.94	0.06	5	1.6	0.0171	0.9829	14.37	0.0518
1.5	1.91	0.09	7	2.2	0.0257	0.9743	14.49	0.0719
2.0	1.88	0.12	11	3.5	0.0343	0.9657	14.62	0.1119
2.5	1.85	0.15	13	4.2	0.0429	0.9571	14.75	0.1311
3.0	1.82	0.18	15	4.8	0.0514	0.9486	14.89	0.1499
3.5	1.79	0.21	16	5.1	0.0600	0.9400	15.02	0.1585
4.0	1.76	0.24	22	7.0	0.0686	0.9314	15.16	0.2159
4.5	1.73	0.27	22	7.0	0.0771	0.9229	15.30	0.2140
5.0	1.70	0.30	24	7.7	0.0857	0.9143	15.44	0.2312
5.5	1.67	0.33	26	8.3	0.0943	0.9057	15.59	0.2482
6.0	1.64	0.36	28	9.0	0.1029	0.8971	15.74	0.2647
6.5	1.61	0.39	29	9.3	0.1114	0.8886	15.89	0.2716
7.0	1.58	0.42	31	9.9	0.1200	0.8800	16.05	0.2875
7.5	1.55	0.45	32	10.2	0.1286	0.8714	16.20	0.2939
8.0	1.52	0.48	33	10.6	0.1371	0.8629	16.36	0.3001
8.5	1.49	0.51	34	10.9	0.1457	0.8543	16.53	0.3061
9.0	1.46	0.54	35	11.2	0.1543	0.8457	16.70	0.3119
9.5	1.43	0.57	36	11.5	0.1629	0.8371	16.87	0.3176
10.0	1.40	0.60	38	12.2	0.1714	0.8286	17.04	0.3318
10.5	1.37	0.63	38	12.2	0.1800	0.8200	17.22	0.3284
11.0	1.34	0.66	39	12.5	0.1886	0.8114	17.40	0.3335
11.5	1.31	0.69	40	12.8	0.1971	0.8029	17.59	0.3384
12.0	1.28	0.72	41	13.1	0.2057	0.7943	17.78	0.3432
12.5	1.25	0.75	42	13.4	0.2143	0.7857	17.97	0.3478
13.0	1.22	0.78	43	13.8	0.2229	0.7771	18.17	0.3522
13.5	1.19	0.81	43	13.8	0.2314	0.7686	18.37	0.3483
14.0	1.16	0.84	44	14.1	0.2400	0.7600	18.58	0.3524

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REPORT OF UNCONFINED COMPRESSION

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032

Client: Barr Engineering Co., 4700 West 77th St., Edina Mn 55435-4803 **Date:** 5/4/2006

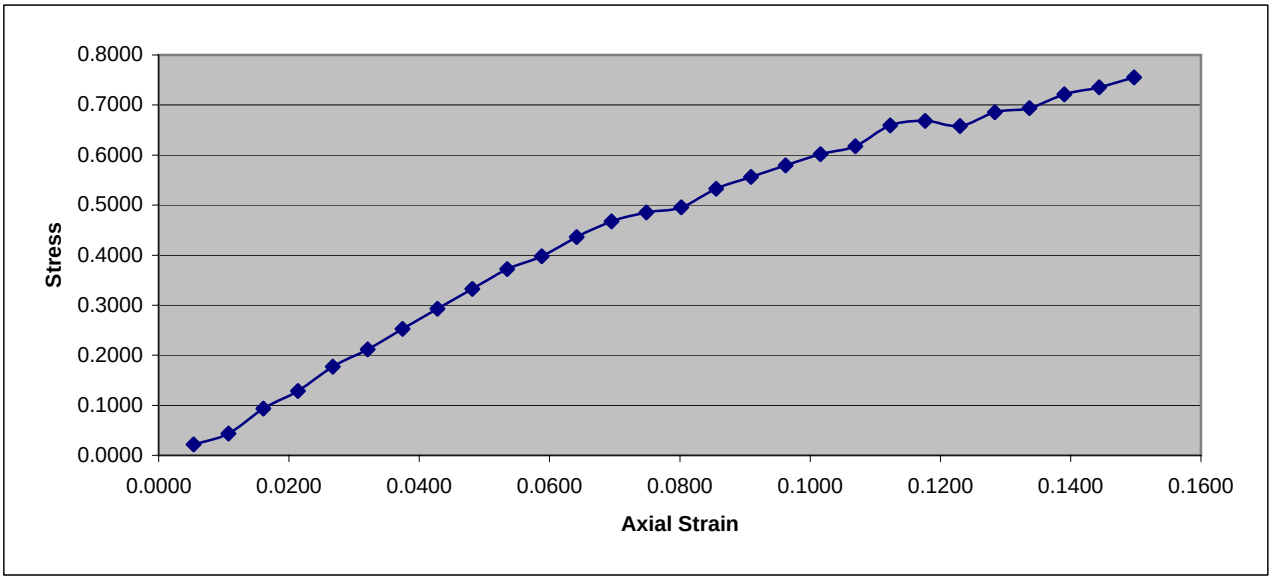
Boring No: S-4 **Sample No:** 16 **Depth:** 41.0'-43.3'

Test No.			1.0			
Type of Specimen			3" TWT			
Initial	Water Content	w_o	15.9			
	Void Ratio	e_o	0.472			
	Saturation	S_o	92.5			
	Dry Density, lb/cu ft	γ_d	116.60			
Time to Failure, min		t_f	14.0			
Unconfined Compressive Strength, T/sq ft		q_u	0.76			
Undrained Shear Strength, T/sq ft		s_u				
Sensitivity Ratio		S_t				
Initial Specimen Diameter, in		D_o	2			
Initial Specimen Height, in		H_o	3.74			

Classification (CL) Lean Clay

LL	22.0	PL	13.9	PI	8.1	G_s	2.74

Remarks:



REPORT OF: UNCONFINED COMPRESSIVE STRENGTH

Client: Barr Engineering Co Date:
Project: Kinnickinnic River Stabilty Analysis Job No. GD-06032

pan no.	63	Diameter (in./cm)	5.1		
wet soil + tare	760.3	length (in./cm)	3.74	9.49	
tare	340.6	area (sq.cm)	20.43		
dry soil	362.2	volume (cc)	193.9		
water	57.5	volume of solids (cc)	131.7		
moisture (%)	15.9	void ratio	0.472		
spec. gr.	2.75	saturation (%)	92.5		
		dry density (pcf)	116.6		

Sample: S-4, Sample #16 USCS:
41.0'-43.3' Bottom

elapsed time (min)	dial rdg (0.01 in)	change (0.01 in.)	load rdg (0.0001in.)	load (lbs.)	axial strain E	1-E	corrected area (scm)	qu(tsf)
0.5	1.98	0.02	3	1.0	0.0053	0.9947	20.54	0.0217
1.0	1.96	0.04	6	1.9	0.0107	0.9893	20.65	0.0432
1.5	1.94	0.06	13	4.2	0.0160	0.9840	20.76	0.0932
2.0	1.92	0.08	18	5.8	0.0214	0.9786	20.88	0.1283
2.5	1.90	0.10	25	8.0	0.0267	0.9733	20.99	0.1772
3.0	1.88	0.12	30	9.6	0.0321	0.9679	21.11	0.2115
3.5	1.86	0.14	36	11.5	0.0374	0.9626	21.22	0.2524
4.0	1.84	0.16	42	13.4	0.0428	0.9572	21.34	0.2928
4.5	1.82	0.18	48	15.4	0.0481	0.9519	21.46	0.3328
5.0	1.80	0.20	54	17.3	0.0535	0.9465	21.58	0.3723
5.5	1.78	0.22	58	18.6	0.0588	0.9412	21.71	0.3976
6.0	1.76	0.24	64	20.5	0.0642	0.9358	21.83	0.4362
6.5	1.74	0.26	69	22.1	0.0695	0.9305	21.96	0.4676
7.0	1.72	0.28	72	23.0	0.0749	0.9251	22.08	0.4851
7.5	1.70	0.30	74	23.7	0.0802	0.9198	22.21	0.4957
8.0	1.68	0.32	80	25.6	0.0856	0.9144	22.34	0.5328
8.5	1.66	0.34	84	26.9	0.0909	0.9091	22.47	0.5562
9.0	1.64	0.36	88	28.2	0.0963	0.9037	22.61	0.5792
9.5	1.62	0.38	92	29.4	0.1016	0.8984	22.74	0.6020
10.0	1.60	0.40	95	30.4	0.1070	0.8930	22.88	0.6179
10.5	1.58	0.42	102	32.6	0.1123	0.8877	23.01	0.6595
11.0	1.56	0.44	104	33.3	0.1176	0.8824	23.15	0.6684
11.5	1.54	0.46	103	33.0	0.1230	0.8770	23.30	0.6579
12.0	1.52	0.48	108	34.6	0.1283	0.8717	23.44	0.6857
12.5	1.50	0.50	110	35.2	0.1337	0.8663	23.58	0.6941
13.0	1.48	0.52	115	36.8	0.1390	0.8610	23.73	0.7211
13.5	1.46	0.54	118	37.8	0.1444	0.8556	23.88	0.7354
14.0	1.44	0.56	122	39.0	0.1497	0.8503	24.03	0.7555

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REPORT OF UNCONFINED COMPRESSION

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032

Client: Barr Engineering Co., 4700 West 77th St., Edina Mn 55435-4803 **Date:** 5/4/2006

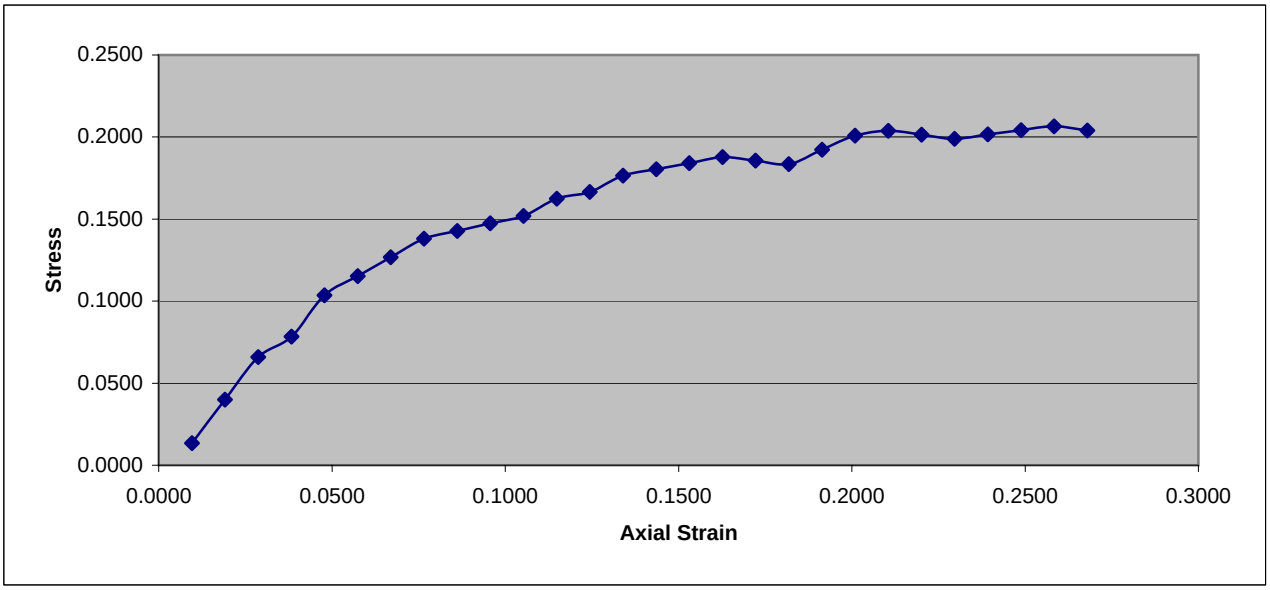
Boring No: S-6 **Sample No:** 21 **Depth:** 51.5'-53.8'

Test No.			1			
Type of Specimen			Thin Wall			
Initial	Water Content	w_o	45.4			
	Void Ratio	e_o	1.079			
	Saturation	S_o	111.6			
	Dry Density, lb/cu ft	γ_d	79.5			
Time to Failure, min		t_f	8.0			
Unconfined Compressive Strength, T/sq ft		q_u	0.18			
Undrained Shear Strength, T/sq ft		s_u				
Sensitivity Ratio		S_t				
Initial Specimen Diameter, in		D_o	2.08			
Initial Specimen Height, in		H_o	4.18			

Classification (OH) Organic Silt

LL	57.5	PL	32.0	PI	25.6	G_s	*2.65

Remarks: * Assumed Value



REPORT OF: UNCONFINED COMPRESSIVE STRENGTH

Client:	Barr Engineering Co	Date:	5/4/2006
Project:	Kinnickinnic River Stabilty Analysis	Job No.	GD-06032

pan no.	68	Diameter (in./cm)	2.08	5.28	
wet soil + tare	772.3	length (in./cm)		4.18	10.61
tare	341.7	area (sq.cm)		21.90	
dry soil	296.10	volume (cc)		232.3	
water	134.50	volume of solids (cc)		111.7	
moisture (%)	45.4	void ratio		1.079	
spec. gr. assumed	2.65	saturation (%)		111.6	
		dry density (pcf)		79.5	
Sample:	Retest S-6, Sample #21 51.5'-53.8'	USCS:			

elapsed time (min)	dial rdg (0.01 in)	change (0.01 in.)	load rdg (0.0001in.)	load (lbs.)	axial strain E	1-E	corrected area (scm)	qu(tsf)
0.5	1.96	0.04	2	0.6	0.0096	0.9904	22.11	0.0135
1.0	1.92	0.08	6	1.9	0.0191	0.9809	22.33	0.0400
1.5	1.88	0.12	10	3.2	0.0287	0.9713	22.55	0.0660
2.0	1.84	0.16	12	3.8	0.0383	0.9617	22.77	0.0784
2.5	1.80	0.20	16	5.1	0.0478	0.9522	23.00	0.1035
3.0	1.76	0.24	18	5.8	0.0574	0.9426	23.23	0.1153
3.5	1.72	0.28	20	6.4	0.0670	0.9330	23.47	0.1268
4.0	1.68	0.32	22	7.0	0.0766	0.9234	23.72	0.1380
4.5	1.64	0.36	23	7.4	0.0861	0.9139	23.96	0.1428
5.0	1.60	0.40	24	7.7	0.0957	0.9043	24.22	0.1475
5.5	1.56	0.44	25	8.0	0.1053	0.8947	24.48	0.1520
6.0	1.52	0.48	27	8.6	0.1148	0.8852	24.74	0.1624
6.5	1.48	0.52	28	9.0	0.1244	0.8756	25.01	0.1666
7.0	1.44	0.56	30	9.6	0.1340	0.8660	25.29	0.1765
7.5	1.40	0.60	31	9.9	0.1435	0.8565	25.57	0.1804
8.0	1.36	0.64	32	10.2	0.1531	0.8469	25.86	0.1841
8.5	1.32	0.68	33	10.6	0.1627	0.8373	26.15	0.1877
9.0	1.28	0.72	33	10.6	0.1722	0.8278	26.46	0.1856
9.5	1.24	0.76	33	10.6	0.1818	0.8182	26.77	0.1835
10.0	1.20	0.80	35	11.2	0.1914	0.8086	27.08	0.1923
10.5	1.16	0.84	37	11.8	0.2010	0.7990	27.41	0.2009
11.0	1.12	0.88	38	12.2	0.2105	0.7895	27.74	0.2038
11.5	1.08	0.92	38	12.2	0.2201	0.7799	28.08	0.2014
12.0	1.04	0.96	38	12.2	0.2297	0.7703	28.43	0.1989
12.5	1.00	1.00	39	12.5	0.2392	0.7608	28.79	0.2016
13.0	0.96	1.04	40	12.8	0.2488	0.7512	29.15	0.2042
13.5	0.92	1.08	41	13.1	0.2584	0.7416	29.53	0.2066
14.0	0.88	1.12	41	13.1	0.2679	0.7321	29.92	0.2039

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MOISTURE CONTENT DETERMINATION

ASTM D-2216

Project: Kinnickinnic River Stability Analysis and Dredging Study

Client: Barr Engineering Company **Job No:** GD-06032C

Address: 4700 West 77th Street, Edina, MN 55435-4803 **Date:** 5/4/2006

Boring No.	S-3	S-1	S-1	S-5	S-2
Sample No.	16	8	12	13	16
Depth (ft.)	33.5-35.0	10.5-12.0	16.5-18.0	34.0-36.0	44.5-46.5
Pan No.	64	69	61	77	16
Weight-Wet Sample & Tare (g)	467.9	430.1	404.4	456.9	475.8
Weight-Dry Sample & Tare (g)	447.8	398.3	369.7	372.4	401.4
Weight of Moisture (g)	20.1	31.8	34.7	84.5	74.4
Weight of Tare (g)	341.7	344.1	340.7	104.0	116.2
Weight of Dry Soil (g)	106.1	54.2	29.0	268.4	285.2
Moisture Content (%)	18.9	58.7	119.7	31.5	26.1

Boring No.	S-3				
Sample No.	13				
Depth (ft.)	19.5-21.0				
Pan No.	69				
Weight-Wet Sample & Tare (g)	543.6				
Weight-Dry Sample & Tare (g)	474.4				
Weight of Moisture (g)	69.2				
Weight of Tare (g)	344.1				
Weight of Dry Soil (g)	130.3				
Moisture Content (g)	53.1				

Remarks:

Tested By: Ryan Backlund **Submitted By:**

Date: 5/4/2006 **Date:** 5/23/2006

Form D2216 Revised 2/24/05

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MOISTURE CONTENT DETERMINATION

ASTM D-2216

Project: Kinnickinnic River Stability Analysis and Dredging Study

Client: Barr Engineering Company **Job No:** GD-06032C

Address: 4700 West 77th Street, Edina, MN 55435-4803 **Date:** 5/3/2006

Boring No.	S-1	S-1	S-1	S-1	S-3
Sample No.	10	14	17	18	9
Depth (ft.)	13.5-15.0	19.5-21.0	32.0-33.5	37.0-38.5	13.5-15.0
Pan No.	61	69	63	59	99
Weight-Wet Sample & Tare (g)	559.4	512.9	440.8	426.1	272.5
Weight-Dry Sample & Tare (g)	496.9	489.2	426.6	415.2	207.6
Weight of Moisture (g)	62.5	23.7	14.2	10.9	64.9
Weight of Tare (g)	340.7	344.0	340.7	342.4	113.1
Weight of Dry Soil (g)	156.2	145.2	85.9	72.8	94.5
Moisture Content (%)	40.0	16.3	16.5	15.0	68.7

Boring No.	S-4				
Sample No.	6				
Depth (ft.)	10.0-12.0				
Pan No.	58				
Weight-Wet Sample & Tare (g)	493.4				
Weight-Dry Sample & Tare (g)	401.8				
Weight of Moisture (g)	91.6				
Weight of Tare (g)	342.2				
Weight of Dry Soil (g)	59.6				
Moisture Content (g)	153.7				

Remarks:

Tested By: Ryan Backlund **Submitted By:**

Date: 5/3/2006 **Date:** 5/23/2006

Form D2216 Revised 2/24/05

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

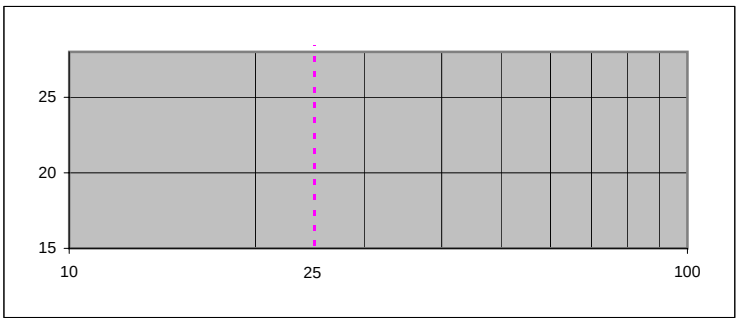
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (OH) Organic Silt/Clay with sand and shells
Depth of Sample: 14.0' - 16.3' **Boring No.:** S-5 **Sample No.:** 8

Liquid Limit Determination

Can No.						
Wt. of wet soil +can (g)	18.55					
Wt. of dry soil + can (g)	10.33					
Wt. of can (g)	1.52					
Wt of dry soil (g)	8.81					
Wt of moisture (g)	8.22					
* No of blows, N (g)	**28**					
*Water content, *w %*	**94.6**					

*One Point Method



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **94.6**
Plastic limit = **64.1**
Plasticity index I_p = **30.5**

Plastic Limit Determination

Can no.						
Wt. of wet soil + can (g)	12.62					
Wt. of dry soil + can (g)	8.28					
Wt. of can (g)	1.51					
Wt. of dry soil (g)	6.77					
Wt. of moisture (g)	4.34					
Water content, $w\% = w_p$	**64.1**					

Tested by: J. Whelan (SET) Date: 5/16/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

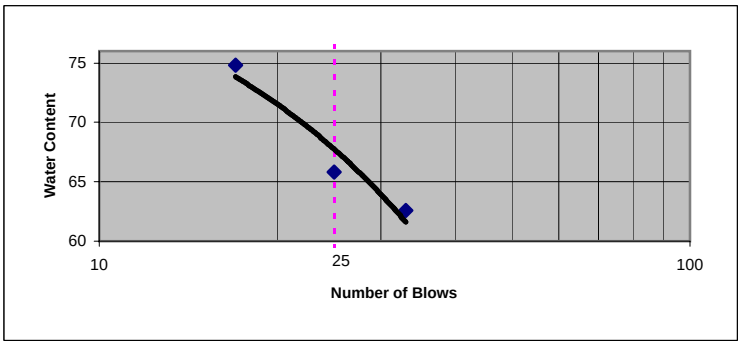
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (OH) Organic Silt, gray-black, high plasticity
Depth of Sample: 10.5-12.0 **Boring No.:** S-1 **Sample No.:** 8

Liquid Limit Determination

Can No.	8	13	21			
Wt. of wet soil +can (g)	29.65	30.34	29.46			
Wt. of dry soil + can (g)	26.86	27.07	26.46			
Wt. of can (g)	22.38	22.1	22.45			
Wt of dry soil (g)	3.85	4.97	4.01			
Wt of moisture (g)	2.77	3.27	3			
* No of blows, N (g)	**33**	**25**	**17**			
Water content, *w %*	**62.6**	**65.8**	**74.8**			

*Blows for trials must be in the following ranges: (25-35), (20-30), (15-25)



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **67.5**
Plastic limit = **36.2**
Plasticity index I_p = **31.3**

Plastic Limit Determination

Can no.	2	7				
Wt. of wet soil + can (g)	29.2	28.89				
Wt. of dry soil + can (g)	27.35	27.18				
Wt. of can (g)	22.22	22.46				
Wt. of dry soil (g)	5.13	4.72				
Wt. of moisture (g)	1.85	1.71				
Water content, $w\% = w_p$	**36.1**	**36.2**				

Tested by: R. Backlund Date: 5/8/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

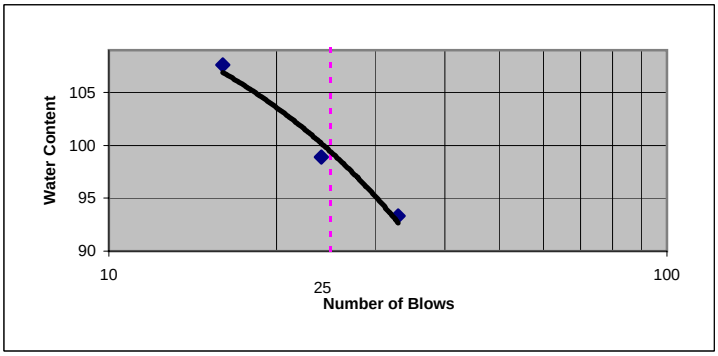
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (OH) Organic Silt, gray-black, high plasticity
Depth of Sample: 16.5-18.0 **Boring No.:** S-1 **Sample No.:** 12

Liquid Limit Determination

Can No.	2	7	29			
Wt. of wet soil +can (g)	31.54	29.77	32.34			
Wt. of dry soil + can (g)	26.72	26.14	27.63			
Wt. of can (g)	22.24	22.47	22.58			
Wt of dry soil (g)	4.48	3.67	5.05			
Wt of moisture (g)	4.82	3.63	4.71			
* No of blows, N (g)	**16**	**24**	**33**			
Water content, *w %*	**107.6**	**98.9**	**93.3**			

*Blows for trials must be in the following ranges: (25-35), (20-30), (15-25)



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **99.1**
Plastic limit = **51.6**
Plasticity index I_p = **47.5**

Plastic Limit Determination

Can no.	1	4
Wt. of wet soil + can (g)	29.53	28.95
Wt. of dry soil + can (g)	27.04	26.69
Wt. of can (g)	22.19	22.33
Wt. of dry soil (g)	4.85	4.36
Wt. of moisture (g)	2.49	2.26
Water content, $w\% = w_p$	**51.3**	**51.8**

Tested by: R. Backlund Date: 5/8/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

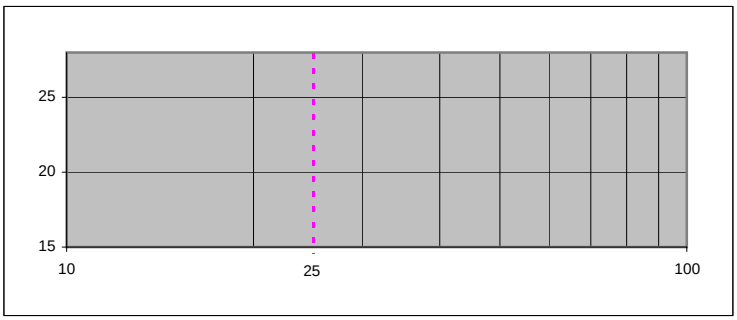
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (CL) Lean Clay
Depth of Sample: 27.0" - 29.3' **Boring No.:** S-1 **Sample No.:** 16

Liquid Limit Determination

Can No.						
Wt. of wet soil +can (g)	24.46					
Wt. of dry soil + can (g)	20.51					
Wt. of can (g)	1.51					
Wt of dry soil (g)	19.00					
Wt of moisture (g)	3.95					
* No of blows, N (g)	**22**					
Water content, *w %*	***20.5**					

*One Point Method



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **20.5**
Plastic limit = **12.2**
Plasticity index I_p = **8.3**

Plastic Limit Determination

Can no.						
Wt. of wet soil + can (g)	14.7					
Wt. of dry soil + can (g)	13.27					
Wt. of can (g)	1.51					
Wt. of dry soil (g)	11.67					
Wt. of moisture (g)	1.43					
Water content, $w\% = w_p$	**12.2**					

Tested by: J. Whelan (SET) Date: 5/16/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

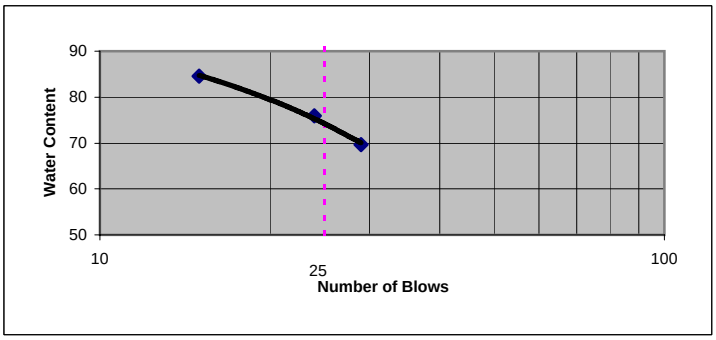
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (OH) Organic Silt, gray-black, high plasticity
Depth of Sample: 18.0-20.3 **Boring No.:** S-2 **Sample No.:** 10

Liquid Limit Determination

Can No.	8b	20	28			
Wt. of wet soil +can (g)	27.77	30.55	29.48			
Wt. of dry soil + can (g)	24.83	27.03	26.51			
Wt. of can (g)	21.35	22.39	22.29			
Wt of dry soil (g)	3.48	4.64	4.22			
Wt of moisture (g)	2.94	3.52	2.97			
* No of blows, N (g)	**15**	**24**	**29**			
Water content, *w %*	**84.5**	**75.9**	**69.6**			

*Blows for trials must be in the following ranges: (25-35), (20-30), (15-25)



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **75.0**
Plastic limit = **36.0**
Plasticity index I_p = **39.0**

Plastic Limit Determination

Can no.	15	25				
Wt. of wet soil + can (g)	30.11	31.55				
Wt. of dry soil + can (g)	28.07	29.11				
Wt. of can (g)	22.34	22.41				
Wt. of dry soil (g)	5.73	6.7				
Wt. of moisture (g)	2.04	2.44				
Water content, $w\% = w_p$	**35.6**	**36.4**				

Tested by: R. Backlund Date: 5/8/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

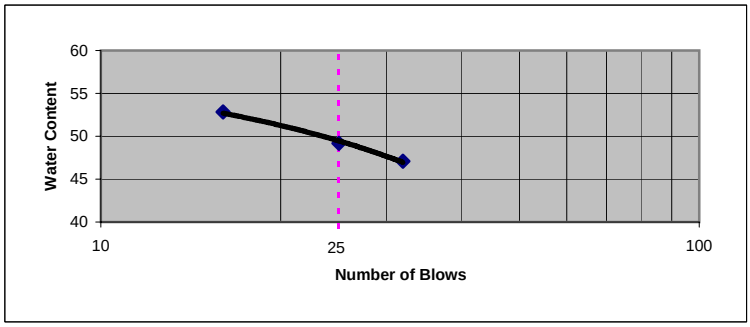
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (OL) Organic Clay,gray, moderate plasticity
Depth of Sample: 36.5-38.8 **Boring No.:** S-2 **Sample No.:** 14

Liquid Limit Determination

Can No.	6	11	16			
Wt. of wet soil +can (g)	31.8	35.17	33.5			
Wt. of dry soil + can (g)	28.56	30.92	29.88			
Wt. of can (g)	22.42	22.28	22.19			
Wt of dry soil (g)	6.14	8.64	7.69			
Wt of moisture (g)	3.24	4.25	3.62			
* No of blows, N (g)	**16**	**25**	**32**			
Water content, *w %*	**52.8**	**49.2**	**47.1**			

*Blows for trials must be in the following ranges: (25-35), (20-30), (15-25)



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **49.5**
Plastic limit = **34.2**
Plasticity index I_p = **15.3**

Plastic Limit Determination

Can no.	6	11				
Wt. of wet soil + can (g)	35.89	35.78				
Wt. of dry soil + can (g)	32.44	32.34				
Wt. of can (g)	22.4	22.21				
Wt. of dry soil (g)	10.04	10.13				
Wt. of moisture (g)	3.45	3.44				
Water content, $w\% = w_p$	**34.4**	**34.0**				

Tested by: R. Backlund Date: 5/8/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

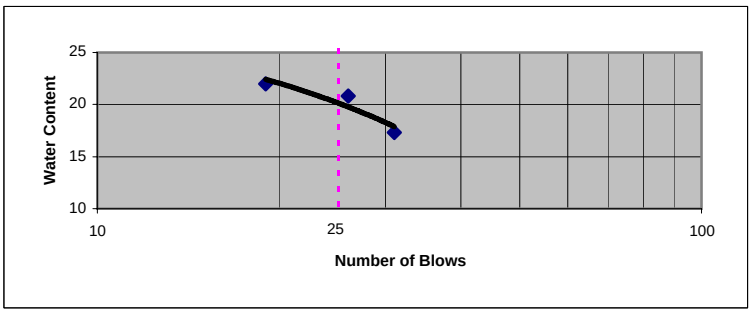
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (CL) Lean Clay, gray, low plasticity
Depth of Sample: 33.5-35.0 **Boring No.:** S-3 **Sample No.:** 16

Liquid Limit Determination

Can No.	19	14	9			
Wt. of wet soil +can (g)	33.05	31.65	28.6			
Wt. of dry soil + can (g)	31.48	30.03	27.51			
Wt. of can (g)	22.43	22.25	22.55			
Wt of dry soil (g)	9.05	7.78	4.96			
Wt of moisture (g)	1.57	1.62	1.09			
* No of blows, N (g)	**31**	**26**	**19**			
Water content, *w %*	**17.3**	**20.8**	**22.0**			

*Blows for trials must be in the following ranges: (25-35), (20-30), (15-25)



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **21.0**
Plastic limit = **12.2**
Plasticity index I_p = **8.8**

Plastic Limit Determination

Can no.	10	17				
Wt. of wet soil + can (g)	31.11	31.31				
Wt. of dry soil + can (g)	30.16	30.33				
Wt. of can (g)	22.25	22.36				
Wt. of dry soil (g)	7.91	7.97				
Wt. of moisture (g)	0.95	0.98				
Water content, $w\% = w_p$	**12.0**	**12.3**				

Tested by: R. Backlund Date: 5/8/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

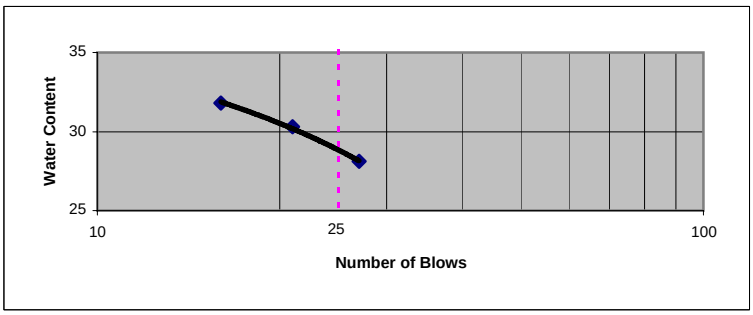
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (CL) Lean Clay, gray-brown, low plasticity
Depth of Sample: 45.0-47.3 **Boring No.:** S-3 **Sample No.:** 20

Liquid Limit Determination

Can No.	10	17	22			
Wt. of wet soil +can (g)	33.2	33.53	33.25			
Wt. of dry soil + can (g)	30.57	30.94	30.87			
Wt. of can (g)	22.29	22.38	22.39			
Wt of dry soil (g)	8.28	8.56	8.48			
Wt of moisture (g)	2.63	2.59	2.38			
* No of blows, N (g)	**16**	**21**	**27**			
Water content, *w %*	**31.8**	**30.3**	**28.1**			

*Blows for trials must be in the following ranges: (25-35), (20-30), (15-25)



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **29.1**
Plastic limit = **15.5**
Plasticity index I_p = **13.6**

Plastic Limit Determination

Can no.	28	31				
Wt. of wet soil + can (g)	32.37	30.91				
Wt. of dry soil + can (g)	30.99	29.80				
Wt. of can (g)	22.26	22.44				
Wt. of dry soil (g)	8.73	7.36				
Wt. of moisture (g)	1.38	1.11				
Water content, $w\% = w_p$	**15.8**	**15.1**				

Tested by: R. Backlund Date: 5/8/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

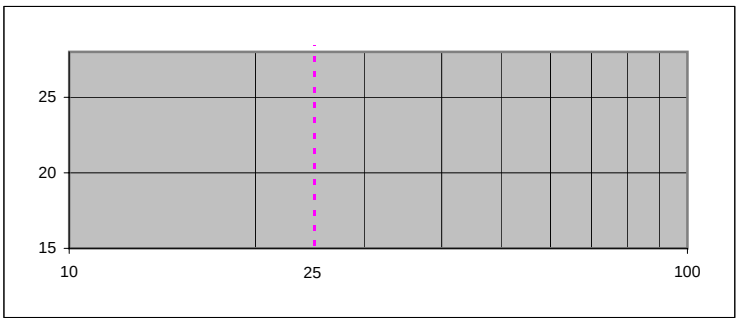
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (OH) Organic Silt/Clay with Shells
Depth of Sample: 26.0' - 28.3' **Boring No.:** S-4 **Sample No.:** 12

Liquid Limit Determination

Can No.						
Wt. of wet soil +can (g)	20.91					
Wt. of dry soil + can (g)	13.93					
Wt. of can (g)	1.54					
Wt of dry soil (g)	12.39					
Wt of moisture (g)	6.98					
* No of blows, N (g)	**22**					
Water content, *w %*	***55.5**					

*One Point Method



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **55.5**
Plastic limit = **22.3**
Plasticity index I_p = **33.2**

Plastic Limit Determination

Can no.						
Wt. of wet soil + can (g)	14.63					
Wt. of dry soil + can (g)	12.24					
Wt. of can (g)	1.51					
Wt. of dry soil (g)	12.39					
Wt. of moisture (g)	2.39					
Water content, $w\% = w_p$	**22.3**					

Tested by: J. Whelan (SET) Date: 5/16/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

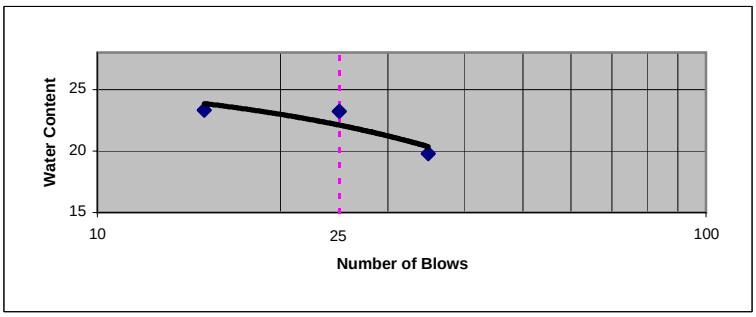
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (CL) Lean Clay, gray-brown, low plasticity
Depth of Sample: 41.0-43.3 **Boring No.:** S-4 **Sample No.:** 16

Liquid Limit Determination

Can No.	1	4	31			
Wt. of wet soil +can (g)	32.06	29.35	35.36			
Wt. of dry soil + can (g)	30.19	28.03	33.23			
Wt. of can (g)	22.18	22.34	22.45			
Wt of dry soil (g)	8.01	5.69	10.78			
Wt of moisture (g)	1.87	1.32	2.13			
* No of blows, N (g)	**15**	**25**	**35**			
Water content, *w %*	**23.3**	**23.2**	**19.8**			

*Blows for trials must be in the following ranges: (25-35), (20-30), (15-25)



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **22.0**
Plastic limit = **13.9**
Plasticity index I_p = **8.1**

Plastic Limit Determination

Can no.	8b	20				
Wt. of wet soil + can (g)	33.23	32.24				
Wt. of dry soil + can (g)	31.79	31.03				
Wt. of can (g)	21.33	22.41				
Wt. of dry soil (g)	10.46	8.62				
Wt. of moisture (g)	1.44	1.21				
Water content, $w\% = w_p$	**13.8**	**14.0**				

Tested by: R. Backlund Date: 5/8/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

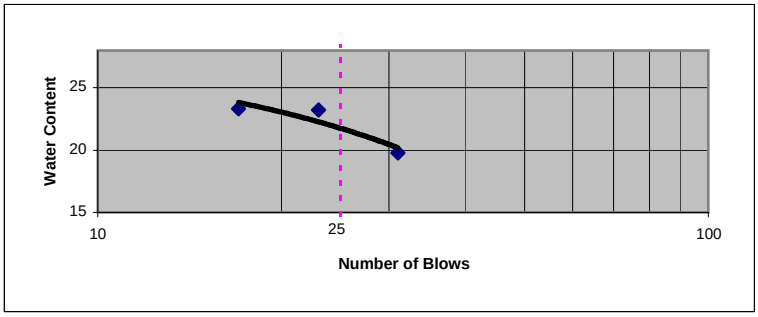
ASTM D-4318

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No.:** GD-06032
Client: Barr Engineering Company **Date Received:**
Address: 4700 West 77th Street, Edina, Mn 55435-4803
Description of Soil: (OH) Organic Silt, gray to black
Depth of Sample: 51.5' - 53.8' **Boring No.:** S-6 **Sample No.:** 21

Liquid Limit Determination

Can No.	3	15	25			
Wt. of wet soil +can (g)	31.48	32.05	30.45			
Wt. of dry soil + can (g)	28.03	28.52	27.57			
Wt. of can (g)	22.34	22.38	22.43			
Wt of dry soil (g)	5.69	6.14	5.14			
Wt of moisture (g)	3.45	3.53	2.88			
* No of blows, N (g)	**17**	**23**	**31**			
Water content, *w %*	**60.6**	**57.5**	**56.0**			

*Blows for trials must be in the following ranges: (25-35), (20-30), (15-25)



Est. Percentage Retained #40 =
Flow index F_i =
Liquid limit = **57.5**
Plastic limit = **32.0**
Plasticity index I_p = **25.5**

Plastic Limit Determination

Can no.	16	3				
Wt. of wet soil + can (g)	31.73	31.69				
Wt. of dry soil + can (g)	29.43	29.40				
Wt. of can (g)	22.16	22.31				
Wt. of dry soil (g)	7.27	7.09				
Wt. of moisture (g)	2.30	2.29				
Water content, $w\% = w_p$	**31.6**	**32.3**				

Tested by: R. Backlund Date: 5/8/2006
Submitted By: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906)-774-3440 Fax: (906)-774-7776

SPECIFIC GRAVITY OF SOIL

ASTM D854

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No:** GL-06032

Client: Barr Engineering Co.

Address:

Location: **Received:** 4/25/06

Sample Description: S-5 Sample 13 34.0'-36.0' (CL) Lean Clay

Sample or Specimen No.			1	2		
Pycnometer No.			1	2		
Temperature º C			19.8	19.8		
Weight in grams	Dish + Dry Soil (g)					
	Dish (g)					
	Dry Soil (g)	W_s	52.67	55.37		
	Pycnometer + Water @T (g)	W_{bw}	673.60	666.15		
	$W_s + W_{bw}$		726.27	721.52		
	Pycnometer + Water+dry Soil (g)	W_{bws}	706.69	700.95		
	Displaced Water, $W_s+W_{bw}-W_{bws}$		19.58	20.57		
Correction Factor		K	1.00004	1.00004		
$(W_sK) / (W_s + W_{bw} - W_{bws})$		G_s	2.69	2.69		

Tested by: Date:

Submitted by: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906)-774-3440 Fax: (906)-774-7776

SPECIFIC GRAVITY OF SOIL

ASTM D854

Project: Kinnickinnic River Stability and Dredging Study **Job No:** GL-06032

Client: Barr Engineering Co.

Address:

Location: **Received:** 4/18/06

Sample Description: S-1 Sample 8 10.5'-12.0' (OH) Organic Silt

Sample or Specimen No.			1			
Pycnometer No.			5			
Temperature º C			19.8			
Weight in grams	Dish + Dry Soil (g)					
	Dish (g)					
	Dry Soil (g)	W_s	51.56			
	Pycnometer + Water @T (g)	W_{bw}	667.20			
	$W_s + W_{bw}$		718.76			
	Pycnometer + Water+dry Soil (g)	W_{bws}	698.23			
	Displaced Water, $W_s+W_{bw}-W_{bws}$		20.53			
Correction Factor		K	1.00004			
$(W_sK) / (W_s + W_{bw} - W_{bws})$		G_s	2.51			

Tested by: Ryan Backlund Date: 5/1/06

Submitted by: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906)-774-3440 Fax: (906)-774-7776

SPECIFIC GRAVITY OF SOIL

ASTM D854

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No:** GL-06032

Client: Barr Engineering Co.

Address:

Location: **Received:** 4/24/06

Sample Description: S-2 Sample 10 (18.0' TO 20.3' DEEP) (OH) Organic Silt

Sample or Specimen No.			S-2, # 10			
Pycnometer No.			5			
Temperature º C			20.2			
Weight in grams	Dish + Dry Soil (g)		233.75			
	Dish (g)		168.65			
	Dry Soil (g)	W_s	65.10			
	Pycnometer + Water @T (g)	W_{bw}	667.12			
	Ws + W_{bw}		732.22			
	Pycnometer + Water+dry Soil (g)	W_{bws}	705.41			
	Displaced Water, $W_s+W_{bw}-W_{bws}$		26.81			
Correction Factor		K	1.00004			
$(W_sK) / (W_s + W_{bw} - W_{bws})$		G_s	2.43			

Tested by: Date:

Submitted by: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906)-774-3440 Fax: (906)-774-7776

SPECIFIC GRAVITY OF SOIL

ASTM D854

Project: Kinnickinnic River Stability Analysis and Dredging Study **Job No:** GL-06032

Client: Barr Engineering Co.

Address:

Location: **Received:** 4/24/06

Sample Description: S-6 Sample 18 39.5'-41.5' (OH) Organic Silt, some clay

Sample or Specimen No.			S-6 #18			
Pycnometer No.						
Temperature º C			20.2			
Weight in grams	Dish + Dry Soil (g)		237.64			
	Dish (g)		175.01			
	Dry Soil (g)	W_s	62.63			
	Pycnometer + Water @T (g)	W_{bw}	673.55			
	$W_s + W_{bw}$		736.18			
	Pycnometer + Water+dry Soil (g)	W_{bws}	712.23			
	Displaced Water, $W_s+W_{bw}-W_{bws}$		23.95			
Correction Factor		K	1.00004			
$(W_sK) / (W_s + W_{bw} - W_{bws})$		G_s	2.62			

Tested by: Date:

Submitted by: Date:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906)-774-3440 Fax: (906)-774-7776

UNIT DRY DENSITY

Project: Kinickinnic River StablityAnalysis and Dredging Study

Client: Barr Engineering **Job No:** GD-06032C

Address: 4700 West 77th Street, Edina, Minnesota 55435-4803 **Date:** 5/3/2006

Boring No.	S-1		S-1	S-1	
Sample No.	9		17	18	
Depth (ft.)	36.5-38.8		32.0-33.5	37.0-38.5	
Pan No.	64		63	59	
Weight-Wet Sample & Tare (g)	452.9		440.8	426.1	
Weight-Dry Sample & Tare (g)	417.5		426.6	415.2	
Weight of Moisture (g)	35.4		14.2	10.9	
Weight of Tare (g)	341.7		340.7	342.4	
Weight of Dry Soil (g)	75.8		85.9	72.8	
Moisture Content (%)	46.7		16.5	15.0	
Sample Length (cm)	6.96		4.26	4.00	
Sample Diameter (cm)	3.43		3.76	3.44	
Cross-Section Area (sq-cm)	9.24		11.10	9.29	
Sample Volume (cc)	64.31		47.30	37.18	
Dry Unit Weight (g/cc)	1.18		1.82	1.96	
Dry Unit Weight (pcf)	**73.6**		**113.4**	**122.2**	

Remarks:

Tested By: Ryan Backlund **Date:** 5/3/2006

Submitted By: **Date:** 5/23/2006

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906)-774-3440 Fax: (906)-774-7776

UNIT DRY DENSITY

Project: Kinickinnic River StablityAnalysis and Dredging Study

Client: Barr Engineering **Job No:** GD-06032C

Address: 4700 West 77th Street, Edina, Minnesota 55435-4803 **Date:** 05-03-06 & 5/4/2006

Boring No.	S-2	S-6	S-2	S-3	S-4
Sample No.	14	21	10	20	16
Depth (ft.)	36.5-38.8	51.5-53.8	18.0-20.3	45.0-47.3	41.0-43.3
Pan No.	65	68	63	59	63
Weight-Wet Sample & Tare (g)	1396.5	772.3	1222.5	605.2	760.3
Weight-Dry Sample & Tare (g)	1085.0	637.8	829.0	553.7	702.8
Weight of Moisture (g)	311.5	134.5	393.5	51.5	57.5
Weight of Tare (g)	341.6	341.7	340.6	342.6	340.6
Weight of Dry Soil (g)	743.4	296.1	488.4	211.1	362.2
Moisture Content (%)	41.9	45.4	80.6	24.4	15.9
Sample Length (cm)	14.34	10.61	14.53	8.88	9.49
Sample Diameter (cm)	7.24	5.28	7.16	4.24	5.1
Cross-Section Area (sq-cm)	41.17	21.90	40.26	14.12	20.43
Sample Volume (cc)	590.40	232.30	585.00	125.40	193.90
Dry Unit Weight (g/cc)	1.26	1.27	0.83	1.68	1.87
Dry Unit Weight (pcf)	**78.6**	**79.6**	**52.1**	**105.1**	**116.6**

Remarks:

Tested By: Dan Absolon **Date:** 5/4/2006

Submitted By: **Date:** 5/23/2006

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
Telephone: (906)-774-3440 Fax: (906)-774-7776

UNIT DRY DENSITY

Project: Kinickinnic River StablityAnalysis and Dredging Study

Client: Barr Engineering **Job No:** GD-06032C

Address: 4700 West 77th Street, Edina, Minnesota 55435-4803 **Date:** 5/16/2006

Boring No.		S-1*	S-4*	S-5*	
Sample No.		16	12	8	
Depth (ft.)		27.0-29.3	26.0-28.3	14.0-16.3	
Pan No.					
Weight-Wet Sample & Tare (g)					
Weight-Dry Sample & Tare (g)					
Weight of Moisture (g)					
Weight of Tare (g)					
Weight of Dry Soil (g)					
Moisture Content (%)		20.5	48.0	95.0	
Sample Length (cm)					
Sample Diameter (cm)					
Cross-Section Area (sq-cm)					
Sample Volume (cc)					
Dry Unit Weight (g/cc)					
Dry Unit Weight (pcf)		**124.0**	**71.0**	**44.0**	

Remarks: * Tests conducted by SET, Inc.

Tested By: John Whelan (SET) **Dated:** 5/17/2006

Submitted By: **Dated:** 5/23/2006

CET lab#: 5000

Extrusion Log

Date: 5/5/2006

Project/Client: Kinnickinnic River Samples / Barr Engineering Company

Boring #	Sample#	Depth(ft)	Recovery (in)		Soil Description
S-1	16	27.0-29.3	BE:	27.5	Note: Damaged TWT, Bottom Crushed & tube is out of round.
			AE:	22.5	7" Pickup/Disturbed, Organic Clay, Gravel, Stems, Roots, Wood & Wirer.
					15.5" Lean Clay, Brownish Gray, a few Laminations of Silt (CL)
S-4	12	26.0-28.3	BE:	27.5	7" Pickup/Disturbed
			AE:	25	18" Fat Clay w/some Shells & a trace of Organic Material, Gray (CH)
S-5	8	14.0-16.3	BE:	20	3 3/4" Pickup/Disturbed
			AE:	19	15 1/4" Organic Clay w/Sand & Shells, Gray, some Peat & Wood
					in upper 3 1/2" (OH)

Grain Size Distribution ASTM D422

Job No. : 5669

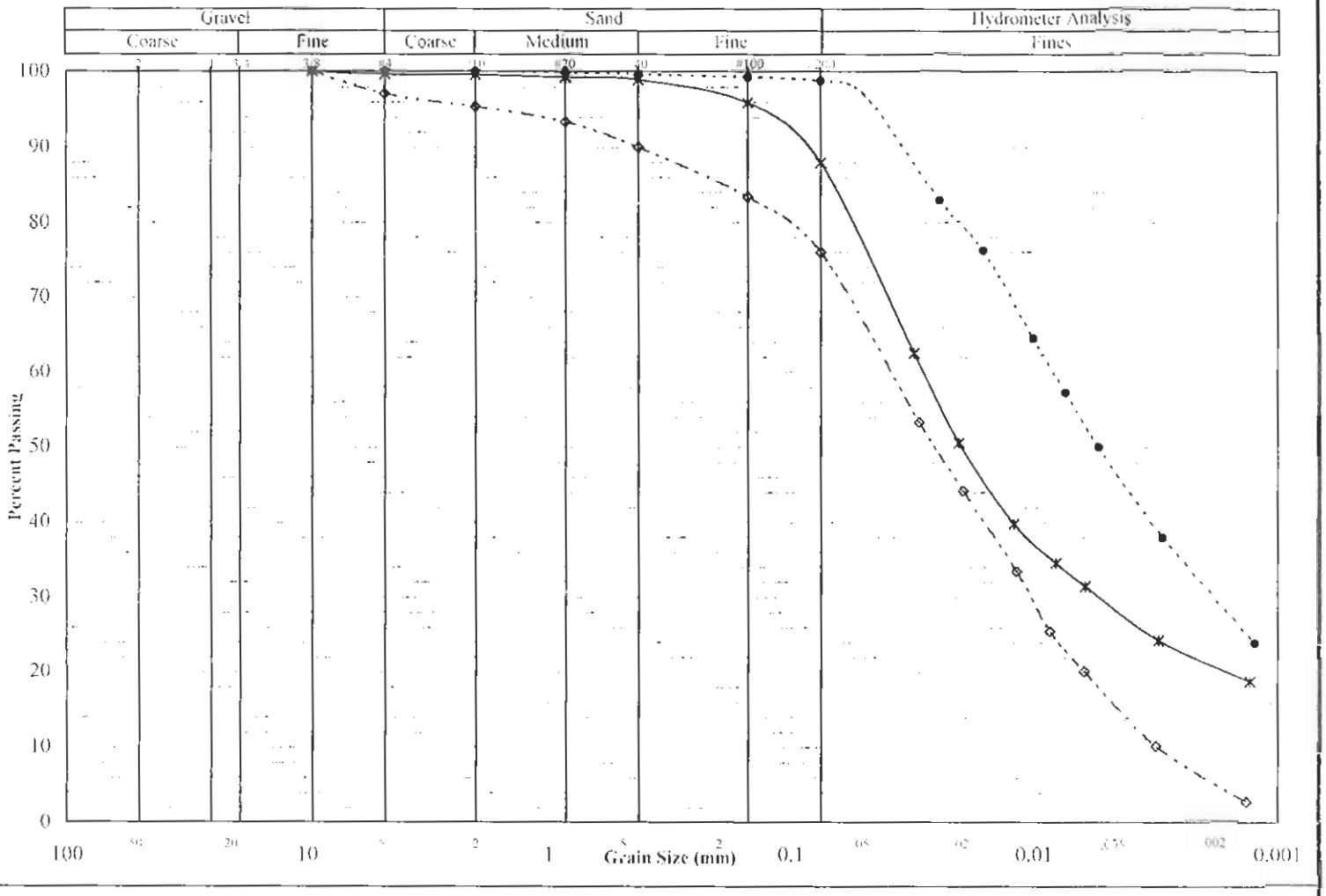
Project: Kinnickinnic River Stability Project - # GD-06032

Test Date: 5/16/06

Reported To: Barr Engineering Company

Report Date: 6/2/06

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
-	S-1	16	27.0-29.3	TWT	Lean Clay, a few Laminations of Silt (CL)
•	S-4	12	26.0-28.3	TWT	Fat Clay w/some Shells & a trace of Organic Material (CH)
◇	S-5	8	14.0-16.3	TWT	Organic Clay w/Sand and Shells (OH)



Other Tests

	-	•	◇
Liquid Limit	20.5	55.5	94.6
Plastic Limit	12.2	22.3	64.1
Plasticity Index	8.3	33.2	30.5
Water Content	20.5	48.0	95.0
Dry Density (pcf)	124.0	71.0	44.0
Specific Gravity	2.78*	2.64*	2.37*
Porosity			
Organic Content			
pH			
Shrinkage Limit			
Penetrometer			
Qu (psf)			

(* = assumed)

Percent Passing

	-	•	◇
Mass (g)	318.4	123.4	991.2
2"			
1.5"			
1"			
3/4"			
3/8"	100.0		100.0
#4	99.6	100.0	97.1
#10	99.3	100.0	95.3
#20	99.2	99.8	93.3
#40	98.9	99.6	90.0
#100	95.9	99.3	83.3
#200	87.9	98.8	75.9

	-	•	◇
D_{60}			
D_{30}			
D_{10}			
C_u			
C_c			

Remarks:

9301 Bryant Ave. South, Suite 107

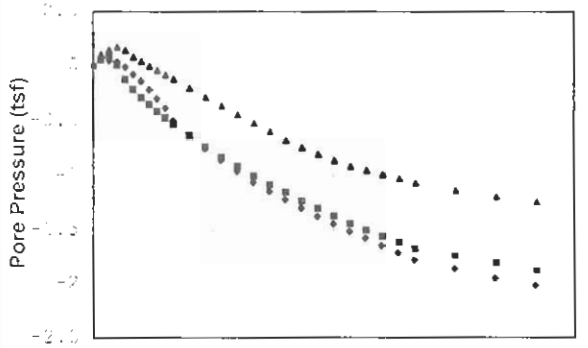
SOIL ENGINEERING TESTING, INC.

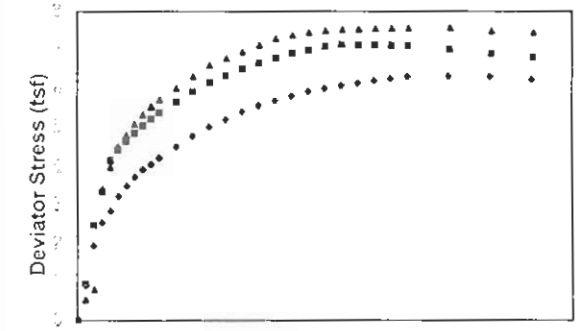
Bloomington, Minnesota 55420-3436

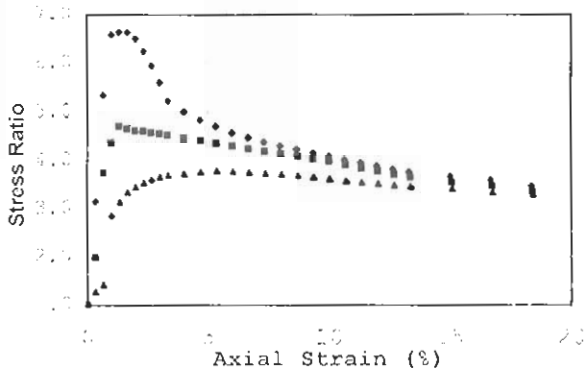
TRIAXIAL TEST ASTM: D 4767

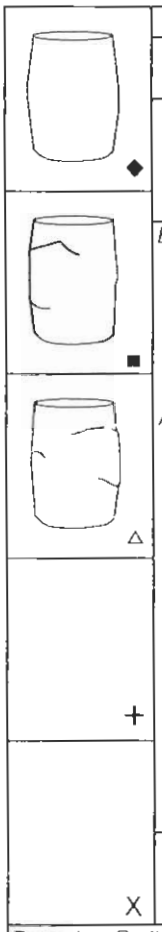
Job No. 5669
Date: 6/2/06

Project: Minnehaha Street Stability Project - # GD-06032
Boring #: S-1 Sample #: 16 Type: 3T Depth (ft): 27-29.3 (Middle)
Soil Type: Lean Clay, a few Laminations of Silt (CL)







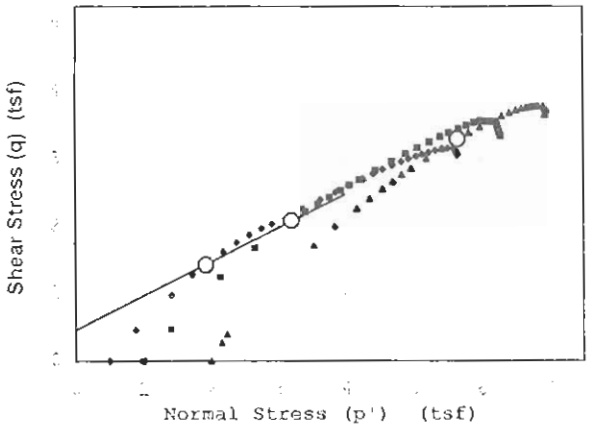


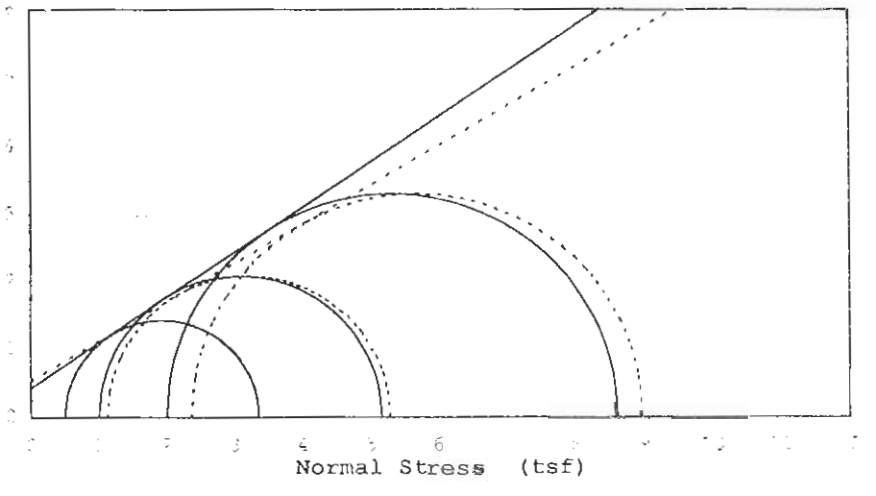
Failure Criterion:	Max. Stress Ratio				
Angle of internal friction, ϕ' =	30.1 °				
Apparent Cohesion, c' =	0.54 (tsf)				
Test Date: 5/5/06		Liquid Limit:	20.5		
Test Type: CU w/pp		Plastic Limit:	12.2		
Strain Rate (in/min): 0.0039		Plasticity Index:	8.3		
Strain Rate (%/min): 0.130		Spec. Gravity (Assumed):	2.78		

Before Consolidation	A	B	C	D	E
Diameter (in)	1.43	1.43	1.43		
Height (in)	3.01	3.01	3.01		
Water Content (%)	13.5	14.6	14.8		
Dry Density (pcf)	124.3	123.4	123.3		
Void Ratio	0.40	0.41	0.41		
After Consolidation					
Diameter (in)	1.42	1.42	1.41		
Height (in)	3.00	2.99	2.98		
Water Content (%)	13.4	13.5	13.2		
Dry Density (pcf)	126.5	126.1	126.9		
Void Ratio	0.37	0.38	0.37		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	6.33	7.13	7.58		
Ultimate Deviator Stress (tsf)	6.13	6.69	7.32		
Deviator Stress at Failure (tsf)	2.85	4.16	6.60		
Max. Pore Pressure Buildup (tsf)	0.07	0.10	0.18		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	1.3	1.3	5.4		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 1, over a period of 20 days; Consolidated 3 days; Drainage valves closed.





Rupture Envelope at Failure
α = 26.6 ° a = 0.5 (tsf)

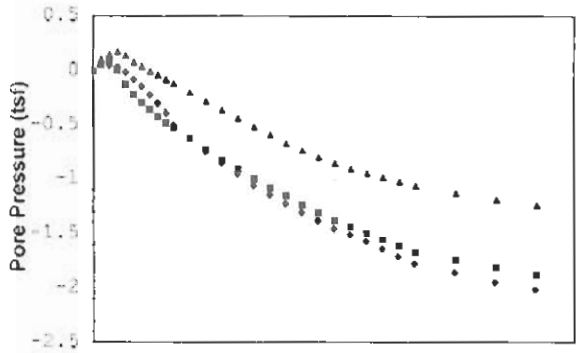
Effective ϕ': 30.1 ° c'= 0.54 (tsf)
Total ϕ': 33.7 ° c= 0.44 (tsf)

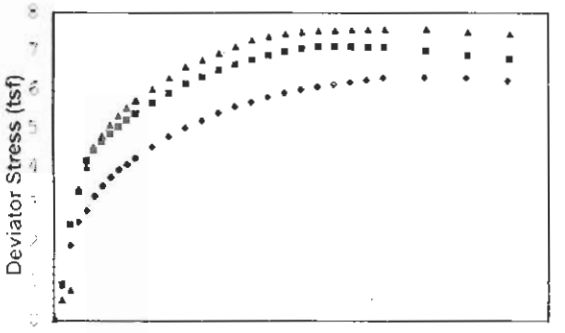
9301 Bryant Ave South Suite #107
OIL ENGINEERING TESTING, INC.
Bloomington, Minnesota 55420-3436

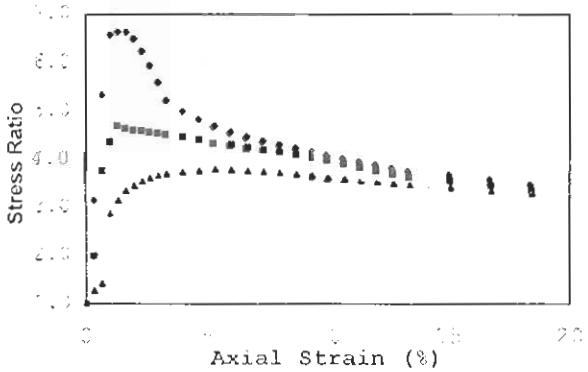
TRIAXIAL TEST ASTM: D 4767

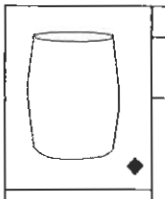
Job No. 5669
Date: 6/2/06

Project: Whitewater River Stability Project - # GD-06032
Boring #: S-1 Sample #: 16 Type: 3T Depth (ft): 27-29.3 (Middle)
Soil Type: Lean Clay, a few Laminations of Silt (CL)





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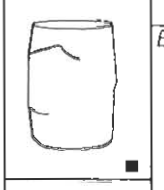
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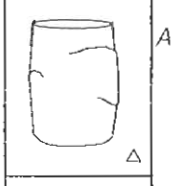
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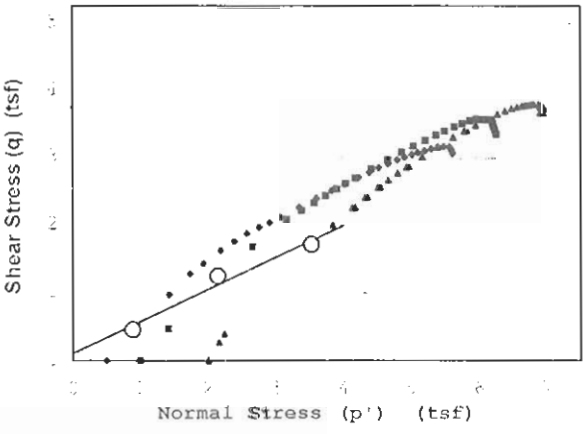
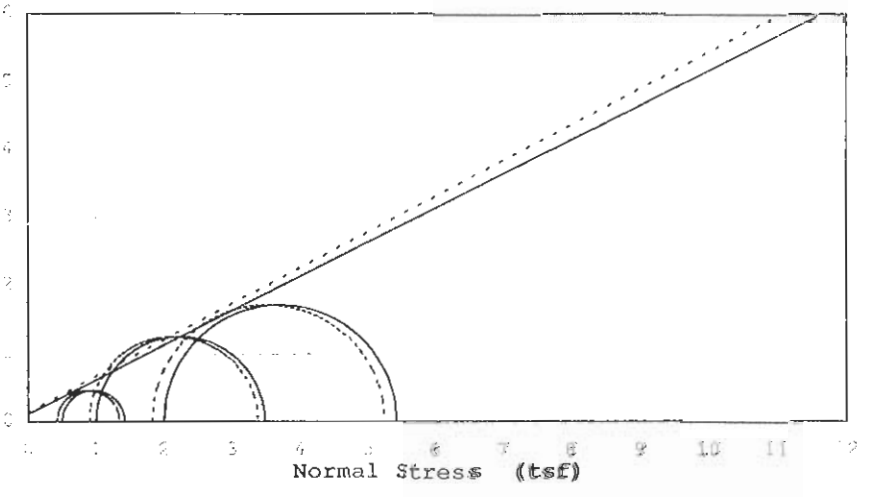
X

Failure Criterion:	Max. Pore Pressure				
Angle of internal friction, ϕ' =	28.0 °				
Apparent Cohesion, c' =	0.12 (tsf)				
Test Date: 5/5/06		Liquid Limit:	20.5		
Test Type: CU w/pp		Plastic Limit:	12.2		
Strain Rate (in/min): 0.0039		Plasticity Index:	8.3		
Strain Rate (%/min): 0.130		Spec. Gravity (Assumed):	2.78		
Before Consolidation	A	B	C	D	E
Diameter (in)	1.43	1.43	1.43		
Height (in)	3.01	3.01	3.01		
Water Content (%)	13.5	14.6	14.8		
Dry Density (pcf)	124.3	123.4	123.3		
Void Ratio	0.40	0.41	0.41		
After Consolidation					
Diameter (in)	1.42	1.42	1.41		
Height (in)	3.00	2.99	2.98		
Water Content (%)	13.4	13.5	13.2		
Dry Density (pcf)	126.5	126.1	126.9		
Void Ratio	0.37	0.38	0.37		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	6.33	7.13	7.58		
Ultimate Deviator Stress (tsf)	6.13	6.69	7.32		
Deviator Stress at Failure (tsf)	0.92	2.49	3.42		
Max. Pore Pressure Buildup (tsf)	0.07	0.10	0.18		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	0.3	0.7	1.0		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 1. over a period of 20 days; Consolidated 3 days; Drainage valves closed.





Rupture Envelope at Failure
ϕ = 25.2 ° a = 0.1 (tsf)

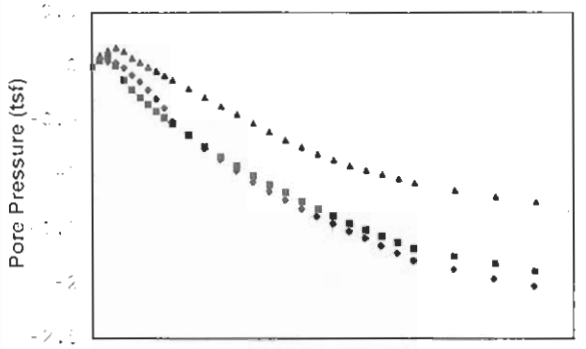
---------- Effective ϕ': 28.0 ° c'= 0.12 (tsf)
_____ Total ϕ: 26.8 ° c= 0.11 (tsf)

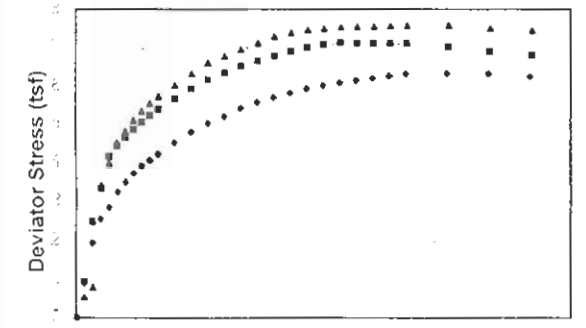
9301 Bryant Ave. South Suite #107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3436

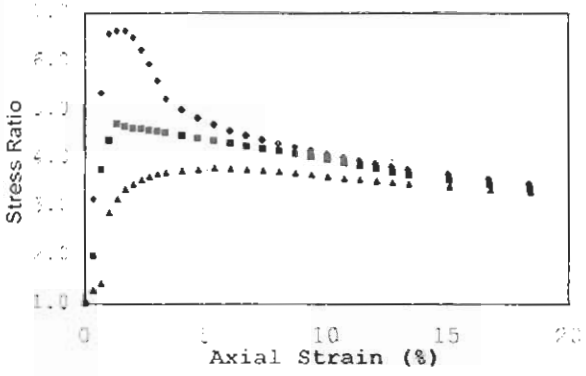
TRIAXIAL TEST ASTM: D 4767

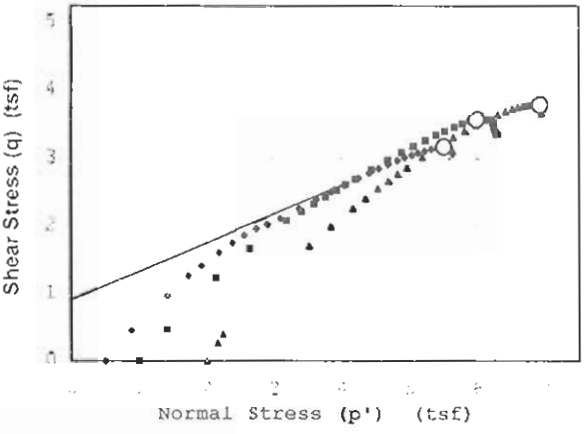
Job No. 5669
Date: 6/2/06

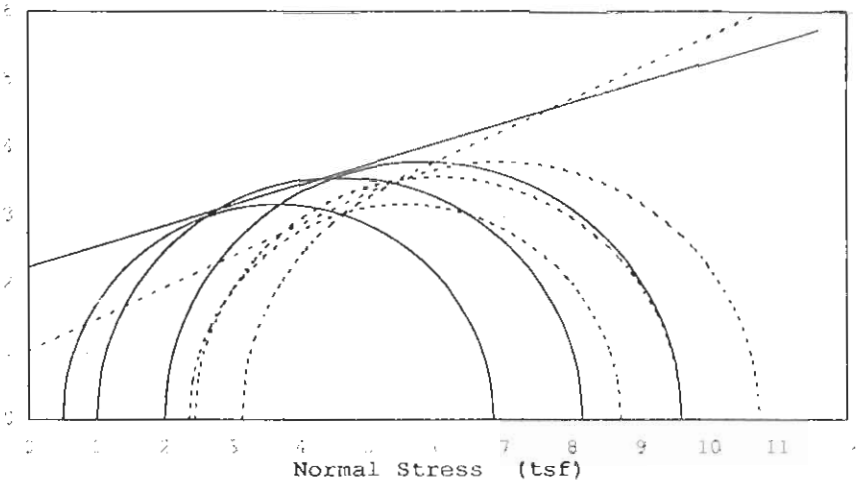
Project: Minnehaha River Stability Project - # GD-06032
Boring #: S-1 Sample #: 16 Type: ST Depth (ft): 27-29.3 (Middle)
Soil Type: Lean Clay, a few Laminations of Silt (CL)











Rupture Envelope at Failure
α = 22.8 ° a = 0.9 (tsf)

Effective ϕ': 24.9 ° c'= 1.01 (tsf)
Total ϕ': 16.8 ° c= 2.26 (tsf)

Failure Criterion: Max. Deviator Stress
Angle of internal friction, ϕ' = 24.9 °
Apparent Cohesion, c' = 1.01 (tsf)

Test Date:	5/5/06	Liquid Limit:	20.5
Test Type:	CU w/pp	Plastic Limit:	12.2
Strain Rate (in/min):	0.0039	Plasticity Index:	8.3
Strain Rate (%/min):	0.130	Spec. Gravity (Assumed):	2.78

	A	B	C	D	E
Before Consolidation					
Diameter (in)	1.43	1.43	1.43		
Height (in)	3.01	3.01	3.01		
Water Content (%)	13.5	14.6	14.8		
Dry Density (pcf)	124.3	123.4	123.3		
Void Ratio	0.40	0.41	0.41		
After Consolidation					
Diameter (in)	1.42	1.42	1.41		
Height (in)	3.00	2.99	2.98		
Water Content (%)	13.4	13.5	13.2		
Dry Density (pcf)	126.5	126.1	126.9		
Void Ratio	0.37	0.38	0.37		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	6.33	7.13	7.58		
Ultimate Deviator Stress (tsf)	6.13	6.69	7.32		
Deviator Stress at Failure (tsf)	6.33	7.13	7.58		
Max. Pore Pressure Buildup (tsf)	0.07	0.10	0.18		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	15.0	10.7	15.1		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

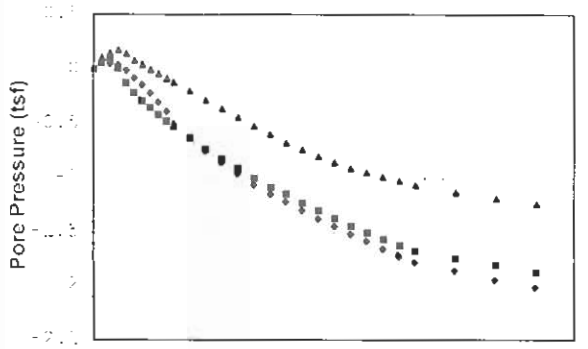
Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 1. over a period of 20 days; Consolidated 3 days; Drainage valves closed.

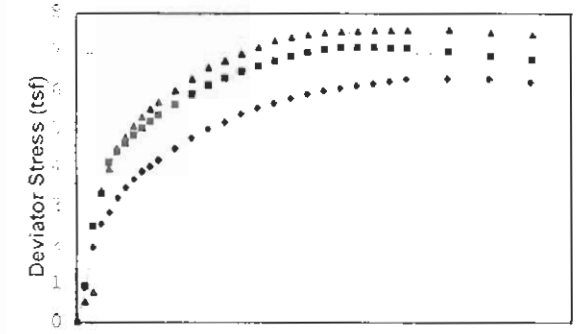
9301 Bryant Ave. South Suite #107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3436

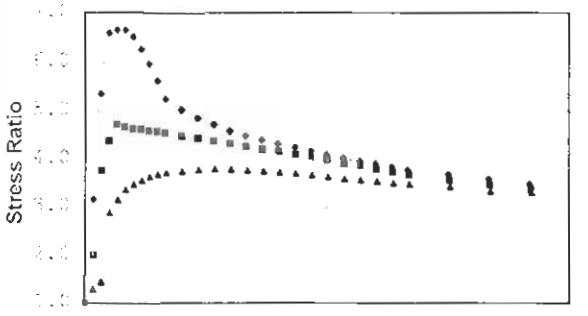
TRIAXIAL TEST ASTM: D 4767

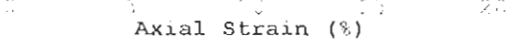
Job No. 5669
Date: 6/2/06

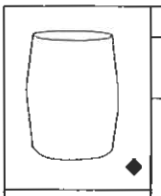
Project: Minnehaha Creek Stability Project # GD 06632
Boring #: S-1 Sample #: 16 Type: 3T Depth (ft): 27-29.3 (Middle)
Soil Type: Lean Clay, a few Laminations of Silt (CL)

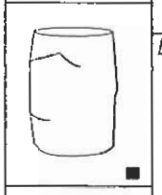


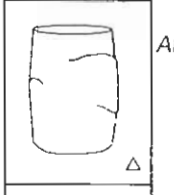


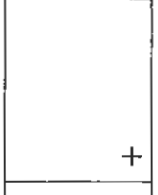


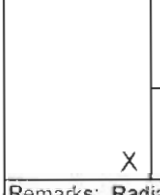












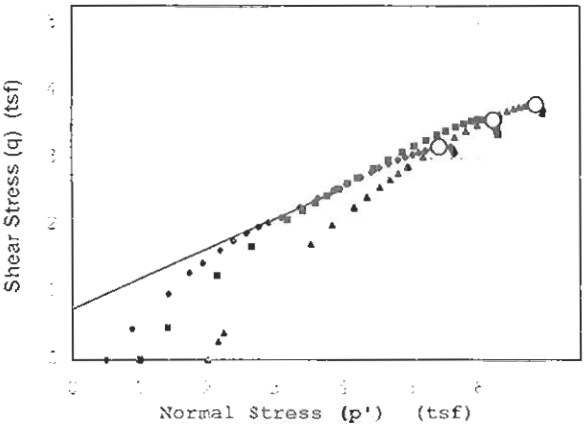
Failure Criterion: Given Strain of: 15%
Angle of internal friction, ϕ' = 26.5 °
Apparent Cohesion, c' = 0.84 (tsf)

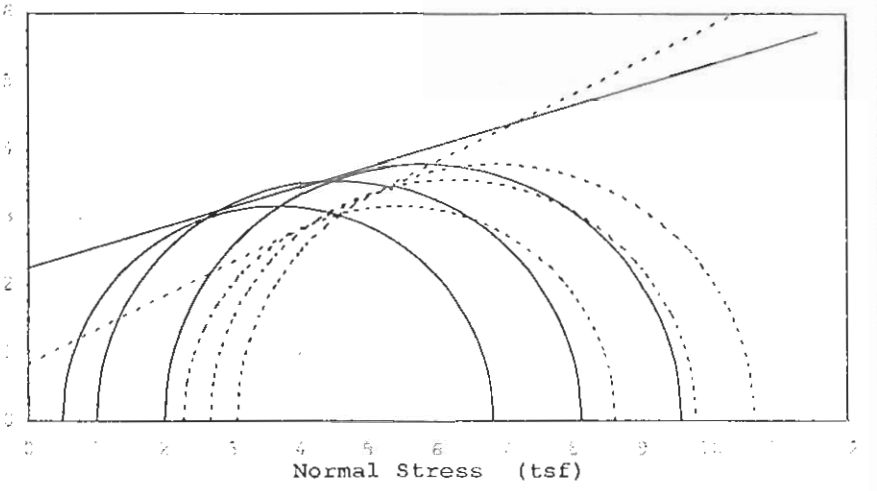
Test Date:	5/5/06	Liquid Limit:	20.5
Test Type:	CU w/pp	Plastic Limit:	12.2
Strain Rate (in/min):	0.0039	Plasticity Index:	8.3
Strain Rate (%/min):	0.130	Spec. Gravity (Assumed):	2.78

Before Consolidation	A	B	C	D	E
Diameter (in)	1.43	1.43	1.43		
Height (in)	3.01	3.01	3.01		
Water Content (%)	13.5	14.6	14.8		
Dry Density (pcf)	124.3	123.4	123.3		
Void Ratio	0.40	0.41	0.41		
After Consolidation					
Diameter (in)	1.42	1.42	1.41		
Height (in)	3.00	2.99	2.98		
Water Content (%)	13.4	13.5	13.2		
Dry Density (pcf)	126.5	126.1	126.9		
Void Ratio	0.37	0.38	0.37		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	6.33	7.13	7.58		
Ultimate Deviator Stress (tsf)	6.13	6.69	7.32		
Deviator Stress at Failure (tsf)	6.32	7.11	7.57		
Max. Pore Pressure Buildup (tsf)	0.07	0.10	0.18		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	15.0	15.0	15.0		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 1, over a period of 20 days; Consolidated 3 days; Drainage valves closed.





Rupture Envelope at Failure
α 24.0 ° a = 0.7 (tsf)

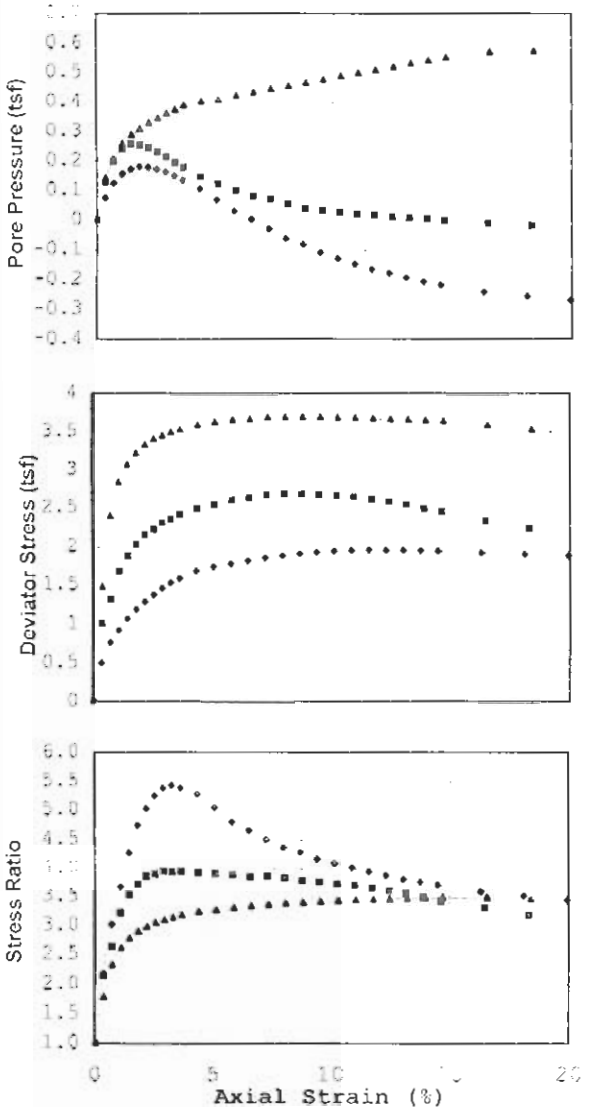
Effective ϕ': 26.5 ° c'= 0.84 (tsf)
Total ϕ': 16.7 ° c= 2.25 (tsf)

9301 Bryant Ave. South Suite #107
SOIL ENGINEERING TESTING, INC.
Bloomington, Minnesota 55420-3436

TRIAXIAL TEST ASTM: D 4767

Job No. 5669
Date: 6/2/06

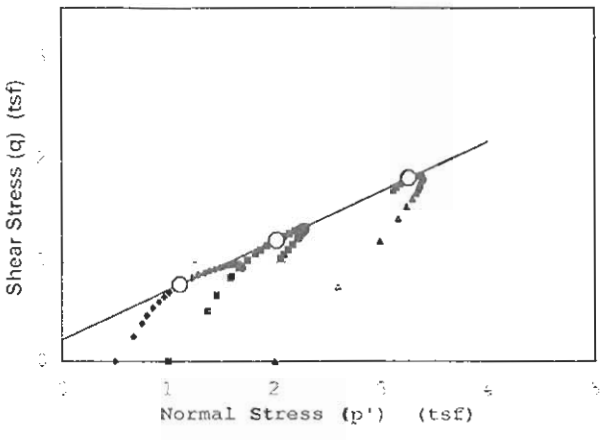
Project: Wanaki Lands West Stability Project - # GD-06032
Boring #: S-4 Sample #: 12 Type: 3T Depth (ft): 26-28.3 (Middle)
Soil Type: Fat Clay w/some Shells & a trace of Organic Material (CH)

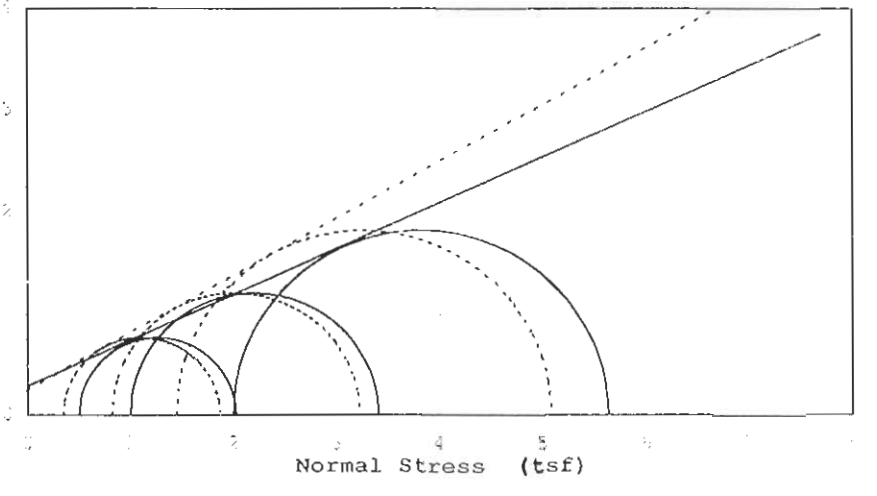


Failure Criterion:	Max. Stress Ratio					
Angle of internal friction, ϕ' =	29.3 °					
Apparent Cohesion, c' =	0.25 (tsf)					
Test Date:	5/6/06	Liquid Limit:	55.5			
Test Type:	CU w/pp	Plastic Limit:	22.3			
Strain Rate (in/min):	0.0039	Plasticity Index:	33.2			
Strain Rate (%/min):	0.141	Spec. Gravity (Assumed):	2.64			
Before Consolidation		A	B	C	D	E
Diameter (in)		1.44	1.44	1.44		
Height (in)		2.99	2.99	2.99		
Water Content (%)		51.2	51.9	47.6		
Dry Density (pcf)		70.2	69.5	73.1		
Void Ratio		1.35	1.37	1.25		
After Consolidation						
Diameter (in)		1.35	1.34	1.34		
Height (in)		2.76	2.73	2.72		
Water Content (%)		34.2	32.6	29.0		
Dry Density (pcf)		86.7	88.6	93.3		
Void Ratio		0.90	0.86	0.77		
Back Pressure (tsf)		5.76	5.76	5.76		
Minor Principal Stress (tsf)		0.50	1.00	2.00		
Max. Deviator Stress (tsf)		1.96	2.68	3.69		
Ultimate Deviator Stress (tsf)		1.86	2.06	3.40		
Deviator Stress at Failure (tsf)		1.53	2.41	3.64		
Max. Pore Pressure Buildup (tsf)		0.18	0.26	0.58		
Pore Pressure Parameter "B"		1.0	1.0	1.0		
Pct. Axial Strain at Failure		3.3	3.7	14.7		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 1, over a period of 9 days; Consolidated 3 days; Drainage valves closed.





Rupture Envelope at Failure
α = 26.1 ° a = 0.22 (tsf)

---------- Effective ϕ': 29.3 ° c'= 0.25 (tsf)
_____ Total ϕ': 24.2 ° c= 0.29 (tsf)

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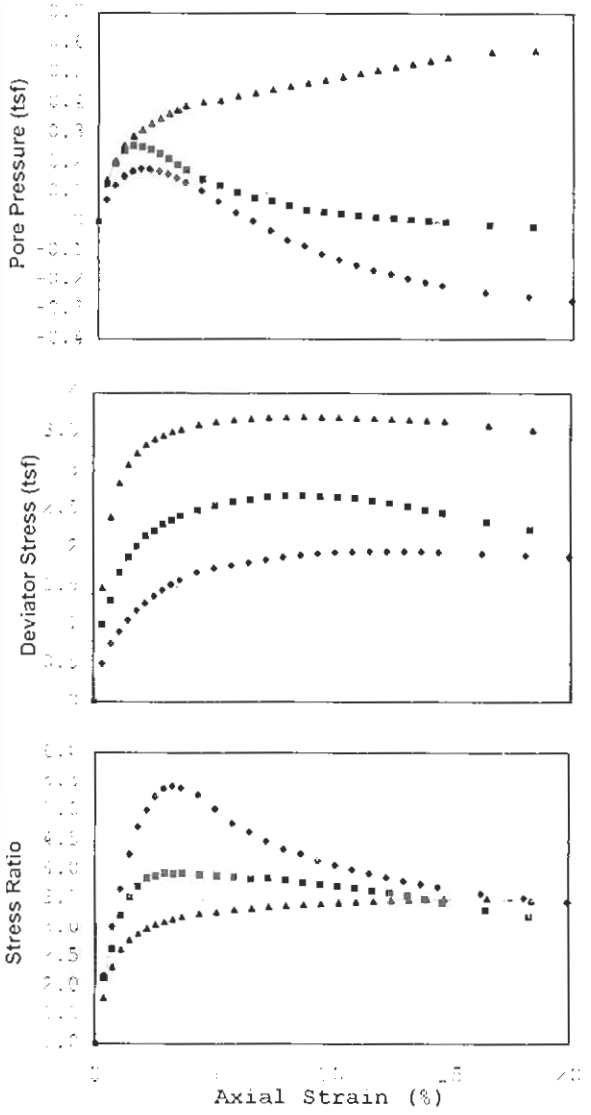
SOIL ENGINEERING TESTING, INC.
Bloomington, Minnesota 55420-3436

TRIAXIAL TEST ASTM: D 4767

Job No. 5669
Date: 6/2/06

Project: Minnehaha River Stability Project - # GD-06032
Boring #: S-4 Sample #: 12 Type: 3T Depth (ft): 26-28.3 (Middle)
Soil Type: Fat Clay w/some Shells & a trace of Organic Material (CH)



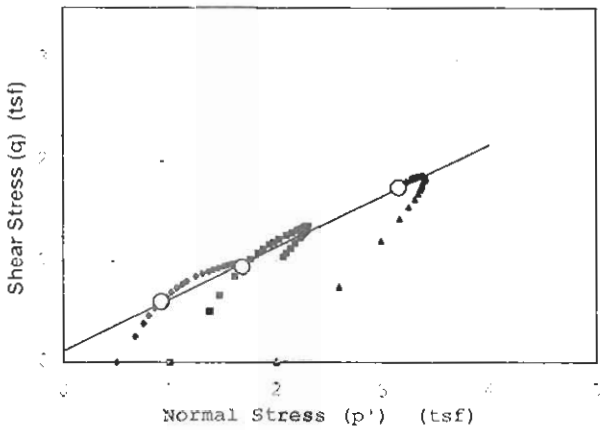
Failure Criterion:	Max. Pore Pressure
Angle of internal friction, ϕ' =	30.8 °
Apparent Cohesion, c' =	0.13 (tsf)

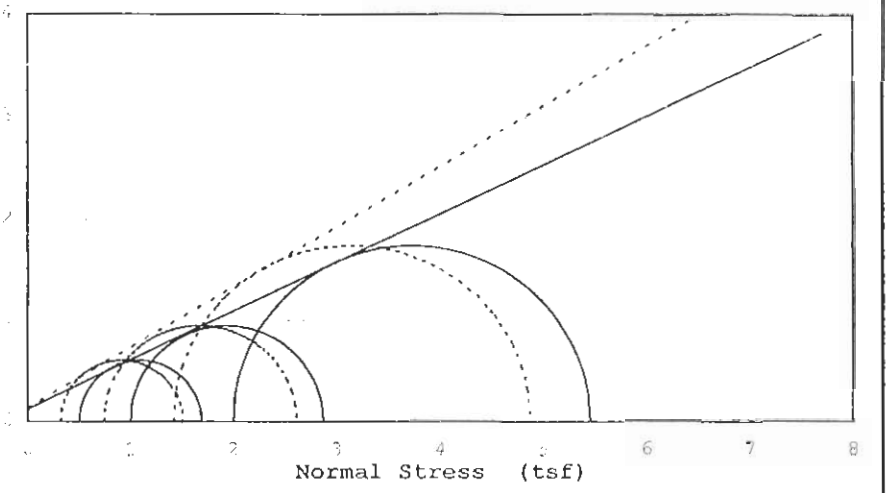
Test Date:	5/6/06		Liquid Limit:		55.5
Test Type:	CU w/pp		Plastic Limit:		22.3
Strain Rate (in/min):	0.0039		Plasticity Index:		33.2
Strain Rate (%/min):	0.141		Spec. Gravity (Assumed):		2.64

Before Consolidation	A	B	C	D	E
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.99	2.99	2.99		
Water Content (%)	51.2	51.9	47.6		
Dry Density (pcf)	70.2	69.5	73.1		
Void Ratio	1.35	1.37	1.25		
After Consolidation					
Diameter (in)	1.35	1.34	1.34		
Height (in)	2.76	2.73	2.72		
Water Content (%)	34.2	32.6	29.0		
Dry Density (pcf)	86.7	88.6	93.3		
Void Ratio	0.90	0.86	0.77		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	1.96	2.68	3.69		
Ultimate Deviator Stress (tsf)	1.86	2.06	3.40		
Deviator Stress at Failure (tsf)	1.19	1.88	3.46		
Max. Pore Pressure Buildup (tsf)	0.18	0.26	0.58		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	1.8	1.5	20.3		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 1. over a period of 9 days; Consolidated 3 days; Drainage valves closed.





Rupture Envelope at Failure		
α	27.1 °	a = 0.11 (tsf)

----------	Effective ϕ':	30.8 °	c'=	0.13 (tsf)
_____	Total ϕ':	25.6 °	c=	0.13 (tsf)

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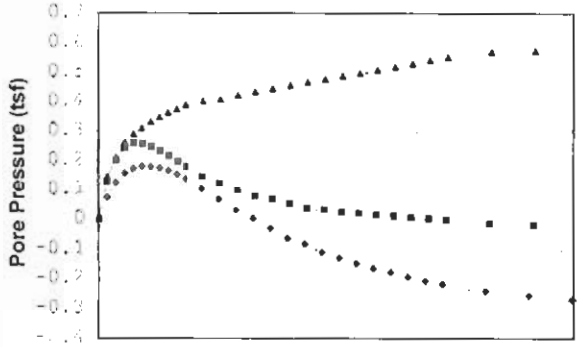
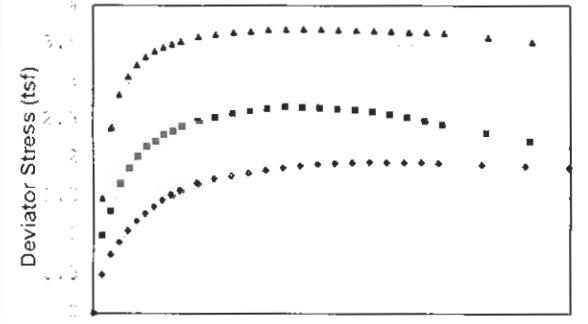
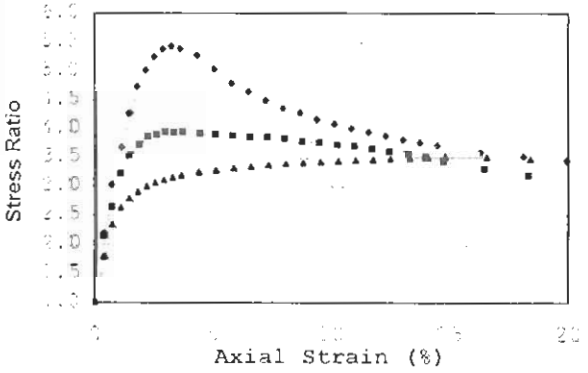
TRIAXIAL TEST ASTM: D 4767

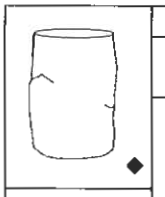
Job No. 5669
Date: 6/2/06

Project: Wanaki Lake Stability Project - # GD-06032
Boring #: S-4 Sample #: 12 Type: 3T Depth (ft): 26-28.3 (Middle)
Soil Type: Fat Clay w/some Shells & a trace of Organic Material (CH)









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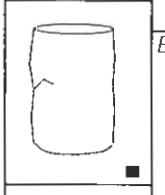

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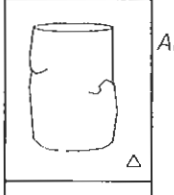

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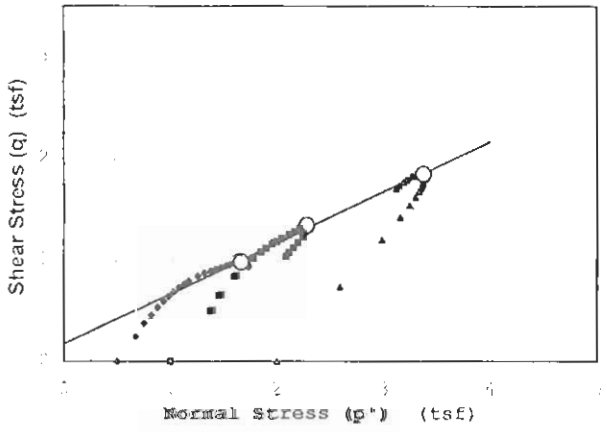
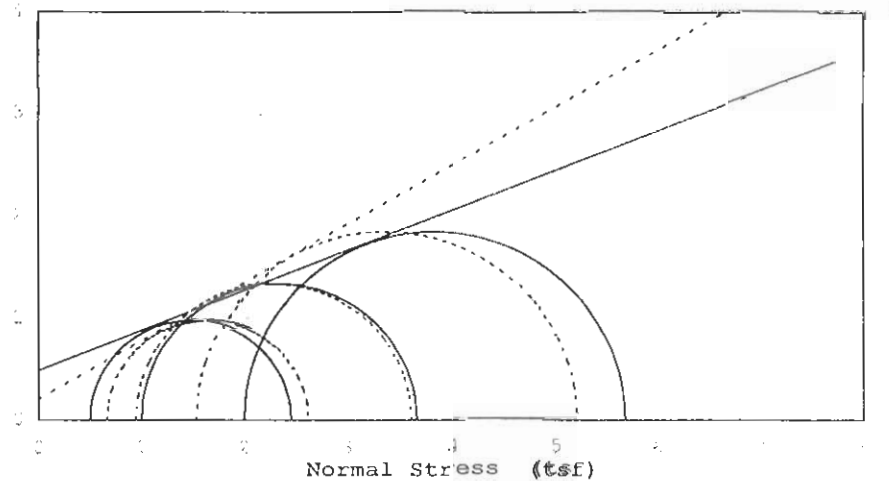
Failure Criterion:	Max. Deviator Stress				
Angle of internal friction, ϕ' =	29.7 °				
Apparent Cohesion, c' =	0.21 (tsf)				
Test Date: 5/6/06		Liquid Limit:	55.5		
Test Type: CU w/pp		Plastic Limit:	22.3		
Strain Rate (in/min): 0.0039		Plasticity Index:	33.2		
Strain Rate (%/min): 0.141		Spec. Gravity (Assumed):	2.64		
Before Consolidation	A	B	C	D	E
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.99	2.99	2.99		
Water Content (%)	51.2	51.9	47.6		
Dry Density (pcf)	70.2	69.5	73.1		
Void Ratio	1.35	1.37	1.25		
After Consolidation					
Diameter (in)	1.35	1.34	1.34		
Height (in)	2.76	2.73	2.72		
Water Content (%)	34.2	32.6	29.0		
Dry Density (pcf)	86.7	88.6	93.3		
Void Ratio	0.90	0.86	0.77		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	1.96	2.68	3.69		
Ultimate Deviator Stress (tsf)	1.86	2.06	3.40		
Deviator Stress at Failure (tsf)	1.96	2.68	3.69		
Max. Pore Pressure Buildup (tsf)	0.18	0.26	0.58		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	11.6	8.1	8.8		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen. Saturated, backpressured until "B" response was 1, over a period of 9 days; Consolidated 3 days; Drainage valves closed.





Rupture Envelope at Failure
α = 25.4 ° a = 0.18 (tsf)

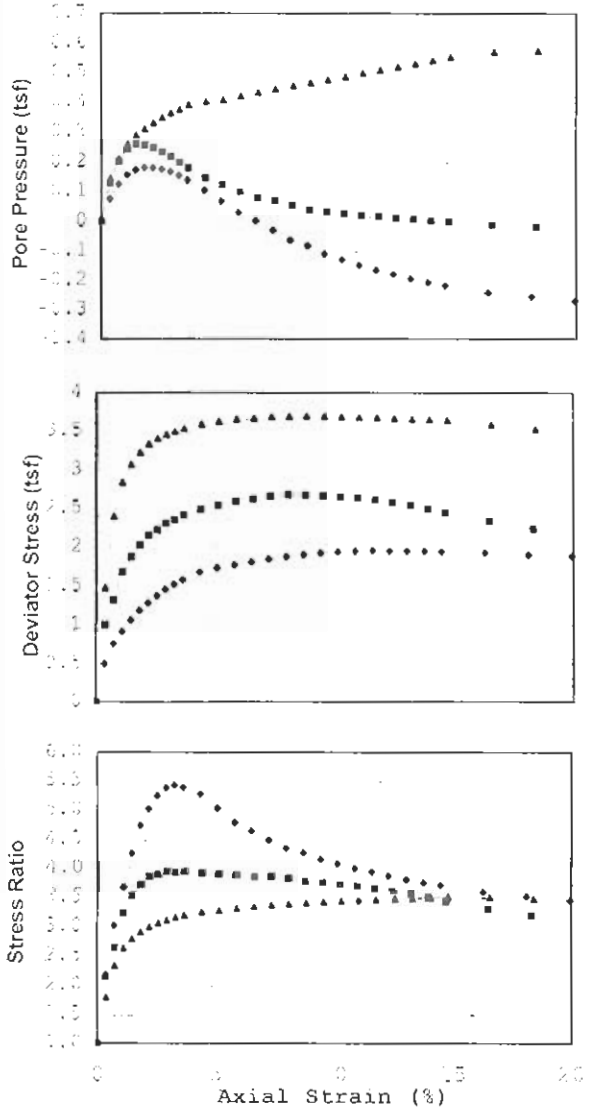
---------- Effective ϕ': 29.7 ° c'= 0.21 (tsf)
——— Total ϕ': 21.3 ° c= 0.49 (tsf)

9301 Bryant Ave. South Suite #107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3436

TRIAXIAL TEST ASTM: D 4767

Job No. 5669
Date: 6/2/06

Project: Kankakee River Stability Project - # GD-06032
Boring #: S-4 Sample #: 12 Type: 3T Depth (ft): 26-28.3 (Middle)
Soil Type: Fat Clay w/some Shells & a trace of Organic Material (CH)



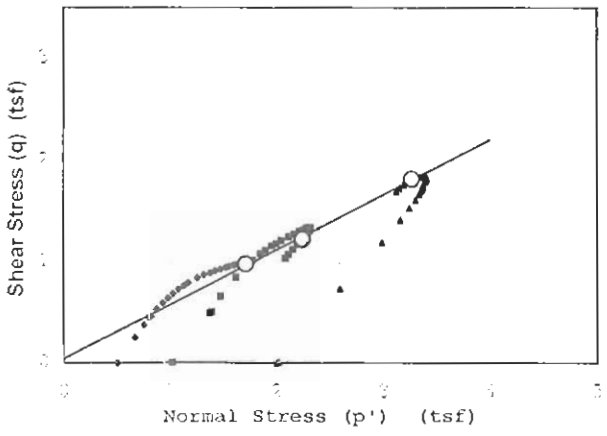
Failure Criterion: Given Strain of: 15%
Angle of internal friction, ϕ' = 32.8 °
Apparent Cohesion, c' = 0.05 (tsf)

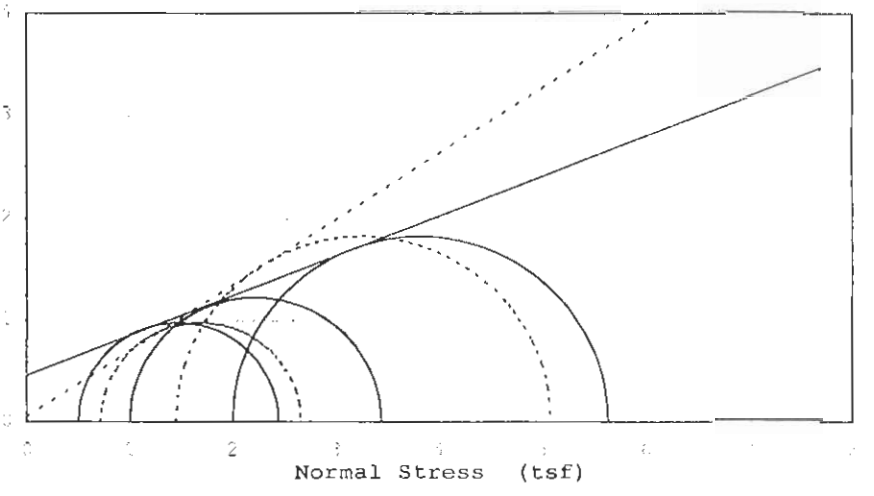
Test Date:	5/6/06		Liquid Limit:		55.5
Test Type:	CU w/pp		Plastic Limit:		22.3
Strain Rate (in/min):	0.0039		Plasticity Index:		33.2
Strain Rate (%/min):	0.141		Spec. Gravity (Assumed):		2.64

	A	B	C	D	E
Before Consolidation					
Diameter (in)	1.44	1.44	1.44		
Height (in)	2.99	2.99	2.99		
Water Content (%)	51.2	51.9	47.6		
Dry Density (pcf)	70.2	69.5	73.1		
Void Ratio	1.35	1.37	1.25		
After Consolidation					
Diameter (in)	1.35	1.34	1.34		
Height (in)	2.76	2.73	2.72		
Water Content (%)	34.2	32.6	29.0		
Dry Density (pcf)	86.7	88.6	93.3		
Void Ratio	0.90	0.86	0.77		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	1.96	2.68	3.69		
Ultimate Deviator Stress (tsf)	1.86	2.06	3.40		
Deviator Stress at Failure (tsf)	1.95	2.45	3.64		
Max. Pore Pressure Buildup (tsf)	0.18	0.26	0.58		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	15.0	15.0	15.0		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 1. over a period of 9 days; Consolidated 3 days; Drainage valves closed.





Rupture Envelope at Failure
α = 28.4 ° a = 0.04 (tsf)

Effective ϕ': 32.8 ° c'= 0.05 (tsf)
Total ϕ': 21.3 ° c= 0.46 (tsf)

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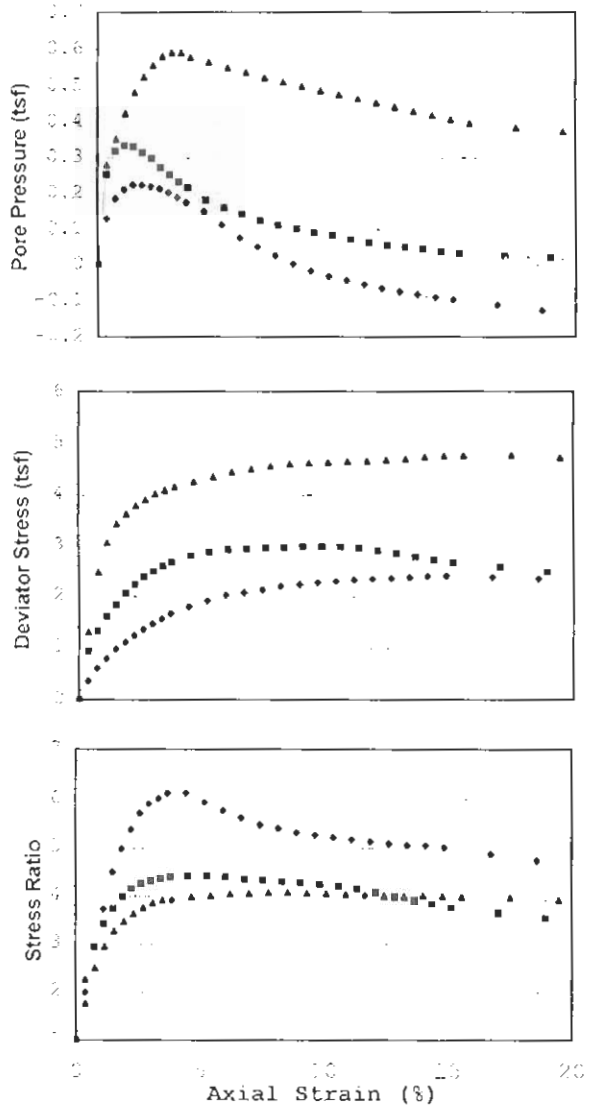
TRIAXIAL TEST ASTM: D 4767

Job No. 5669
Date: 6/2/06

Project: Woodlands Wet Stability Project # GD 06032
Boring #: S-5 Sample #: 8 Type: 3T Depth (ft): 14-16.3 (Bottom)
Soil Type: Organic Clay w/Sand & Shells (OH)



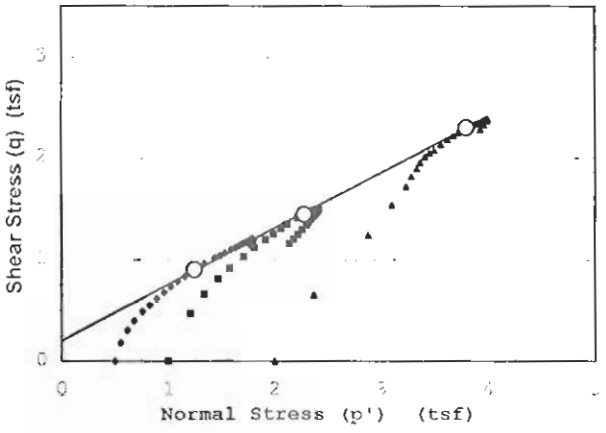
Failure Criterion:	Max. Stress Ratio
Angle of internal friction, ϕ' =	33.4 °
Apparent Cohesion, c' =	0.24 (tsf)

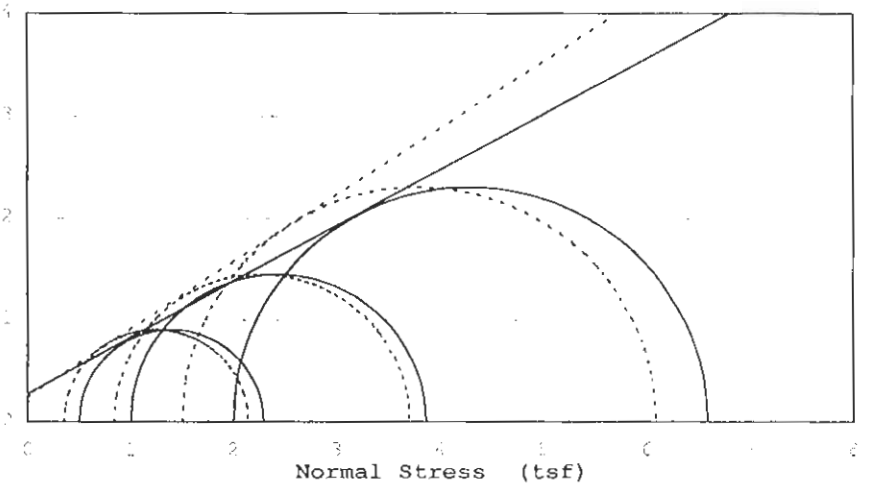
Test Date:	5/15/06	Liquid Limit:	94.6
Test Type:	CU w/pp	Plastic Limit:	64.1
Strain Rate (in/min):	0.0039	Plasticity Index:	30.5
Strain Rate (%/min):	0.145	Spec. Gravity (Assumed):	2.37

Before Consolidation	A	B	C	D	E
Diameter (in)	1.45	1.45	1.45		
Height (in)	2.99	2.99	2.99		
Water Content (%)	95.2	92.6	106.5		
Dry Density (pcf)	44.8	45.9	42.2		
Void Ratio	2.30	2.23	2.50		
After Consolidation					
Diameter (in)	1.35	1.35	1.31		
Height (in)	2.69	2.64	2.57		
Water Content (%)	66.6	61.8	62.3		
Dry Density (pcf)	57.4	60.0	59.8		
Void Ratio	1.58	1.46	1.48		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	2.39	2.97	4.77		
Ultimate Deviator Stress (tsf)	2.27	2.29	4.55		
Deviator Stress at Failure (tsf)	1.79	2.87	4.59		
Max. Pore Pressure Buildup (tsf)	0.22	0.33	0.59		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	4.5	5.3	8.6		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 1, over a period of 10 days; Consolidated 4 days; Drainage valves closed.





Rupture Envelope at Failure
α = 28.8 ° a = 0.2 (tsf)

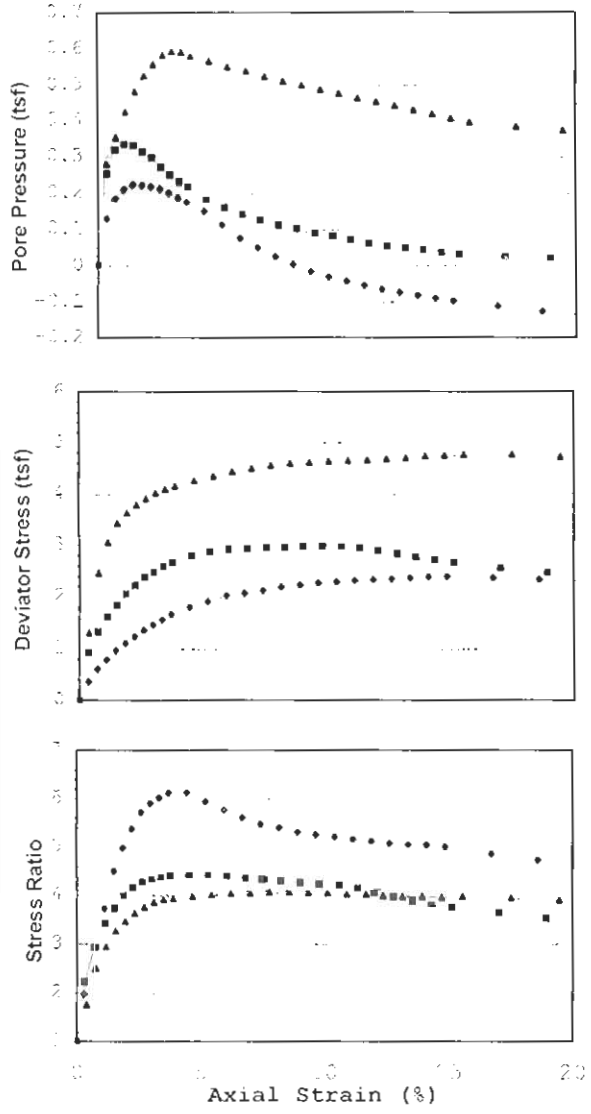
---------- Effective ϕ': 33.4 ° c'= 0.24 (tsf)
_____ Total ϕ': 28.7 ° c= 0.28 (tsf)

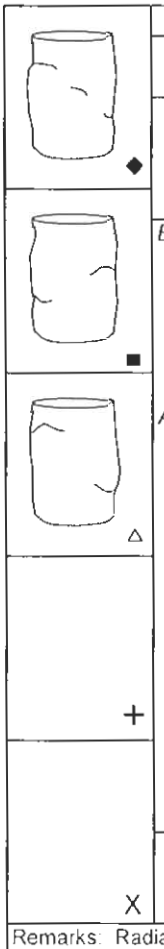
9301 Bryant Ave. South Suite #107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3436

TRIAXIAL TEST ASTM: D 4767

Job No. 5669
Date: 6/2/06

Project: Woodbury Water Stability Project # GD 06632
Boring #: S-5 Sample #: 8 Type: 3T Depth (ft): 14-16.3 (Bottom)
Soil Type: Organic Clay w/Sand & Shells (OH)





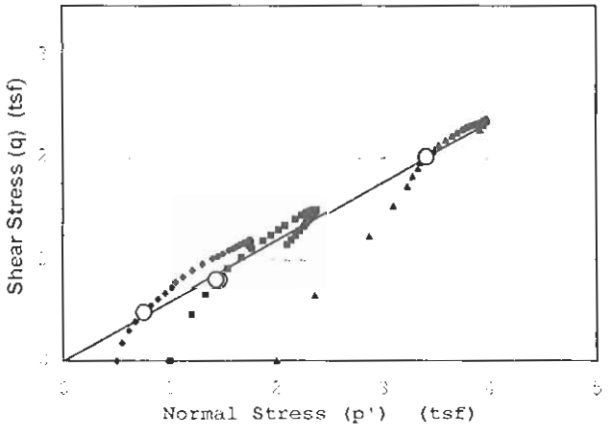
Failure Criterion: Max. Pore Pressure
Angle of internal friction, ϕ' = 35.7 °
Apparent Cohesion, c' = 0.00 (tsf)

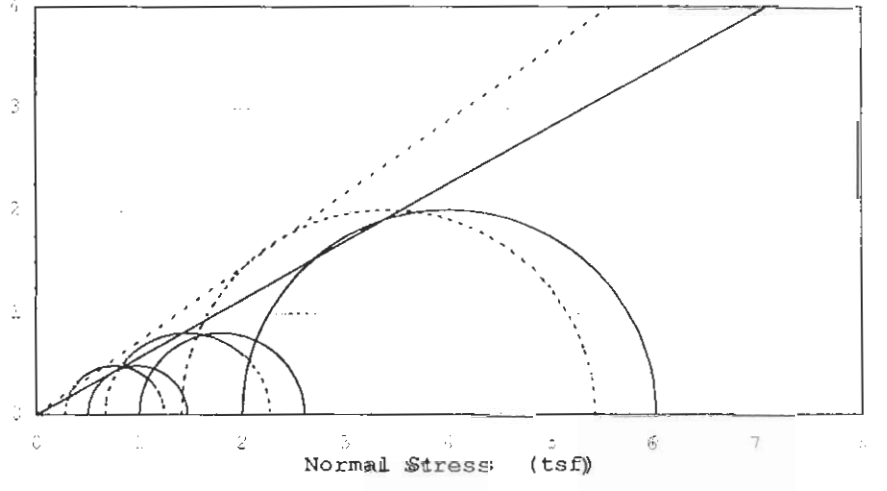
Test Date:	5/15/06		Liquid Limit:		94.6
Test Type:	CU w/pp		Plastic Limit:		64.1
Strain Rate (in/min):	0.0039		Plasticity Index:		30.5
Strain Rate (%/min):	0.145		Spec. Gravity (Assumed):		2.37

	A	B	C	D	E
Before Consolidation					
Diameter (in)	1.45	1.45	1.46		
Height (in)	2.99	2.99	2.99		
Water Content (%)	95.2	92.6	106.5		
Dry Density (pcf)	44.8	45.9	42.2		
Void Ratio	2.30	2.23	2.50		
After Consolidation					
Diameter (in)	1.35	1.35	1.31		
Height (in)	2.69	2.64	2.57		
Water Content (%)	66.6	61.8	62.3		
Dry Density (pcf)	57.4	60.0	59.8		
Void Ratio	1.58	1.46	1.48		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	2.39	2.97	4.77		
Ultimate Deviator Stress (tsf)	2.27	2.29	4.55		
Deviator Stress at Failure (tsf)	0.97	1.61	4.91		
Max. Pore Pressure Buildup (tsf)	0.22	0.33	0.59		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	1.5	1.1	3.1		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen. Saturated, backpressured until "B" response was 1, over a period of 10 days; Consolidated 4 days; Drainage valves closed.





Rupture Envelope at Failure
α = 30.3 ° a = 0.0 (tsf)

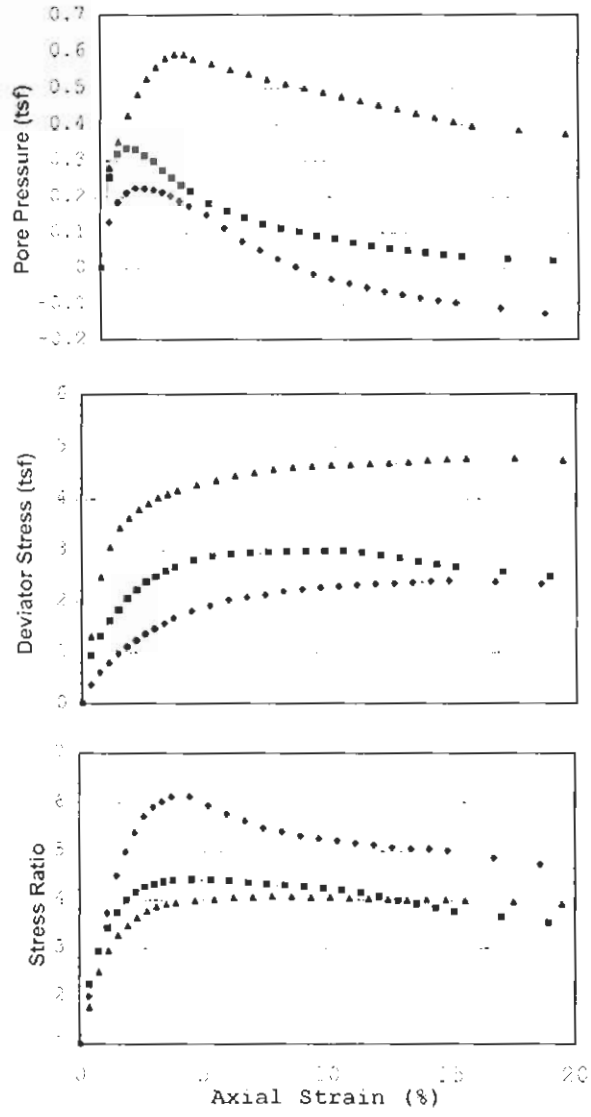
----------	Effective ϕ':	35.7 °	c'=	0.00 (tsf)
_____	Total ϕ':	29.4 °	c=	0.00 (tsf)

9301 Bryant Ave. South Suite #107 — OIL ENGINEERING TESTING, INC. — Bloomington, Minnesota 55420-3436

TRIAXIAL TEST ASTM: D 4767

Job No. 5669
Date: 6/2/06

Project: Woodchuck River Stability Project # GD-06032
Boring #: S-5 Sample #: 8 Type: 3T Depth (ft): 14-16.3 (Bottom)
Soil Type: Organic Clay w/Sand & Shells (OH)



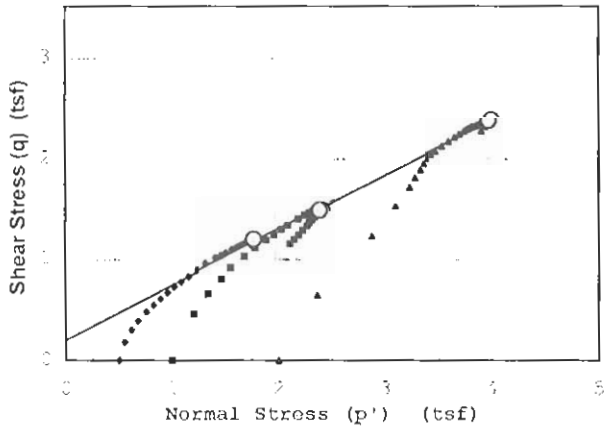
Failure Criterion: Max. Deviator Stress
Angle of internal friction, ϕ' = 32.9 °
Apparent Cohesion, c' = 0.24 (tsf)

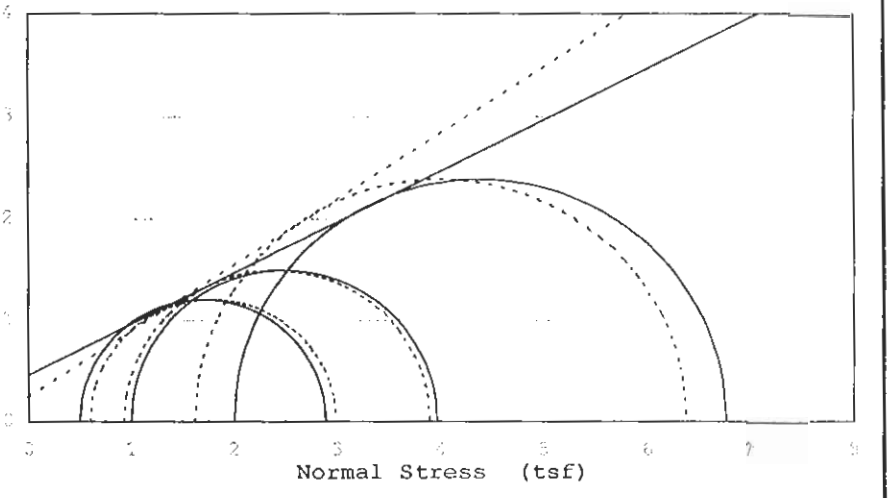
Test Date:	5/15/06		Liquid Limit:		94.6
Test Type:	CU w/pp		Plastic Limit:		64.1
Strain Rate (in/min):	0.0039		Plasticity Index:		30.5
Strain Rate (%/min):	0.145		Spec. Gravity (Assumed):		2.37

	A	B	C	D	E
Before Consolidation					
Diameter (in)	1.45	1.45	1.45		
Height (in)	2.99	2.99	2.99		
Water Content (%)	95.2	92.6	106.5		
Dry Density (pcf)	44.8	45.9	42.2		
Void Ratio	2.30	2.23	2.50		
After Consolidation					
Diameter (in)	1.35	1.35	1.31		
Height (in)	2.69	2.64	2.57		
Water Content (%)	66.6	61.8	62.3		
Dry Density (pcf)	57.4	60.0	59.6		
Void Ratio	1.58	1.46	1.48		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	2.39	2.97	4.77		
Ultimate Deviator Stress (tsf)	2.27	2.29	4.55		
Deviator Stress at Failure (tsf)	2.39	2.97	4.77		
Max. Pore Pressure Buildup (tsf)	0.22	0.33	0.59		
Pore Pressure Parameter 'B'	1.0	1.0	1.0		
Pct. Axial Strain at Failure	14.9	10.6	17.5		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen. Saturated, backpressured until "B" response was 1, over a period of 10 days; Consolidated 4 days; Drainage valves closed.





Rupture Envelope at Failure
α 28.5 ° a = 0.2 (tsf)

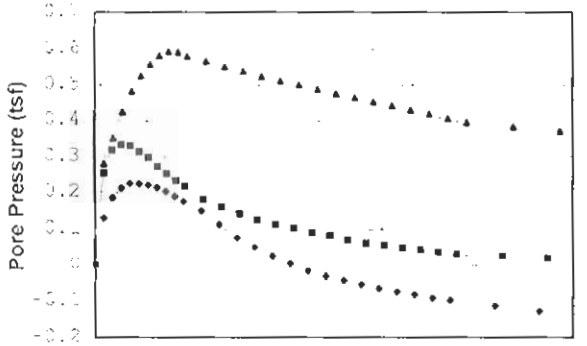
----------	Effective ϕ':	32.9 °	c'=	0.24 (tsf)
_____	Total ϕ':	26.6 °	c=	0.46 (tsf)

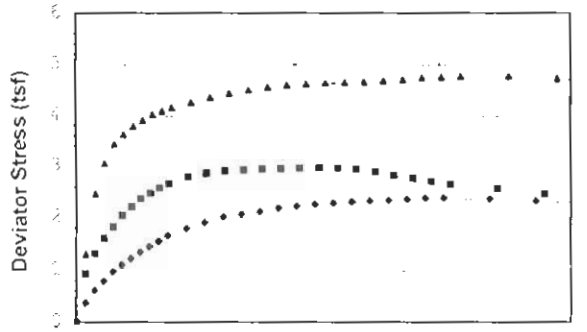
9301 Bryant Ave. South Suite #107 SOIL ENGINEERING TESTING, INC. Bloomington, Minnesota 55420-3435

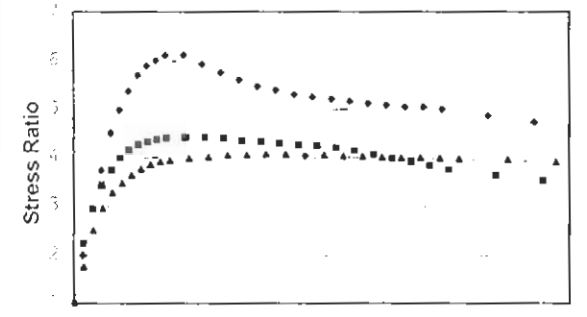
TRIAXIAL TEST ASTM: D 4767

Job No. 5669
Date: 6/2/06

Project: Kinnickinnic River Stability Project - # GD-06032
Boring #: S-5 Sample #: 8 Type: 3T Depth (ft): 14-16.3 (Bottom)
Soil Type: Organic Clay w/Sand & Shells (OH)







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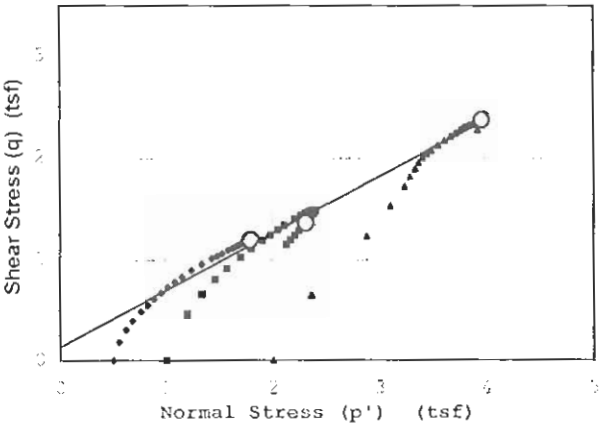
Failure Criterion: Given Strain of: 15%
Angle of internal friction, ϕ' = 34.1 °
Apparent Cohesion, c' = 0.16 (tsf)

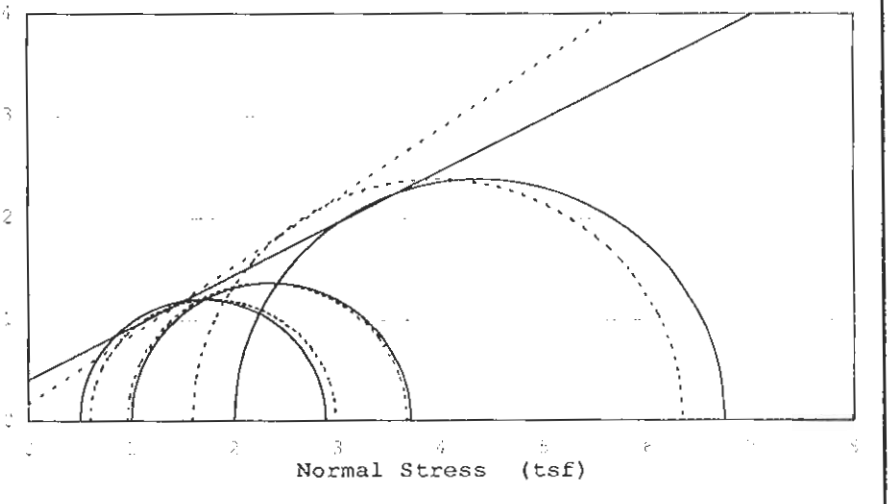
Test Date:	5/15/06	Liquid Limit:	94.6
Test Type:	CU w/pp	Plastic Limit:	64.1
Strain Rate (in/min):	0.0039	Plasticity Index:	30.5
Strain Rate (%/min):	0.145	Spec. Gravity (Assumed):	2.37

Before Consolidation	A	B	C	D	E
Diameter (in)	1.45	1.45	1.45		
Height (in)	2.99	2.99	2.99		
Water Content (%)	95.2	92.6	106.5		
Dry Density (pcf)	44.8	45.9	42.2		
Void Ratio	2.30	2.23	2.50		
After Consolidation					
Diameter (in)	1.35	1.35	1.31		
Height (in)	2.69	2.64	2.57		
Water Content (%)	66.6	61.8	62.3		
Dry Density (pcf)	57.4	60.0	59.8		
Void Ratio	1.58	1.46	1.48		
Back Pressure (tsf)	5.76	5.76	5.76		
Minor Principal Stress (tsf)	0.50	1.00	2.00		
Max. Deviator Stress (tsf)	2.39	2.97	4.77		
Ultimate Deviator Stress (tsf)	2.27	2.29	4.55		
Deviator Stress at Failure (tsf)	2.39	2.71	4.75		
Max. Pore Pressure Buildup (tsf)	0.22	0.33	0.59		
Pore Pressure Parameter "B"	1.0	1.0	1.0		
Pct. Axial Strain at Failure	15.0	15.0	15.0		

"These test results are for informational purposes only and must be reviewed by a qualified professional engineer to verify that the test parameters shown are appropriate for any particular design"

Remarks: Radial drainage strips applied to trimmed specimen; Saturated, backpressured until "B" response was 1, over a period of 10 days; Consolidated 4 days: Drainage valves closed.





Rupture Envelope at Failure
a = 29.2 ° a = 0.1 (tsf)

---------- Effective ϕ': 34.1 ° c'= 0.16 (tsf)
_____ Total ϕ': 27.1 ° c= 0.41 (tsf)

9301 Bryant Ave. South Suite #107
SOIL ENGINEERING TESTING, INC.
Bloomington, Minnesota 55420-3436

APPENDIX H

TIE-BACK SURVEY

COLEMAN ENGINEERING CO.
635 CIRCLE DRIVE – IRON MOUNTAIN, MICHIGAN 49801 (906) 774-3440
OFFICE ALSO LOCATED AT: IRONWOOD, MICHIGAN 49938 (906) 932-5048

TIEBACK LOCATION DRAWING
KINNICKINNIC RIVER
MILWAUKEE, WISCONSIN

NO	DATE	REVISIONS	BY

SURVEYED BY	DRAWN BY	CHECKED	APPROVED	DRAWING NO.
CEC I.M.	MRK	WR	WR	H
DATE	CADD DRAWING	CADD PROJECT	JOB NUMBER	
–	06032 TIE-BACK	CAD060032	GD-06032-H	
SCALE				
1"=30'				
DATE:				
6/28/06				

LEGEND
- ✖ – TIEBACK LOCATION WITH ELEVATION
- ⊕ – SOIL BORING LOCATION
- — — — – APPROX. SHORELINE

NOTE: SURVEY SHOTS SPACING VARIES BASED ON CLIENTS RECOMMENDATIONS

NORTH

GRAPHIC SCALE 0 30' 60'

TIE BACK SPACING 2.68'±
TIE BACK SPACING 2.68'±
TIE BACK SPACING 2.66'±
TIE BACK SPACING 2.68'±
TIE BACK SPACING 2.66'±
OPEN STORAGE
TIE BACK SPACING 2.67'±
TIE BACK SPACING 2.63'±
DOCKS
DOCKS
DOCKS
TIE BACK SPACING 0.64'±
TIE BACK SPACING 0.72'±
TIE BACK SPACING 0.81'±
TIE BACK SPACING 0.88'±
OPEN STORAGE
TIE BACK SPACING 0.64'±
TIE BACK SPACING 0.67'±
TIE BACK SPACING 0.63'±
TIE BACK SPACING 0.67'±
TIE BACK SPACING 0.60'±
TIE BACK SPACING 0.68'±
TIE BACK SPACING 0.85'±
O.S.
W. BECHER ST. BRIDGE

APPENDIX I

PARRALLEL SEISMIC SURVEY

APPENDIX I

REPORT OF PARALLEL SEISMIC SURVEY FOR KINNICKINNIC RIVER STABILITY ANALYSIS AND DREDGING STUDY

MILWAUKEE COUNTY, WISCONSIN

PREPARED FOR:

BARR ENGINEERING COMPANY

JUNE 2006

CEC PROJECT GD-06032

PARALLEL SEISMIC SURVEY
U.S. CORPS OF ENGINEERS
KINNICKINNIC RIVER
MILWAUKEE, WISCONSIN

June 2006

Prepared by:

COLEMAN ENGINEERING COMPANY
635 Circle Drive
Iron Mountain, Michigan 49801
CEC# GD-06032

TABLE OF CONTENTS

ATTACHMENTS

I. Introduction

On May 2-3, 2005, Coleman Engineering Company (CEC) conducted a parallel seismic survey at select borehole locations along the Kinnickinnic River (Figure 1) to assess the depth of sheet piling in relation to a proposed dredging operation and sheet pile analysis. The data acquisition platform was a Geotechnics S-12 Seismograph with Geostuff Wall-Lock Borehole Geophone Model BHG-2. The BHG-2 contains three (3) 14 Hz geophones in an X-Y-Z orientation. The geophone is clamped to the wall of the casing by a robust steel spring that is compressed by a DC electric motor. The array has a 100-meter cable and a controller module. Details of the instrumentation are found in Attachment 2.

II. Field Operation

Six (6) soil borings (S-1 through S-6) were advanced by CEC from April 18-25, 2006 and three (3) test wells (S-1, S-3, and S-5) were installed in the designated boreholes within 5 feet of the sheet piling along the Kinnickinnic River. The S-12 Seismograph and BHG-2 were connected and the BHG-2 was set in the well at ground surface (0.0') for the initial test. Several test shots were conducted to set the recording parameters of the seismograph in the optimal range (filters, gain, etc.). The seismograph was also tested without a triggered shot to test background noise and adjust the gain. The extraneous noise was very low due to the geophones being inside the borehole and filtering was set to omit 40-hertz waves, which are typical outside interference. Each test was triggered when the hammer struck the sheet piling. The response was monitored by the geophone array in the borehole and recorded on the seismograph. The test proceeded in 5-foot increments until a general depth of the bottom of the sheet piling was evident. The S-12 seismograph recorded the direct arrival times of compressional and shear waves as well as wave amplitudes. The first arrival times were plotted as a function of depth, and the depth where the change of slope occurred was observed to be the depth of the sheet piling. The sheet piling depth was also determined by the depth where the first arrival signal is significantly reduced. The accuracy of the method depended on the variability of the surrounding soil and the distance between borehole and sheet piling. As the distance from the borehole to the sheet piling increases, the error or the curve becomes more rounded, thus the estimate of the bottom of the sheet piling becomes a range of depth (higher and lower). Results of the survey are found in Attachment 3.

III. Interpretation

The first arrival times were plotted as a function of depth, and the depth where the change of slope occurred was observed to be the depth of the sheet piling. The accuracy of the method depends on the variability of the surrounding soil and the distance between borehole and sheet piling. The estimated depth to the bottom of the sheet piling at soil boring S-1 is 33 feet below ground surface (bgs). The text presentation of S-1 differs from S-3 and S-5 in that all geophone channels were operating at the time of each test. It was subsequently determined that using the three (3) geophones would yield a more aesthetically appealing presentation. The depth of the

borehole beneath the sheet piling (the borehole was terminated due to auger refusal at 38 feet bgs) reduces the confidence in this interpretation. However, amplitude attenuation of the signal appears in the 35 and 38 foot shot points. It also appears that there is void space between the sheet piling and the soil strata from 21 to 26 feet bgs. This may be the result of channeling or migration of soil through the sheets from water action. The estimated depth to the bottom of the sheet piling in soil boring S-3 is 31.5 feet bgs and in soil boring S-5 is 30 feet bgs. Graphical solutions of the surveys are provided as Attachment 4.

IV. Disclaimer

There are limitations inherent to the geophysical investigation process. No geophysical investigation can wholly eliminate uncertainty regarding actual geophysical conditions of the subject study area(s). When dealing with existing conditions that are hidden from view affected by time, changes in state and other limitations, it would require a substantial level of financial and technical effort in order to remove all of the uncertainty associated with a site evaluation.

It must be understood that the results and the conclusions drawn from the results have inherent limitations and uncertainty. The limitations and uncertainty exist when site refraction samples are collected and analyzed for the purpose of representing existing site conditions. Although special care is taken in the field to assure adequate sampling, the results of those refraction samples are most representative of the exact location of where the samples were collected. The results, however, are used as a basis for demonstrating existing conditions, when in fact the overall actual conditions may vary.

ATTACHMENT 1
LIST OF FIGURES

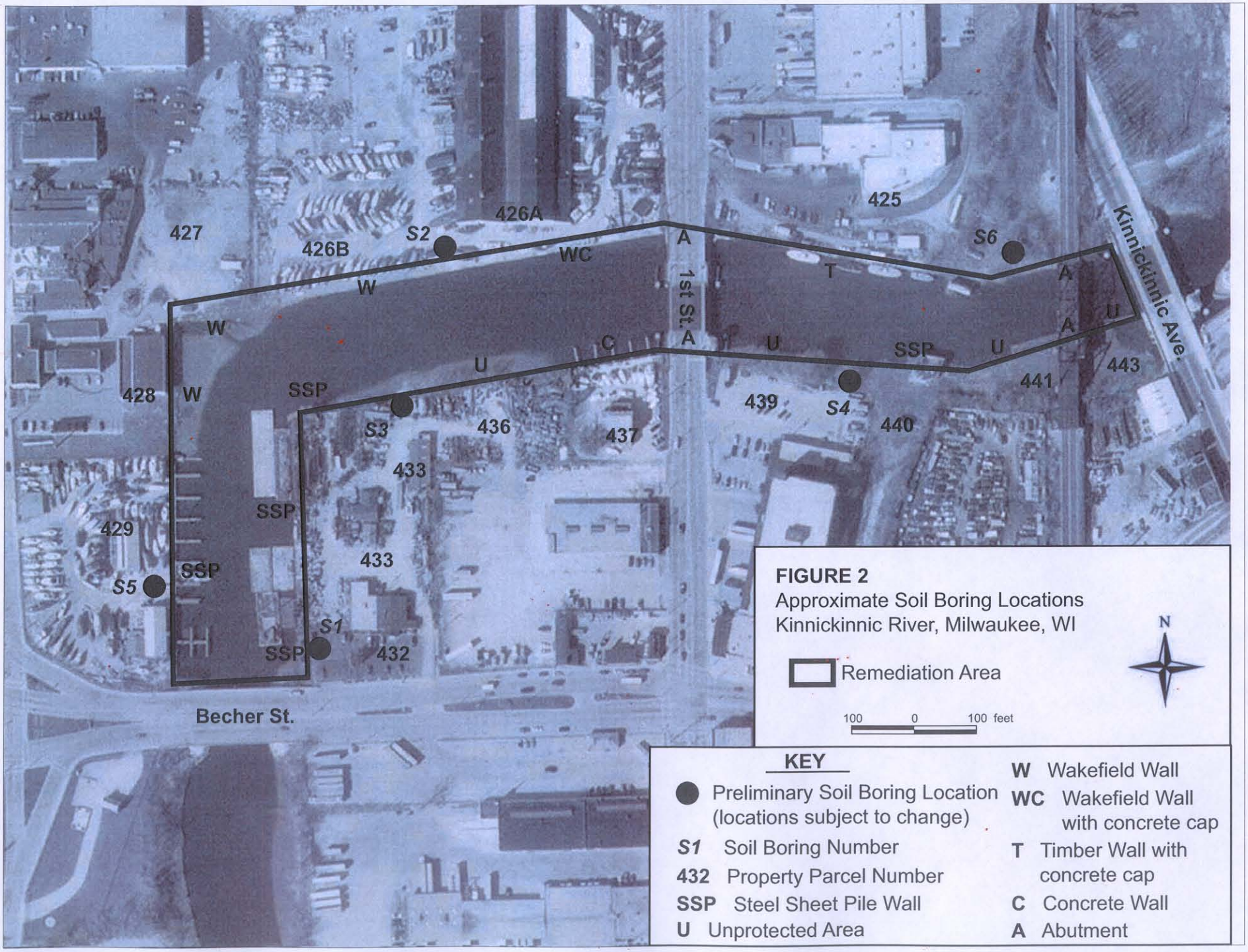


FIGURE 2
Approximate Soil Boring Locations
Kinnickinnic River, Milwaukee, WI

Remediation Area

N

100 0 100 feet

KEY

- Preliminary Soil Boring Location (locations subject to change)
- ***S1*** Soil Boring Number
- **432** Property Parcel Number
- **SSP** Steel Sheet Pile Wall
- **U** Unprotected Area
- **W** Wakefield Wall
- **WC** Wakefield Wall with concrete cap
- **T** Timber Wall with concrete cap
- **C** Concrete Wall
- **A** Abutment

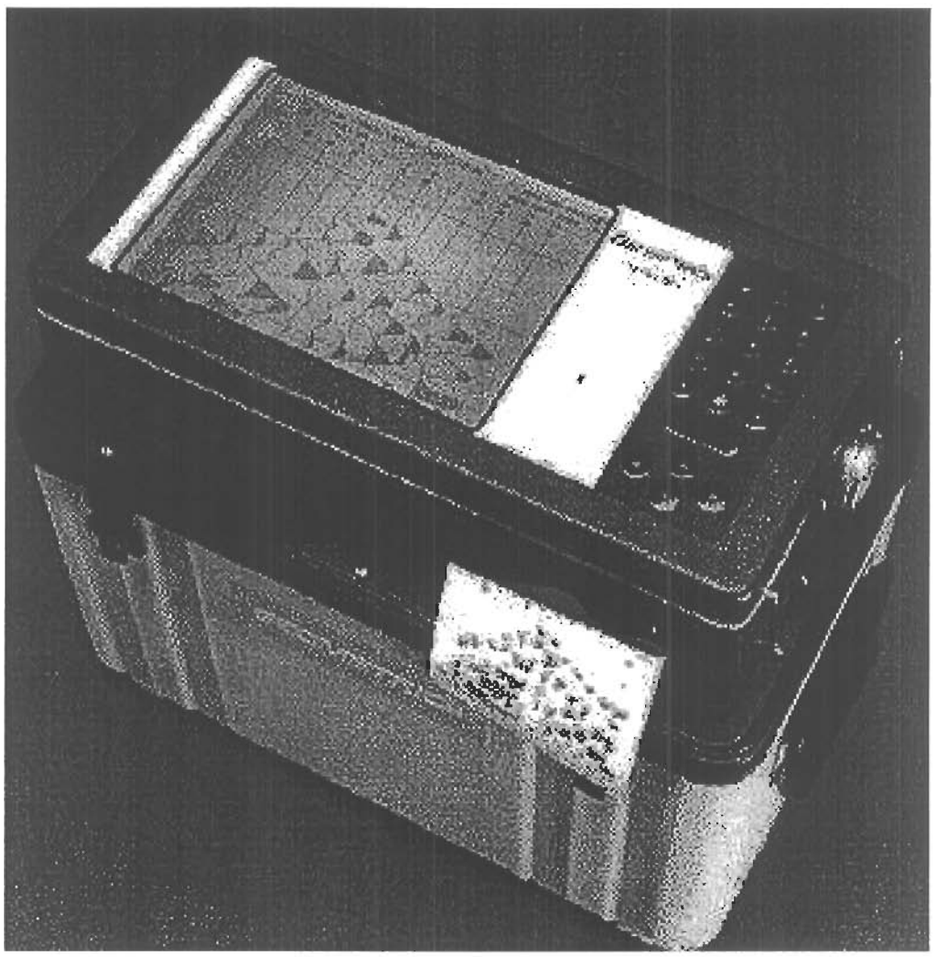
ATTACHMENT 2
INSTRUMENT DETAILS

SmartSeis Exploration Seismograph

26325-01 Rev. B

Operation Manual

GEOMETRICS, INC.
2190 Fortune Drive, San Jose, CA 95131 USA
Phone 408-954-0522, Fax: 408-954-0902
E-mail: sales@geom.geometrics.com



Appendix E. Specifications

Data Acquisition:

Preamplifier:

Input: Floating differential

Gain: 3X (36 dB) 2% accuracy

Differential input impedance: 20,000 ohms

Common mode input impedance: 5,000 ohms

Maximum undistorted differential input signal: 0.312 volts peak-to-peak

Input protected: against static and transient discharge.

Filters:

Acquisition filters:

Anti-alias filter automatically set by sample interval except none at fastest sample rate.

Selectable Lowcut, Notch or Highcut filter. Lowcut frequencies 10, 15, 25, 35, 50, 70, 100, 140, 200, 280, or 400 Hz, attenuation 24 dB/octave. Notch frequencies of 50, 60, 150 or 200 Hz. Highcut frequencies of 250, 500 or 1000 Hz.

Second filter available identical to above.

Display filters:

Two display filters are available, identical to the acquisition filters. Display filters do not alter the raw data stored in memory and saved on disk.

Digitizer: 16-bit (15+sign) analog-to-digital converter, preceded by an automatic 24 dB, single-stage, gain-ranging amplifier.

Summer: Signal is summed into a 32-bit accumulator. Will also subtract for enhancement of shear waves. Maximum signal may be stacked 8000 times without saturation.

Sample intervals: selectable 31.25, 62.5, 125, 250, or 500 microseconds for all channels.

Memory size: 32-bit word per sample, 2048 samples per channel, can be reduced by menu control to 1536, 1024, or 512 samples to save disk storage space.

Record duration: 64, 128, 256, 512 or 1024 milliseconds, depending on sample interval. Length of memory in use may be restricted to ¼, ½ or ¾ of the available amount to reduce amount of data stored.

Memory freeze: selectable memory protection on individual channels to prevent erasure or further stacking.

Preview: incoming data may be displayed on screen and either selected or rejected at operator's discretion to allow editing of noisy records.

Delay: start of record may be delayed from initiation by selected value from 0 to 999 milliseconds in 1 ms increments. Negative delay may be selected to display a portion of the record prior to the zero time trigger.

Trigger: System triggers from a standard hammer switch, geophone signal, saturated NPN transistor, 5-volt logic level, contact closure, contact open, or +/- voltage. Trigger voltage sensitivity adjustable from 0 to 800 millivolts.

System:

Number of Seismic Channels: 12 (in SmartSeis™ S12) or 24 (in SmartSeis™ S24).

Graphics display: liquid crystal, VGA-compatible, with 640 by 480 pixels, 11 inch (28 cm) diagonal viewing area.

Display annotation: data is annotated with acquisition parameters and time-labeled cursors.

Display parameters: data is displayed in variable area, shaded, or wiggle trace, with and without clipping, in fixed gain or AGC, with adjustments for trace amplitude and time scale.

Plotter: Paper copy of record provided by internal, 11-cm wide thermal plotter with 640 dot resolution. Record is annotated with acquisition parameters, other variables, and time lines. Time scale and trace amplitude and format adjustable, controlled by settings on display.

Noise Monitor: Multi-channel, long-persistence, oscillographic noise monitor with trace for each geophone signal. Sensitivity is adjustable with scale factor displayed on screen. Waveform envelope can be observed.

Data storage: Internal 3.5-inch floppy disk drive provides data storage on 1.44-Mbyte, DOS-compatible media. Internal 40-Mbyte hard disk for program and data storage.

Computer: Internal computer with 80386SX processor, IBM AT compatible. Available for use as computer with computer interface option, which includes outputs for an external VGA monitor, parallel printer port, standard keyboard, and RS-232 interface. Programs may be loaded on standard disk drive.

Environmental:

Temperature: operates from 0 to 50 degrees Celsius. Will operate in light rain in vertical position.

Power: External 12-volt power from rechargeable battery or other source. Operates from 10.5 to 15 volts. Current drain approximately 2½ amps for SmartSeis™ S12 and 3½ amps for SmartSeis™ S24.

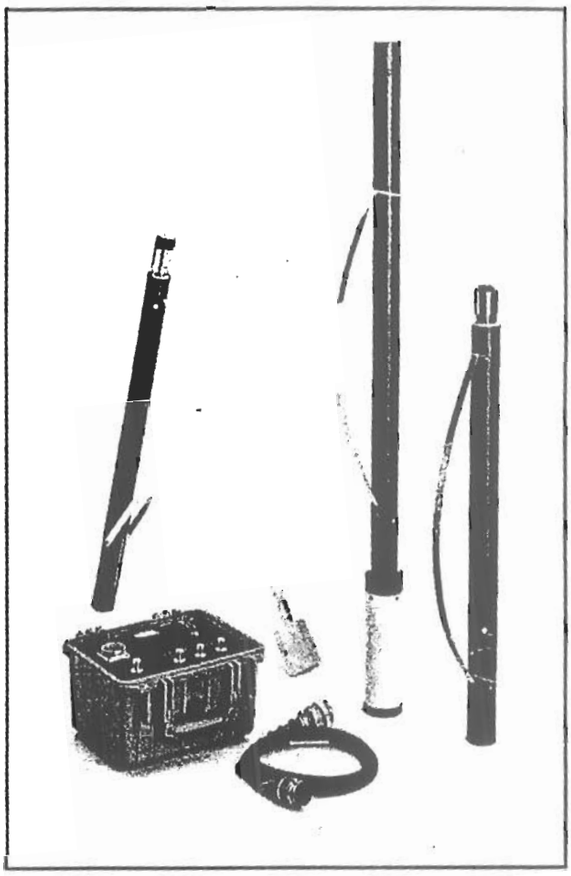
BHG-2 Borehole Geophone
BHG-3 Borehole Geophone
BHGC-1 Geophone Controller

Operation Manual

Geostuff
19623 Via Escuela Drive
Saratoga, California 95070
U.S.A.

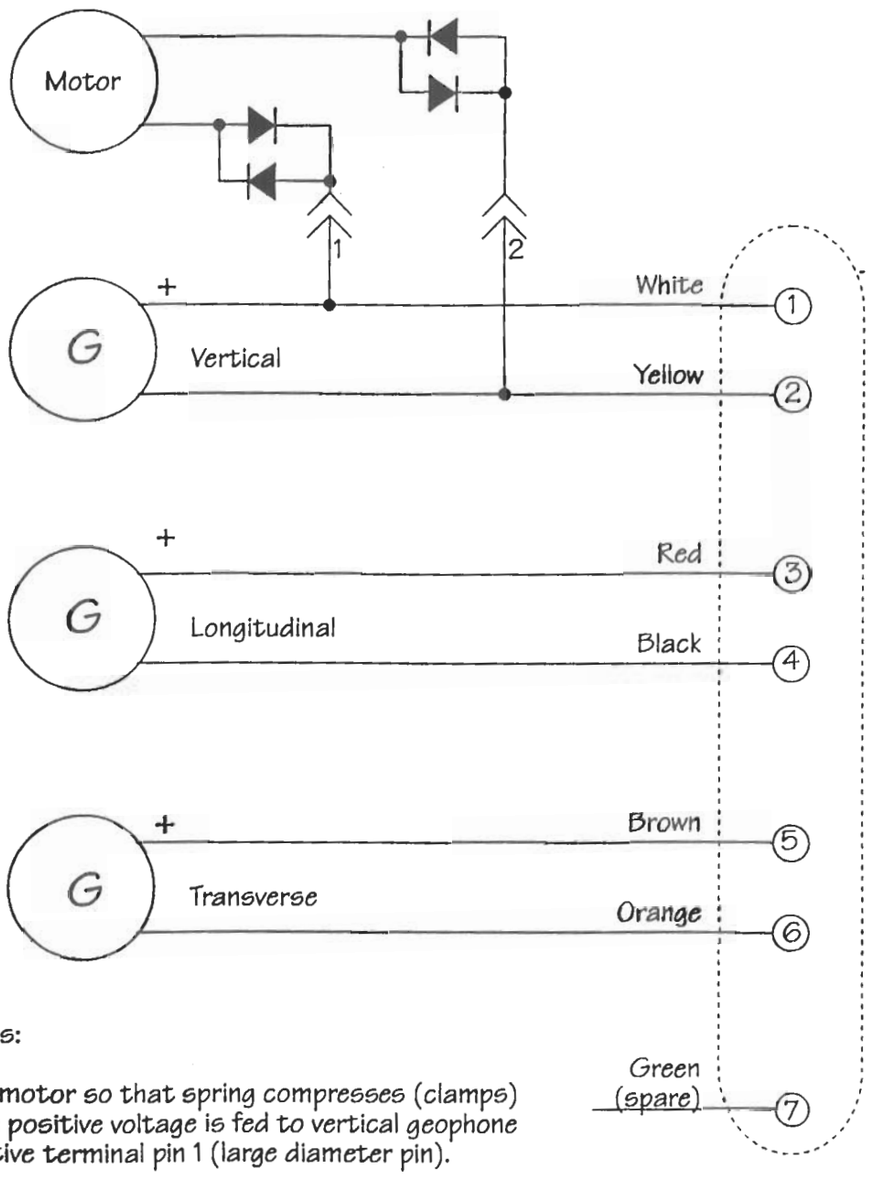
phone 408-867-3792
fax 408-867-4900

The Geostuff family of borehole instruments includes several products.



- The BHG-2 is a wall-lock, 3-component geophone.
- The BHG-3 is a wall-lock, 3-component geophone which includes a flux-gate compass and servo mechanism to orient the horizontal geophones along any particular azimuth.
- The BHGC-1 is an optional controller which provides power to the clamp, orientation mechanism, and selects seismograph channels.
- The Big Hole kit allows either BHG to operate in very large boreholes.
- The cable includes waterproof connector on the wet end, high strength copperweld conductors, and a Kevlar braid for additional strength beneath a Polyurethane jacket. The cable is also available as as extension cable with waterproof connectors on each end to provide a temporarily longer cable.

This manual describes the operation of all these products.



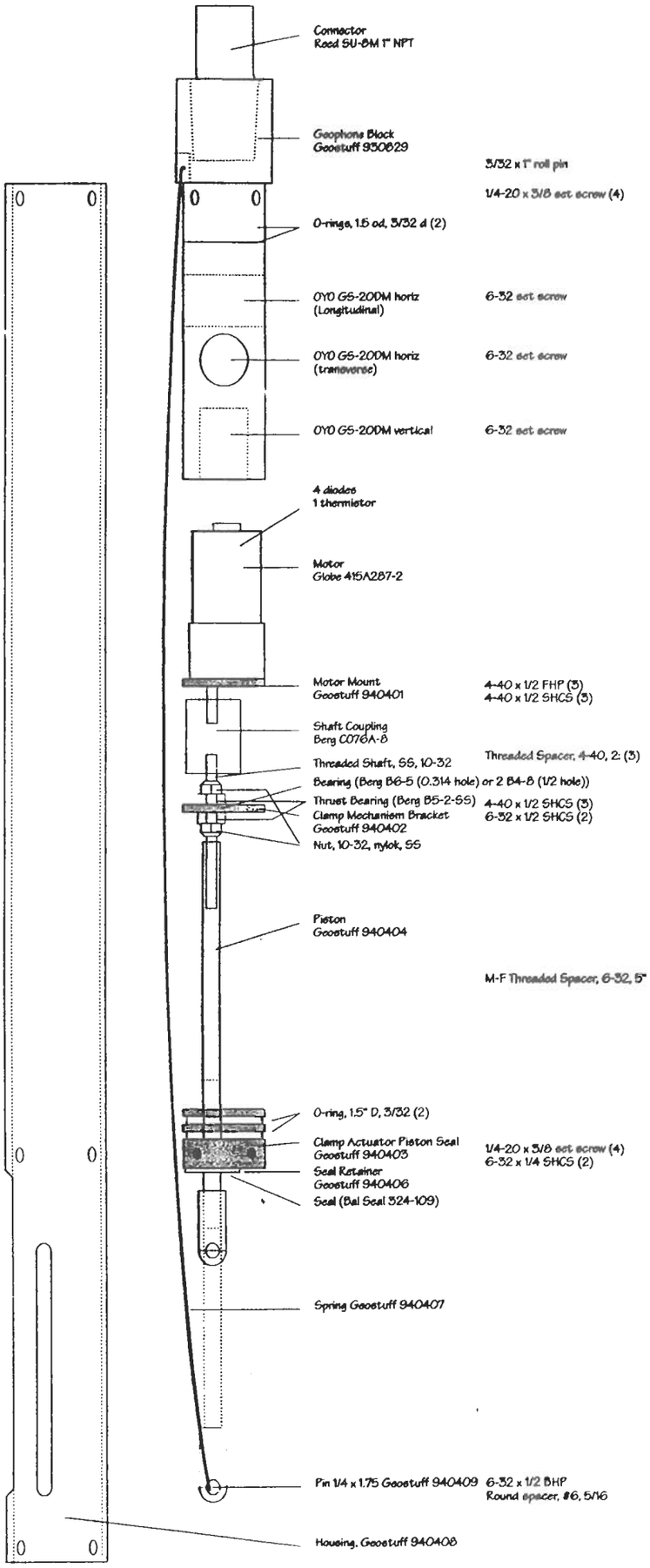
Notes:

Wire motor so that spring compresses (clamps) when positive voltage is fed to vertical geophone positive terminal pin 1 (large diameter pin).

Axis of longitudinal sensor points toward spring

Mating connector, Reed Products SU-8F. Pin numbers on Reed connector are same as pin numbers on NK-27-21C connector used on cable.

Part	BHG-2 Schematic Diagram	GEOSTUFF		
Where Used	BHG-2	Part No.	Rev	Date 7/28/94


Connector
Reed SU-8M 1" NPT
Geophone Block
Geostuff 930629
3/32 x 1" roll pin
1/4-20 x 3/8 set screw (4)
O-rings, 1.5 od, 3/32 d (2)
OYO GS-20DM horiz
(Longitudinal)
6-32 set screw
OYO GS-20DM horiz
(transverse)
6-32 set screw
OYO GS-20DM vertical
6-32 set screw
4 diodes
1 thermistor
Motor
Globe 415A287-2
Motor Mount
Geostuff 940401
4-40 x 1/2 FHP (3)
4-40 x 1/2 SHCS (3)
Shaft Coupling
Berg C076A-8
Threaded Shaft, SS, 10-32
Threaded Spacer, 4-40, 2: (3)
Bearing (Berg B6-5 (0.314 hole) or 2 B4-8 (1/2 hole))
Thrust Bearing (Berg B5-2-SS)
Clamp Mechanism Bracket
Geostuff 940402
4-40 x 1/2 SHCS (3)
6-32 x 1/2 SHCS (2)
Nut, 10-32, nylok, SS
Piston
Geostuff 940404
M-F Threaded Spacer, 6-32, 5"
O-ring, 1.5" D, 3/32 (2)
Clamp Actuator Piston Seal
Geostuff 940403
1/4-20 x 3/8 set screw (4)
6-32 x 1/4 SHCS (2)
Seal Retainer
Geostuff 940406
Seal (Bal Seal 324-109)
Spring Geostuff 940407
Pin 1/4 x 1.75 Geostuff 940409
6-32 x 1/2 BHP
Round spacer, #6, 5/16
Housing, Geostuff 940408

BHG-2 Borehole Geophone

The BHG-2 is a 3-component, borehole geophone with a motor-driven clamp to hold the geophone in place against the wall of a borehole. The BHG is used for a variety of borehole seismic surveys, including downhole and crosswell. The geophone elements are oriented in an X-Y-Z pattern. The body of the geophone is 1.75 inches (45 mm) in diameter, so it will fit in boreholes as small as 2 inches (50 mm) diameter.

The clamping mechanism is a steel spring which is compressed and expanded by a piston actuated by a 12-volt DC motor. The motor and the vertical geophone element share a pair of wires. A voltage high enough to overcome the resistance of the cable is applied to the appropriate conductors and the motor turns. Reversing the voltage reverses the motor. The current drain provides the operator with a measurement of how much work the motor is doing, and indicates when the spring is pushing against the wall. This can be confirmed by pulling on the cable.

The geophone cable contains seven conductors of copperweld, a high-strength wire. There is a kevlar braid for even more strength inside the polyurethane jacket. The cable is connected to the borehole geophone with an underwater connector, allowing the cable and geophone to be disconnected for transit. This also allows the use of extension cords so that the system can be configured with various cable lengths appropriate to the survey.

The cable may be supplied with bare wires or a Cannon NK-27-21C. This connector will mate with the BHGC controller, or can be plugged directly into a standard seismograph. In that case, the Vertical component will be connected to pins 1 & 2 (usually channel 1 on a 12-channel seismograph, or channel 12 on a 24-channel seismograph). The Longitudinal geophone will be connected to pins 3 & 4, and the Transverse geophone will be connected to pins 5 & 6.

If there is no connector on the cable, then use the following color code:

Color	BHG Pin No.	Function
White	1	Vert geophone + and motor power
Yellow	2	Vert geophone - and motor power
Red	3	Longitudinal geophone +
Black	4	Longitudinal geophone -
Brown	5	Transverse geophone +
Orange	6	Transverse geophone -
Green	7	spare wire (no connection)

To operate the clamp mechanism without a controller, apply a DC voltage directly to pins 1 & 2 of the connector. If the positive terminal is connected to pin 1, the spring will expand against the borehole and clamp the geophone in place. Connect the positive lead to pin 2 to compress the spring and release the geophone. Verify proper operation before putting the geophone in the hole.

The supply can be any convenient source, including standard flashlight batteries connected in series. The power supply is a nominal 12 volts DC at the geophone, but the voltage will need to be increased to compensate for the voltage drop in the cable. Measure the line resistance (times two) and calculate the voltage drop at 1/2 amp to estimate the amount of excess voltage to apply to the top of the cable. The voltage required will vary from 12 to 48 volts (or even more for long cables) depending on the cable length (see the discussion in the BHGC instructions).

If you wish to construct a motor controller, a schematic diagram for a suitable unit is included with this manual.

Do not leave the power connected after the spring is in position.

When connecting the waterproof connectors between the cable and geophone, it is necessary to lubricate the connector with a silicone-based lubricant. Be careful not to get too much lubricant on the pins or the excess will become trapped inside the connection and might cause a leak. Use a silicone spray lubricant or a very small amount of silicone grease. **Do not use petroleum based lubricants, they will eventually damage the rubber**. Do not use large amounts of silicone grease, as it will be trapped inside the connector and lessen the seal. Use just enough to moisten the contacts.

The Longitudinal geophone points toward the clamping spring.

For large diameter boreholes, an optional "big-hole" kit is available. This kit replaces the spring with a set of arms (available in different lengths in the kit). The foot is designed for soft-wall uncased holes, and it can be omitted in cased holes. See the illustration for the proper installation of the kit.

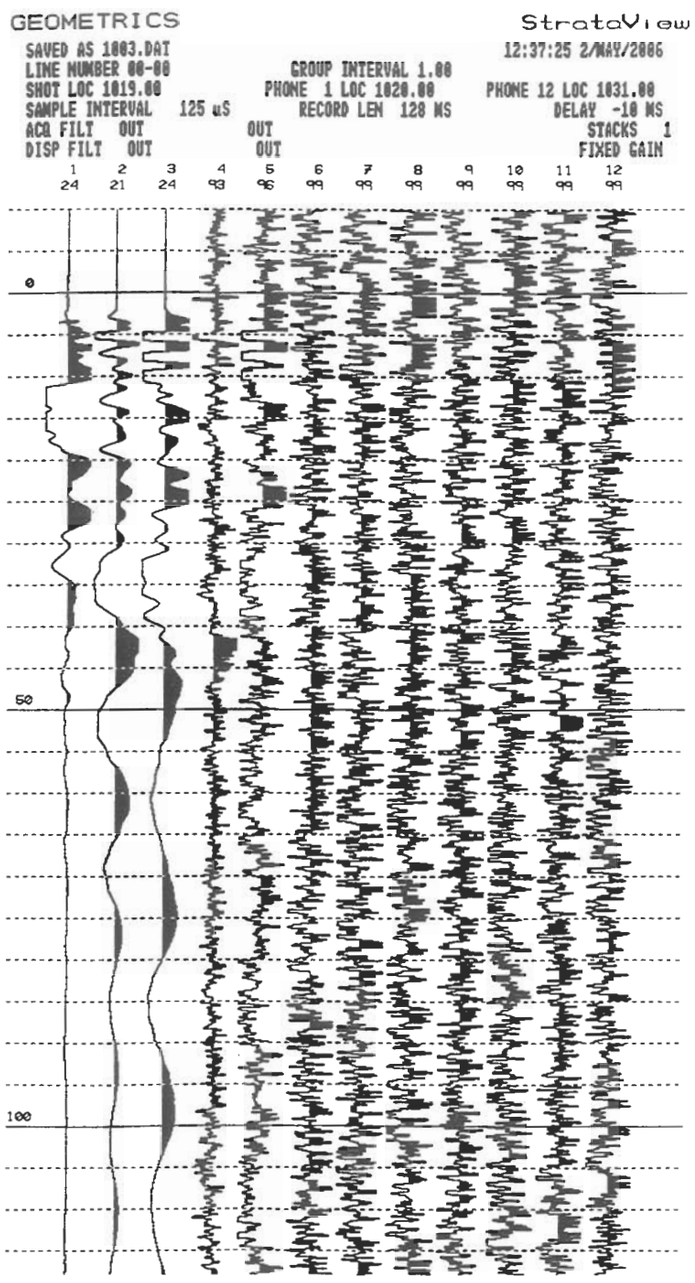
The standard geophone elements are OYO Geospace type GSC-20DM, 14 Hz natural frequency, with a 240 ohm coil. 10, 28 and 40 Hz elements are also available. The geophone elements can be replaced by any reasonably skilled electronics technician.

To service the geophone elements, just remove the 4 screws around the perimeter of the connector end and pull the geophone block out. To service the motor/clamp assembly, you must then remove the four screws near the bottom end. See the drawing for the interior view.

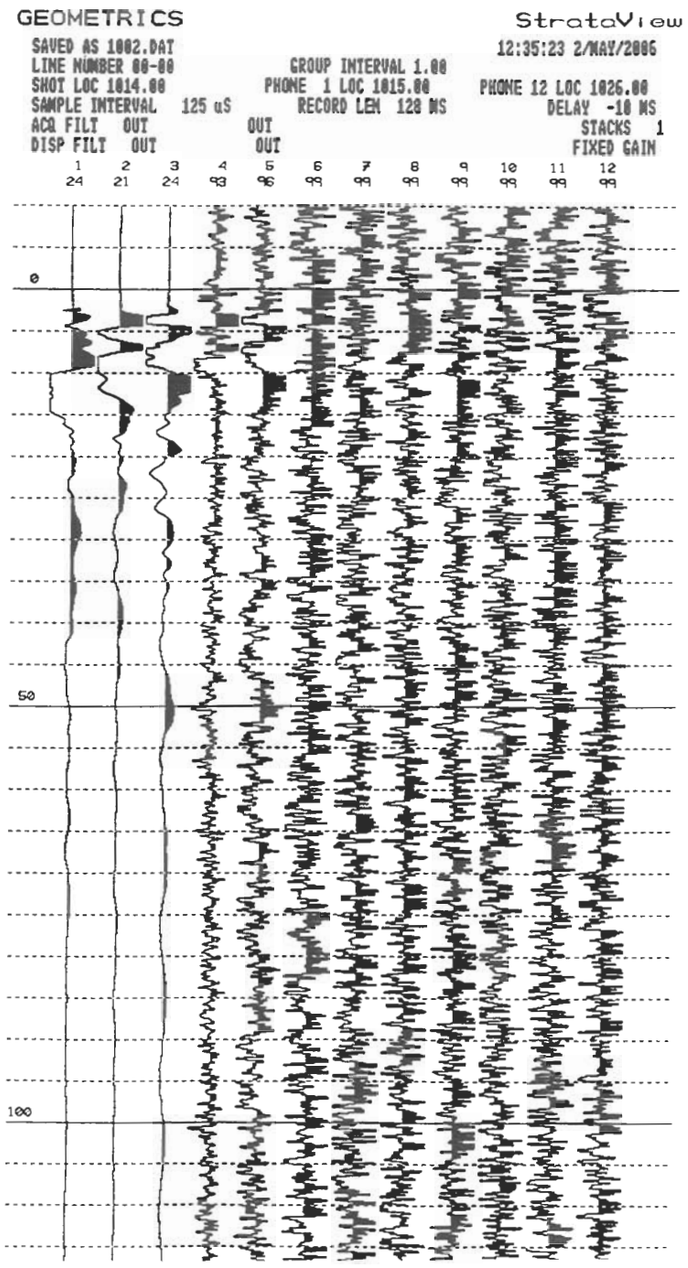
The cable for the BHG has a Reed Products type SU-8F connector molded on Tescorp TL7-1002 cable.

ATTACHMENT 3
SURVEY RESULTS

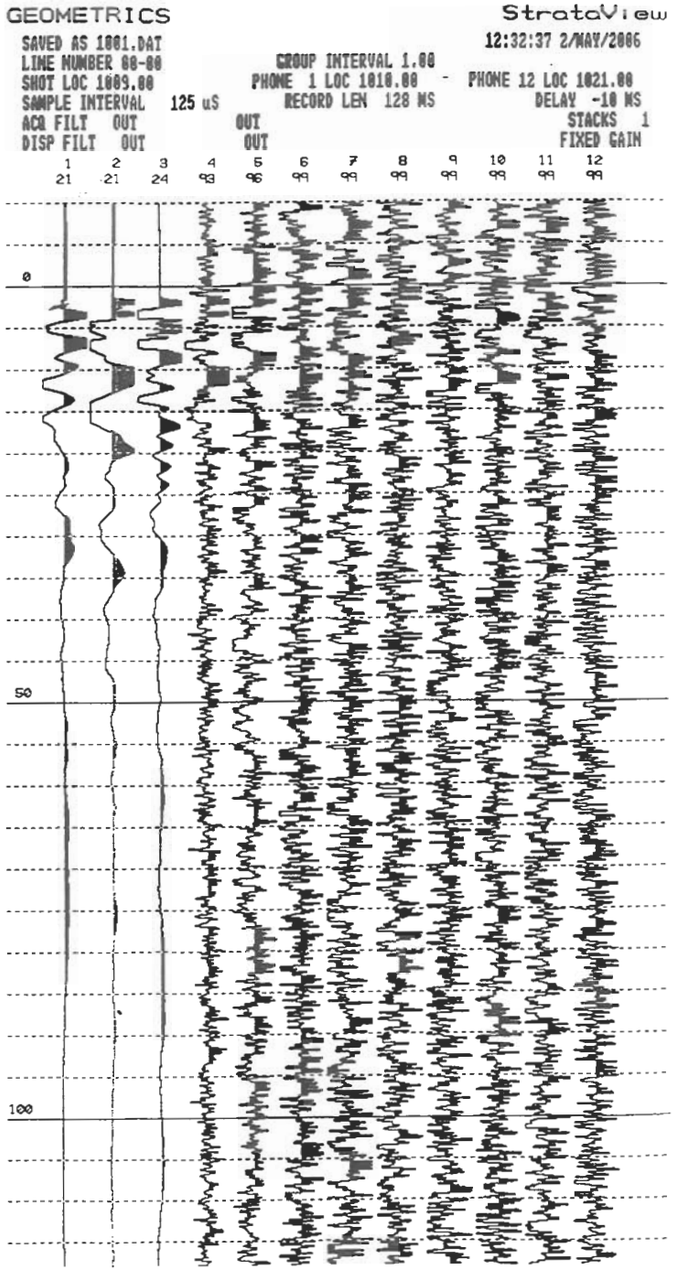
S-1
15'



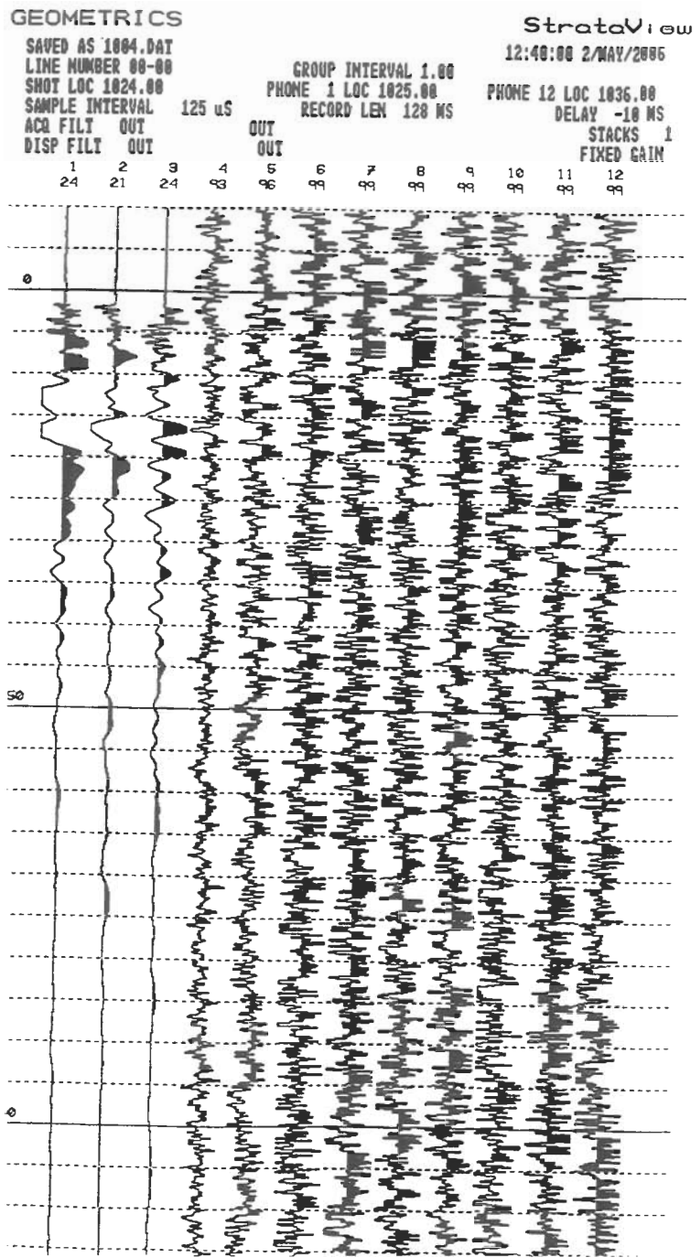
S-1
10'



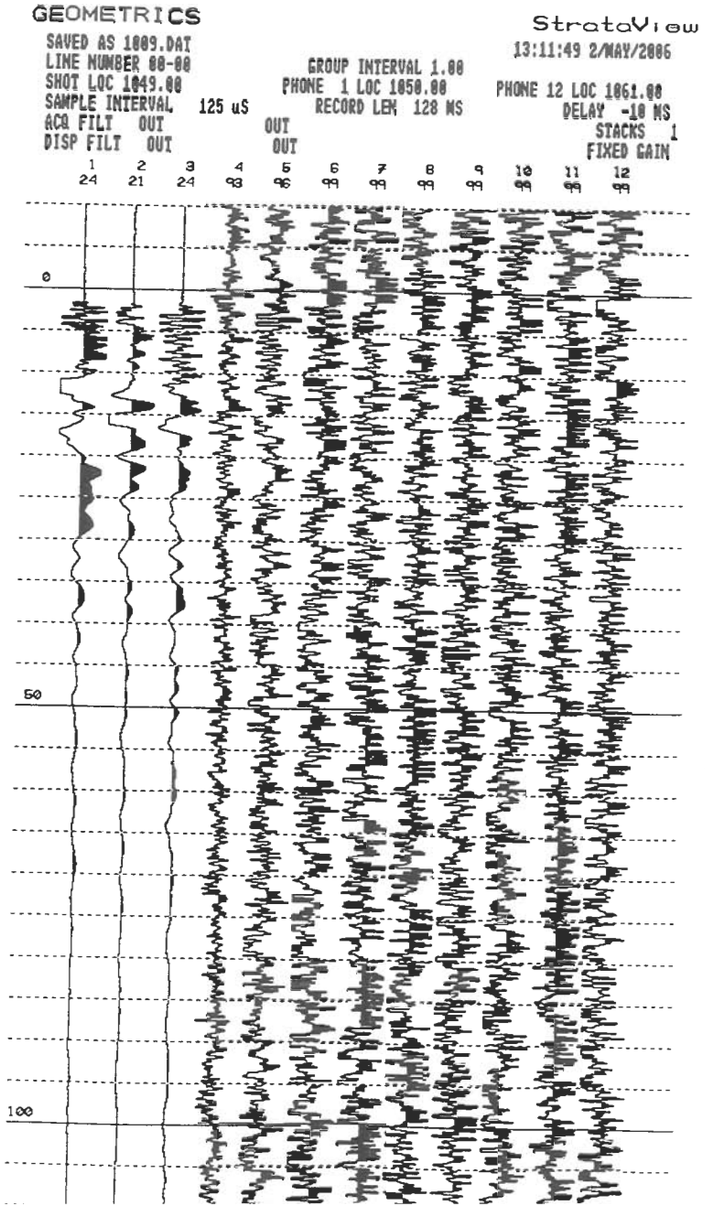
S-1
5'



S-1
20'



S-1
21'



S-1
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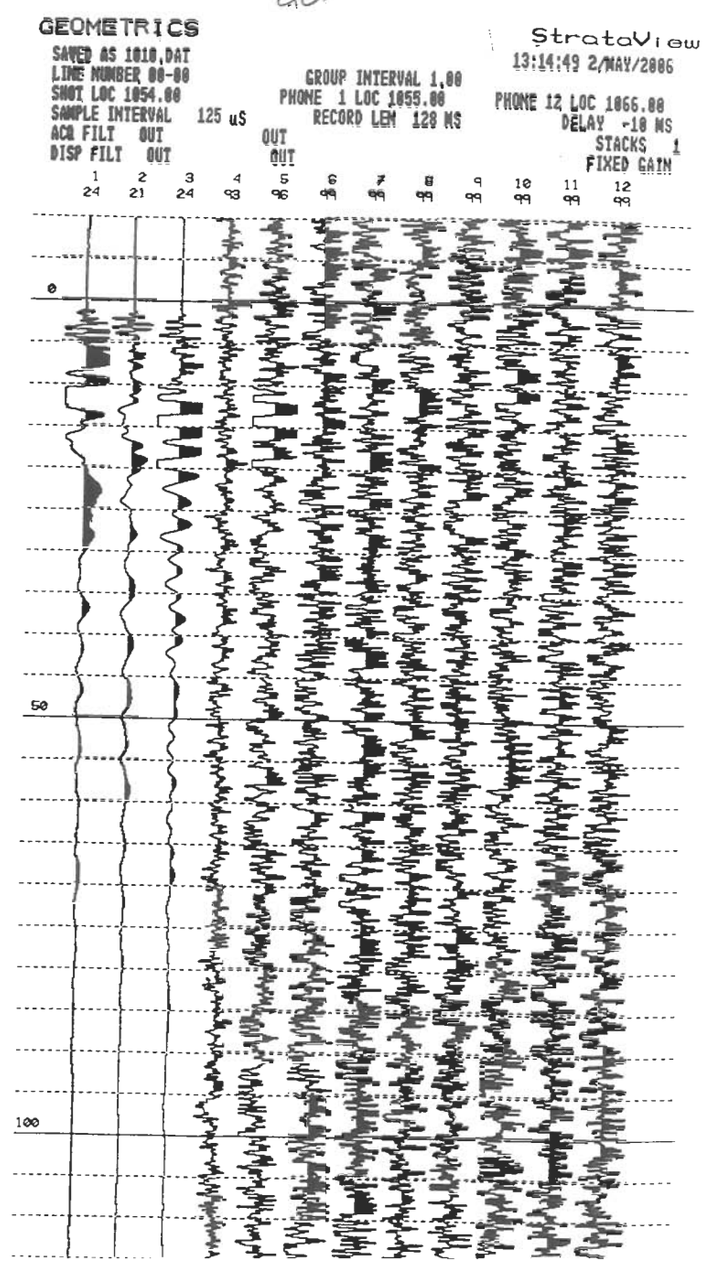

S-1
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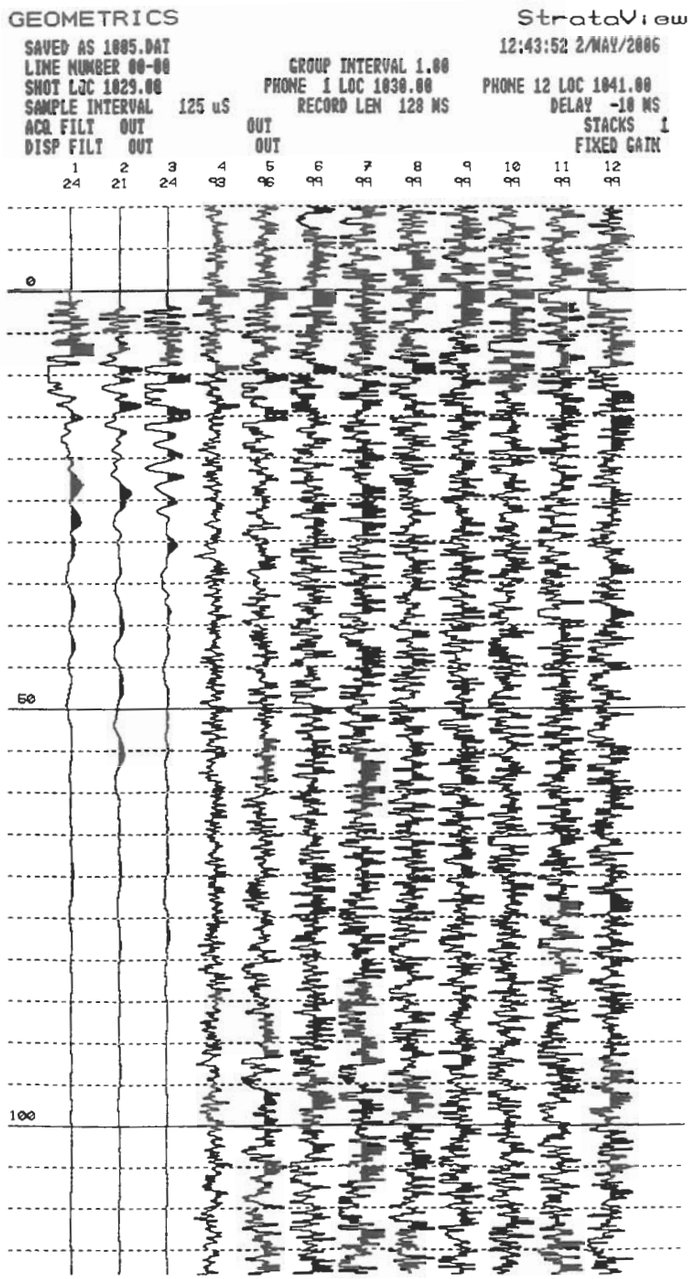

S-1
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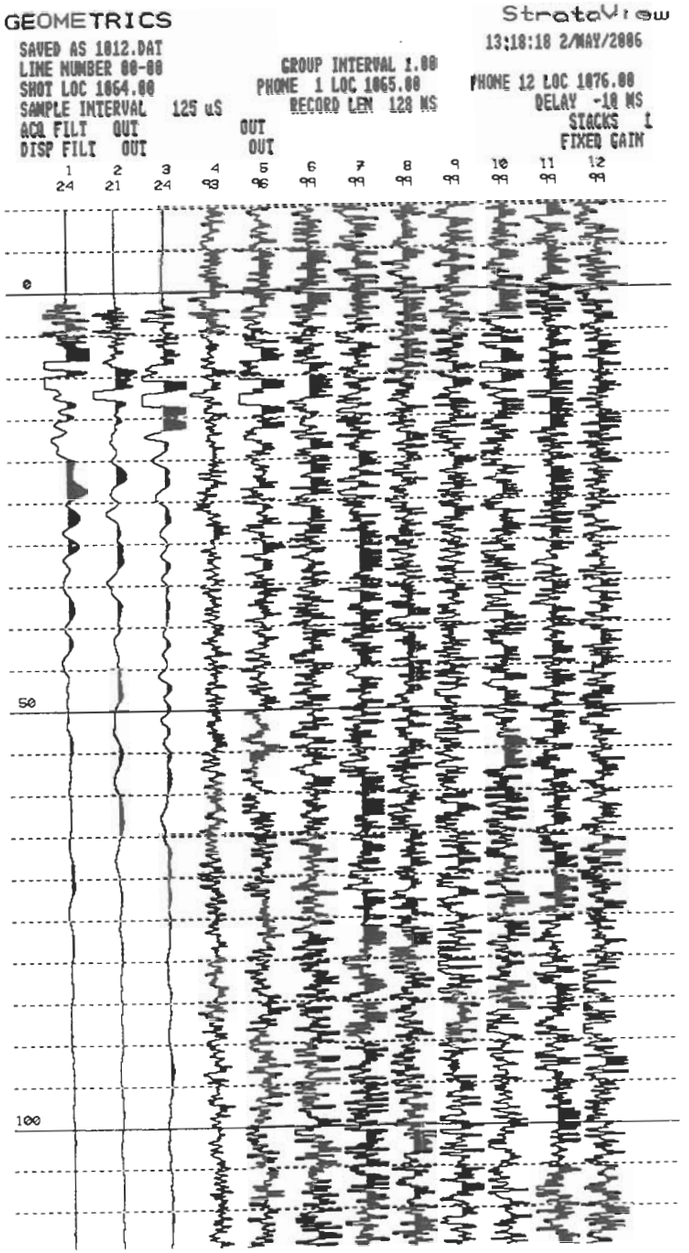
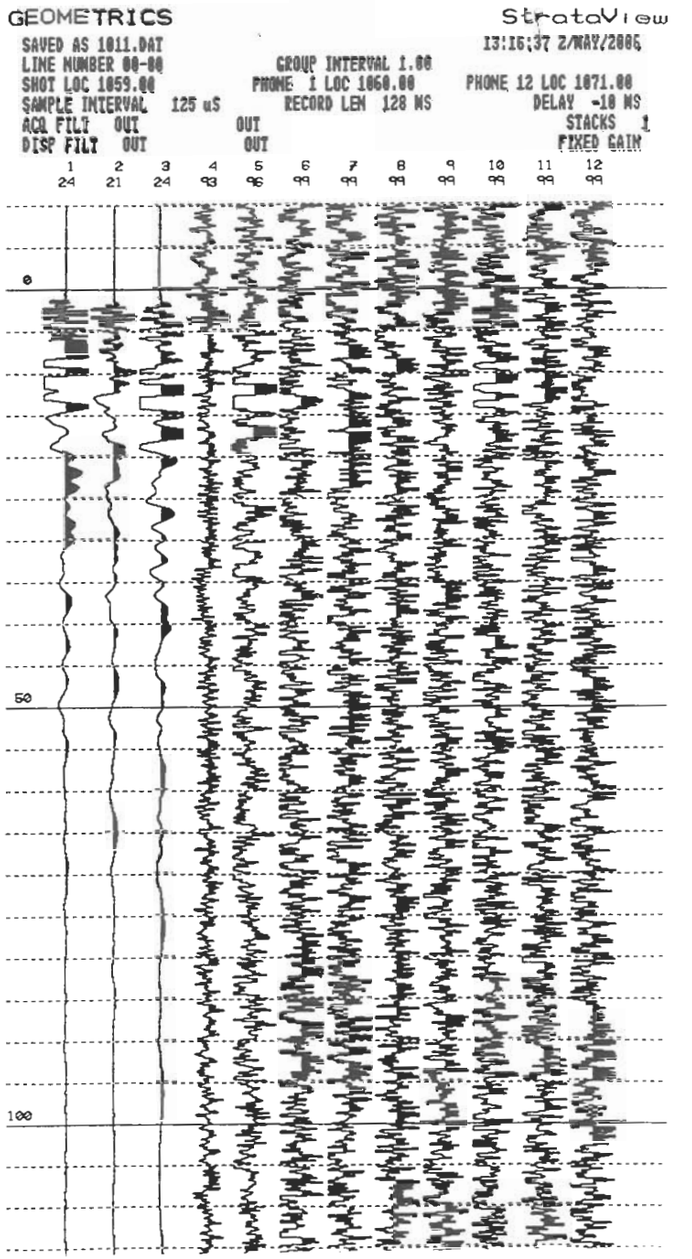
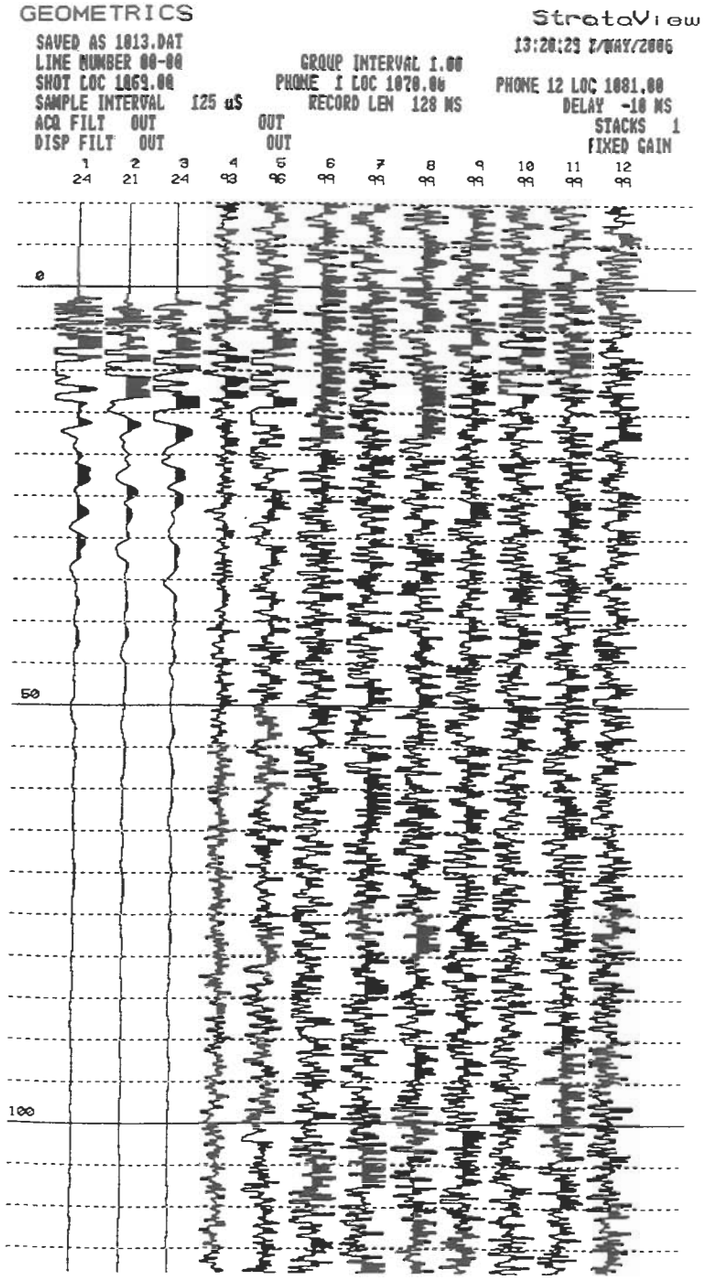


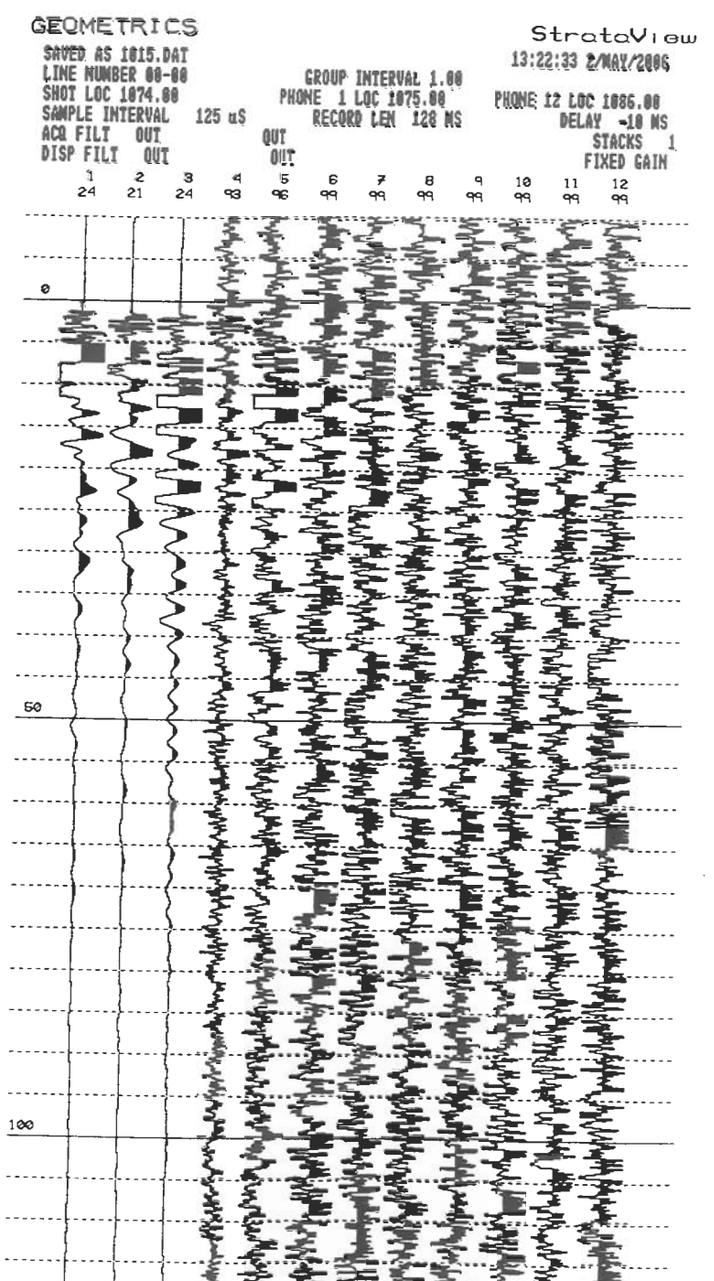
S-1
23'



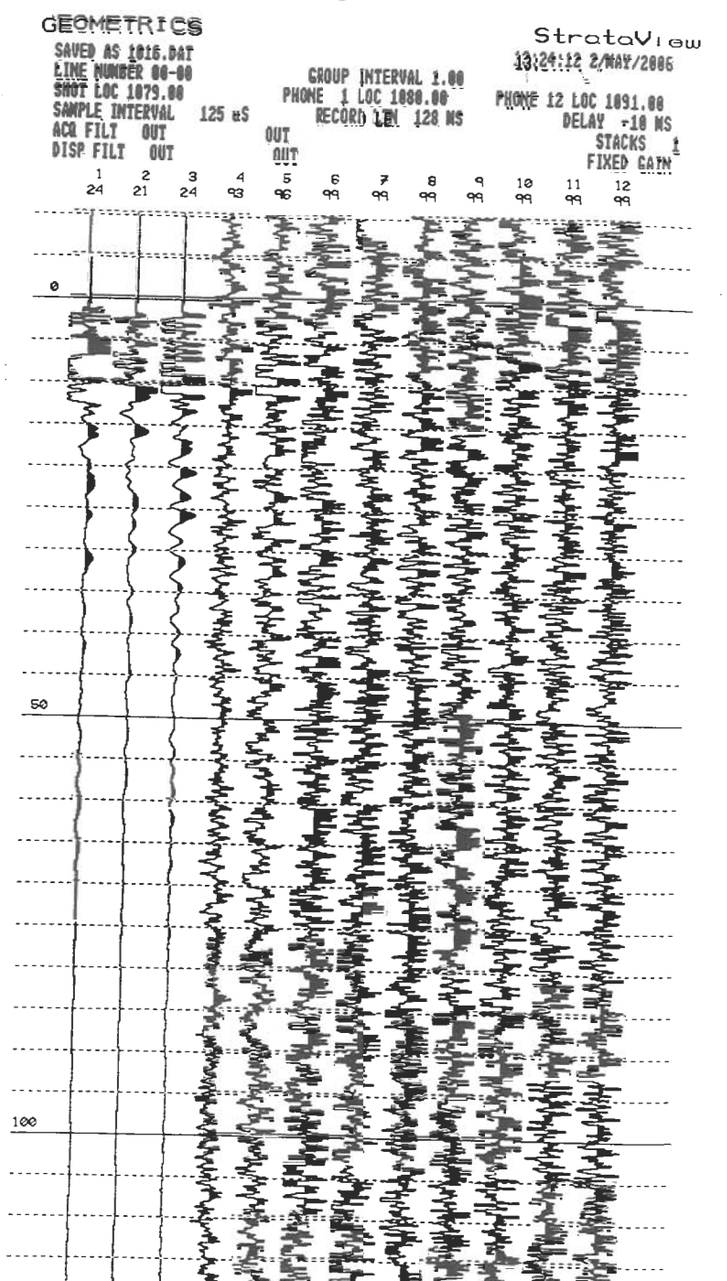
S-1
26'



S-1
27'



S-1
28'



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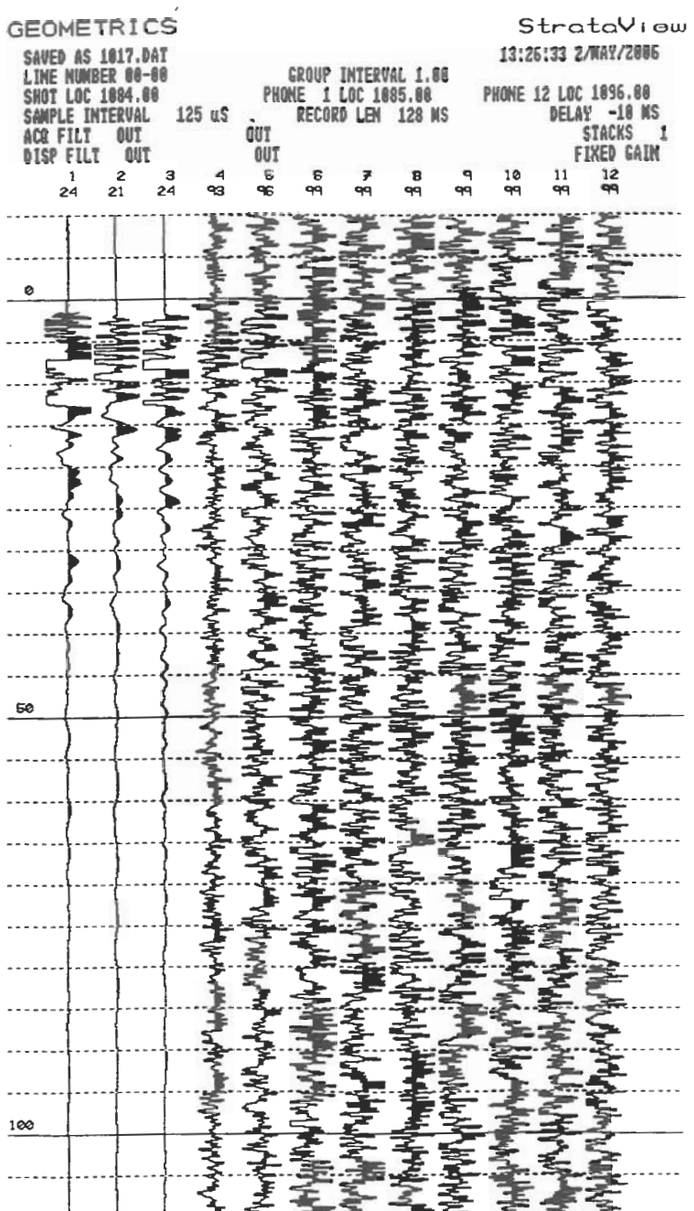
29'



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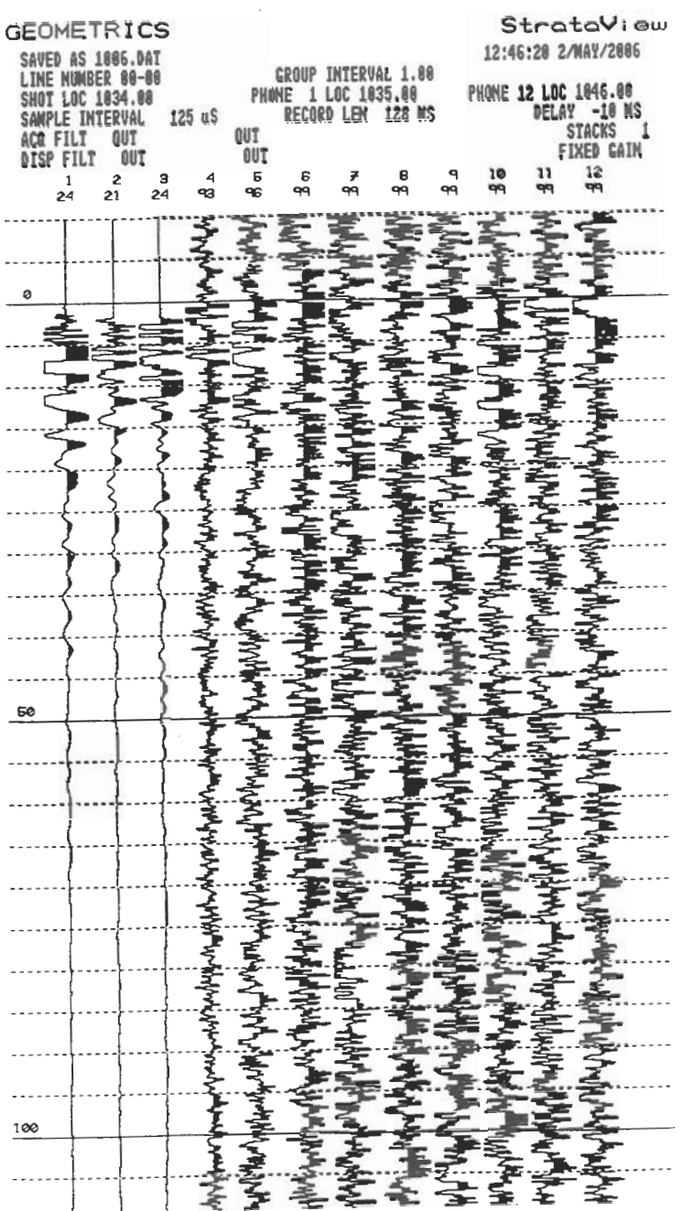
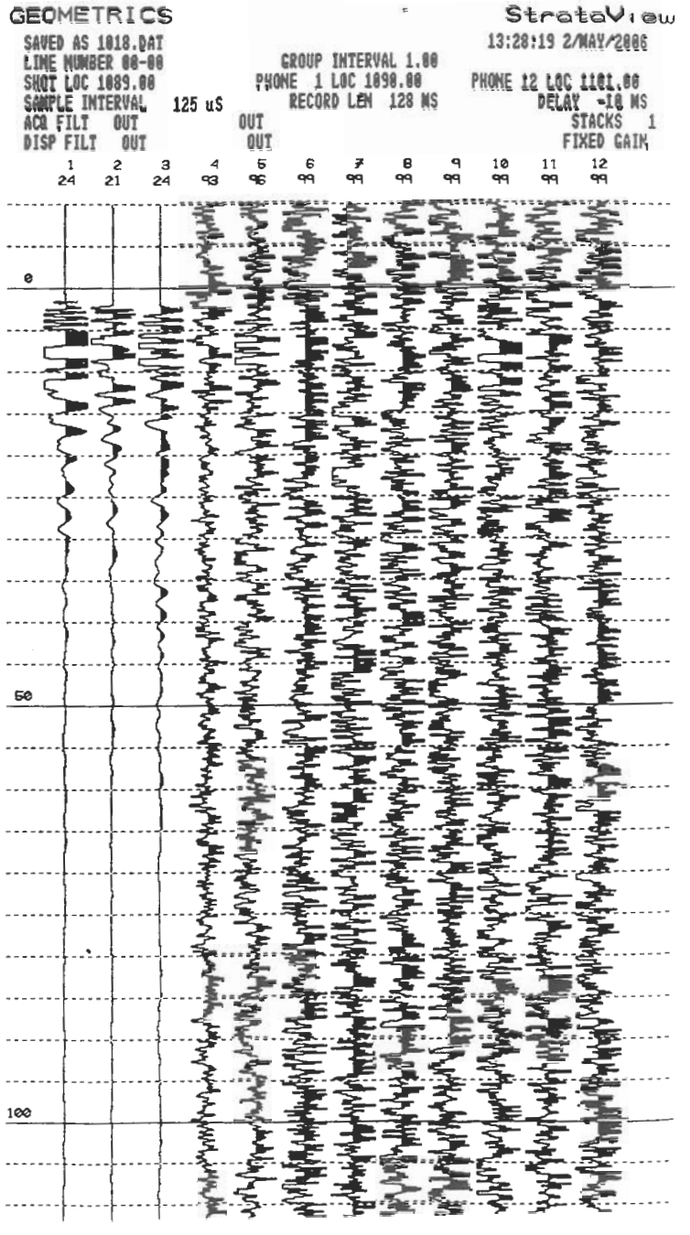
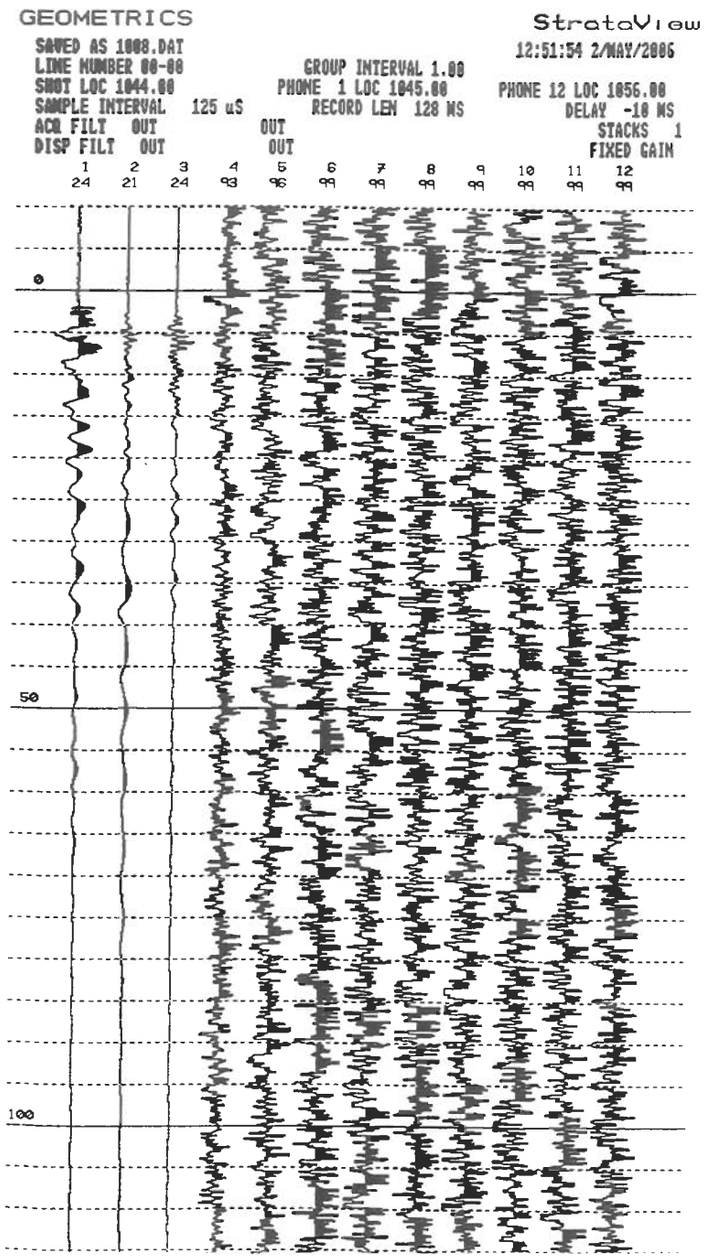


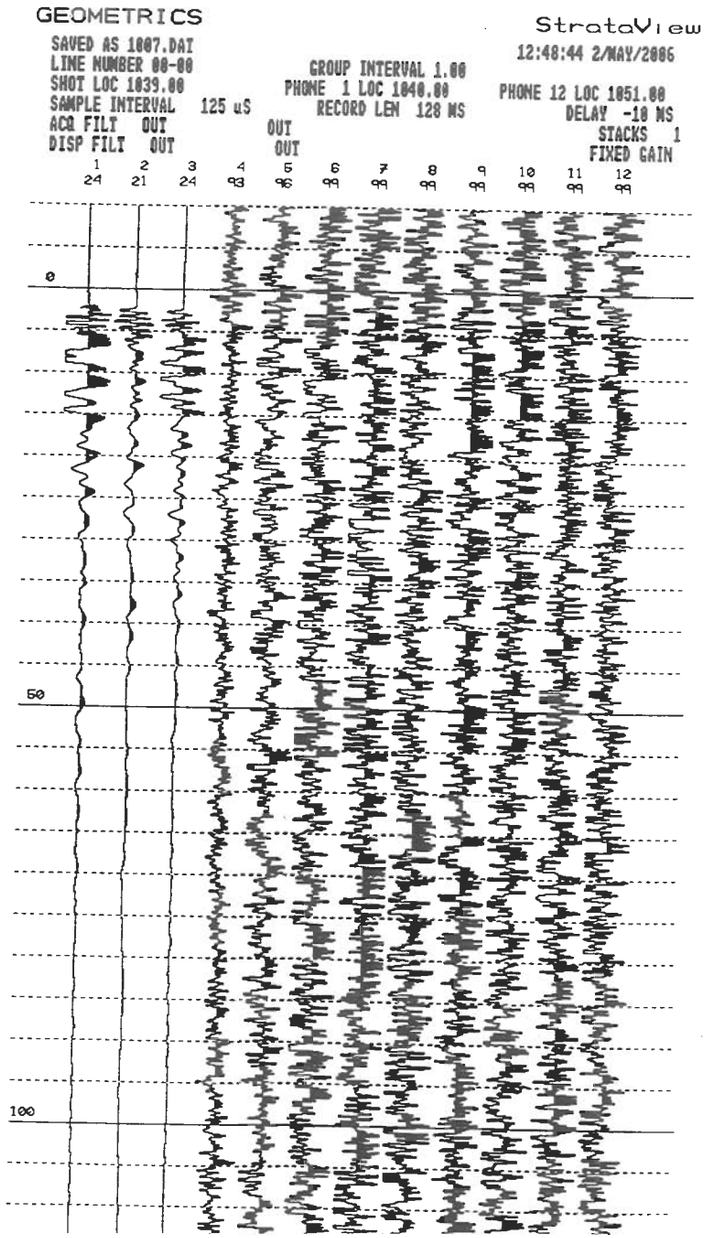
S-1
31'



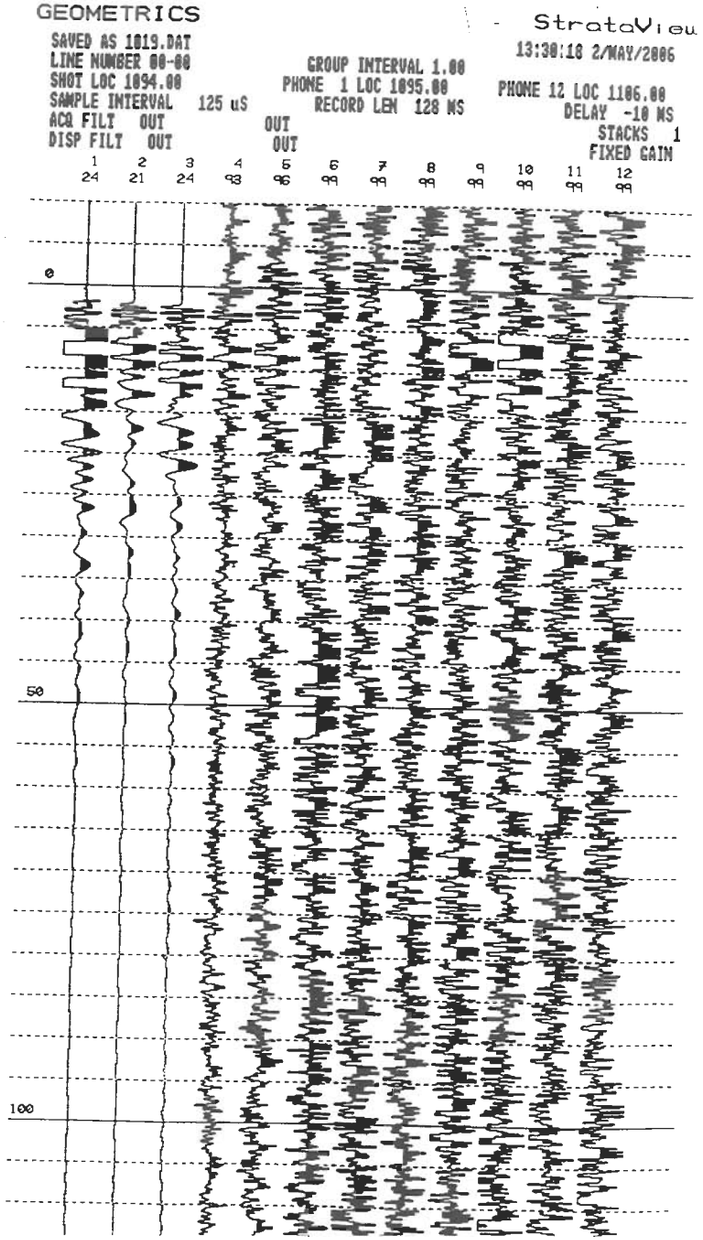
S-1
38'



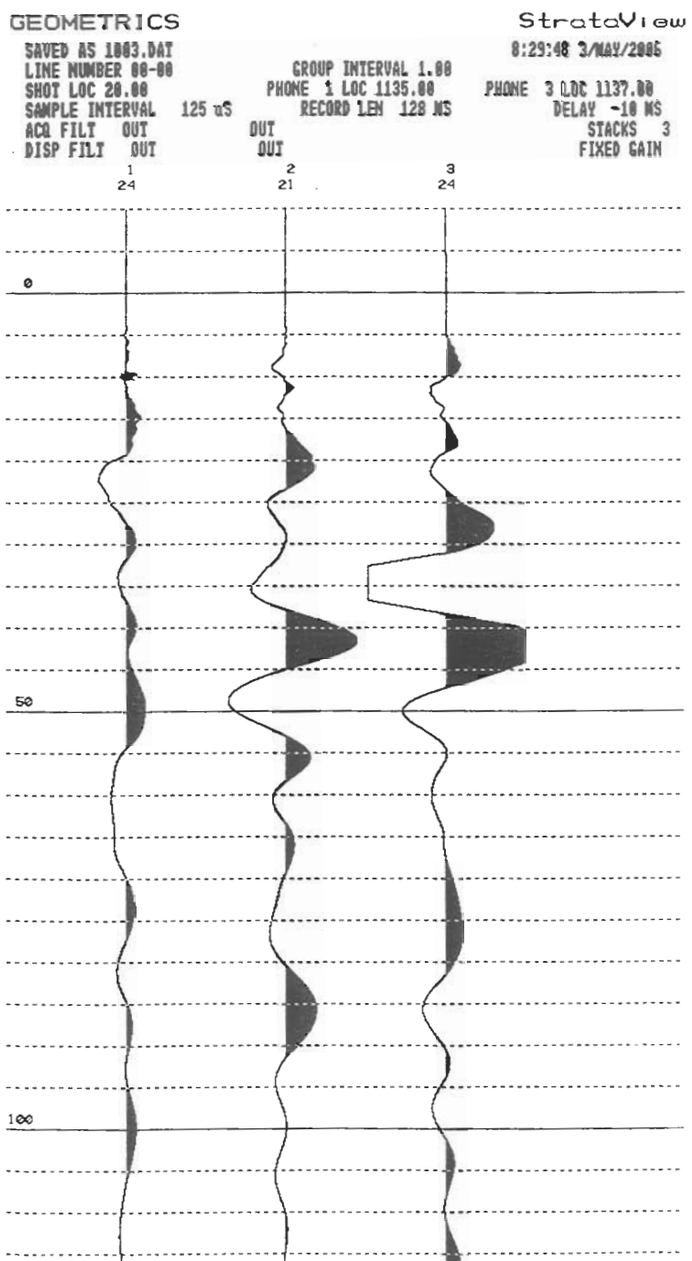
S-1
35'



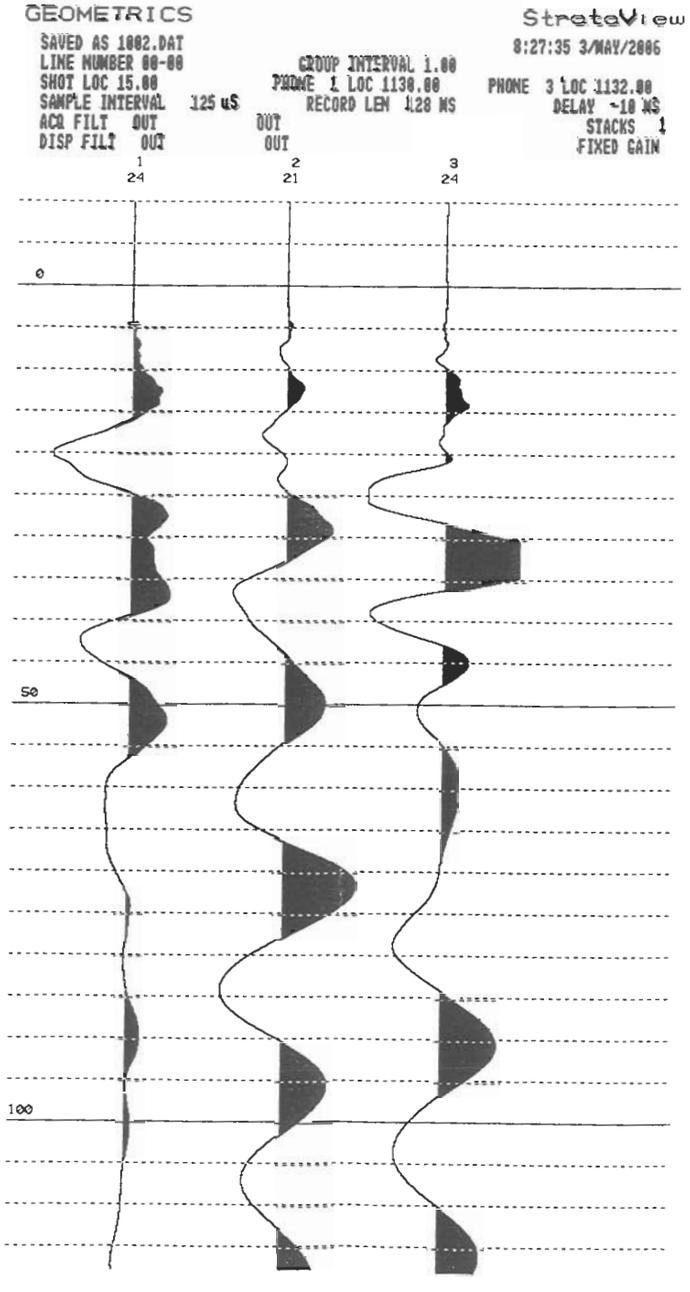
S-1
32



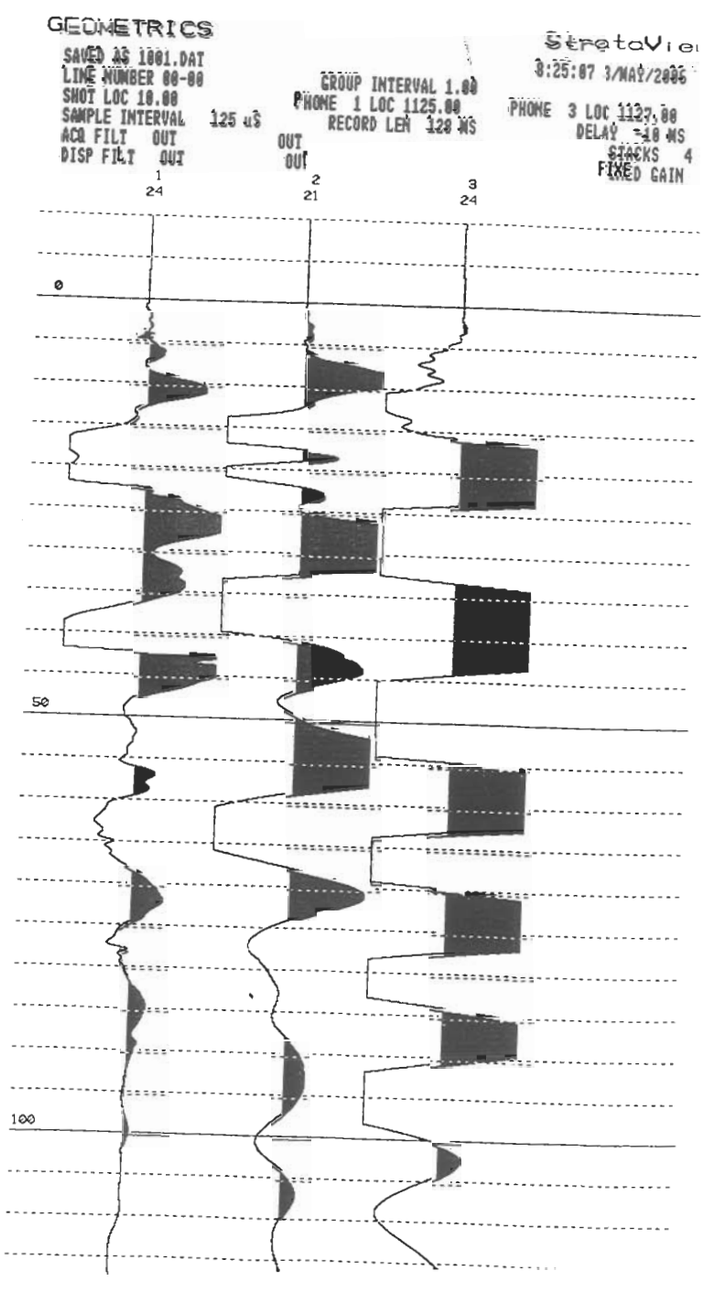
S-3
15'



S-3
10'



S-3
5'



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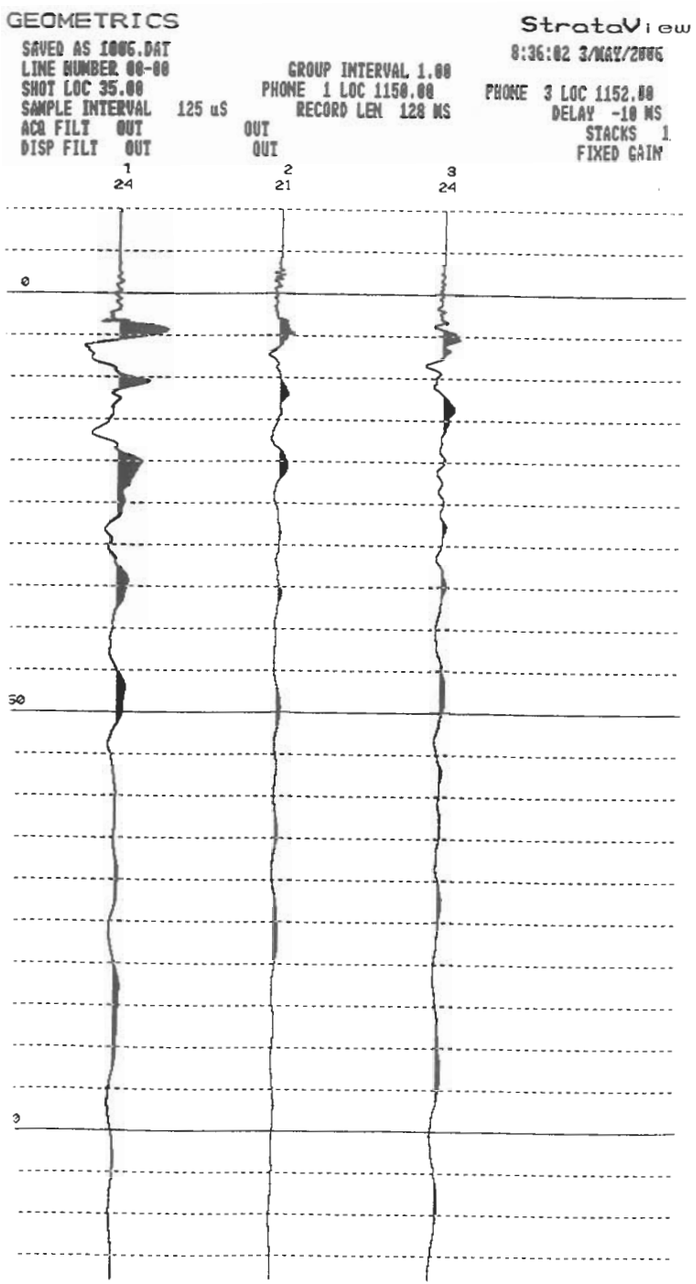

S-3
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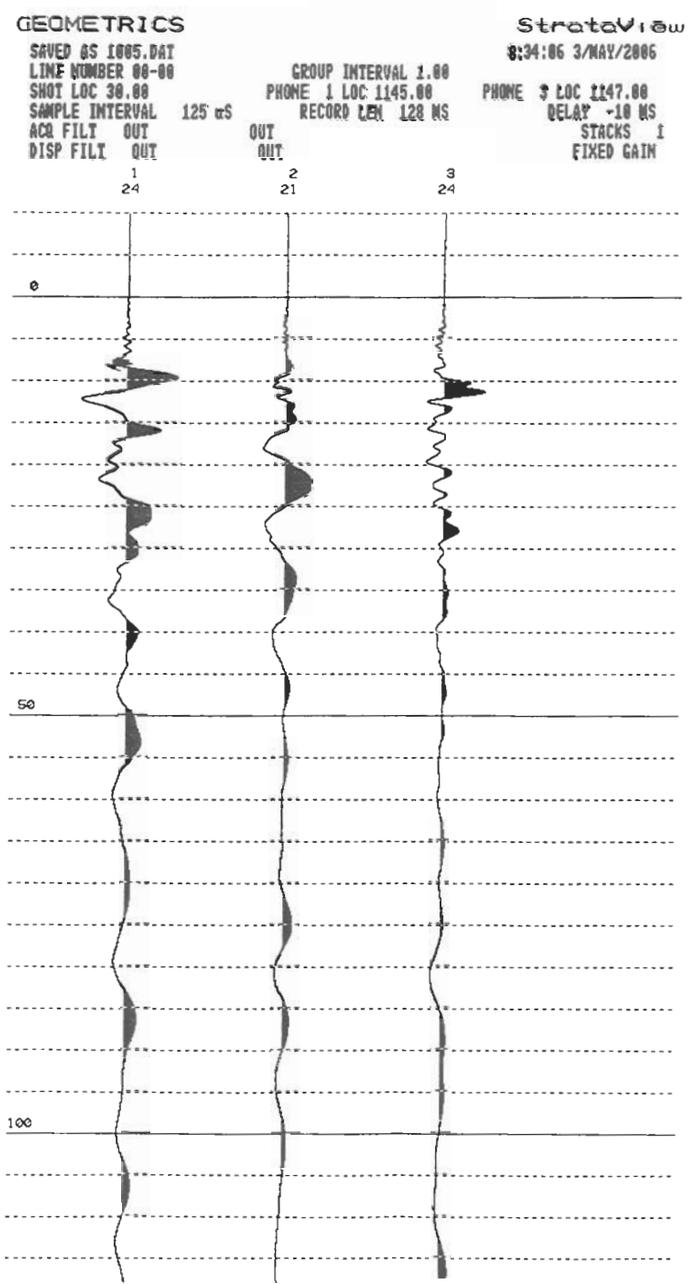

S-3
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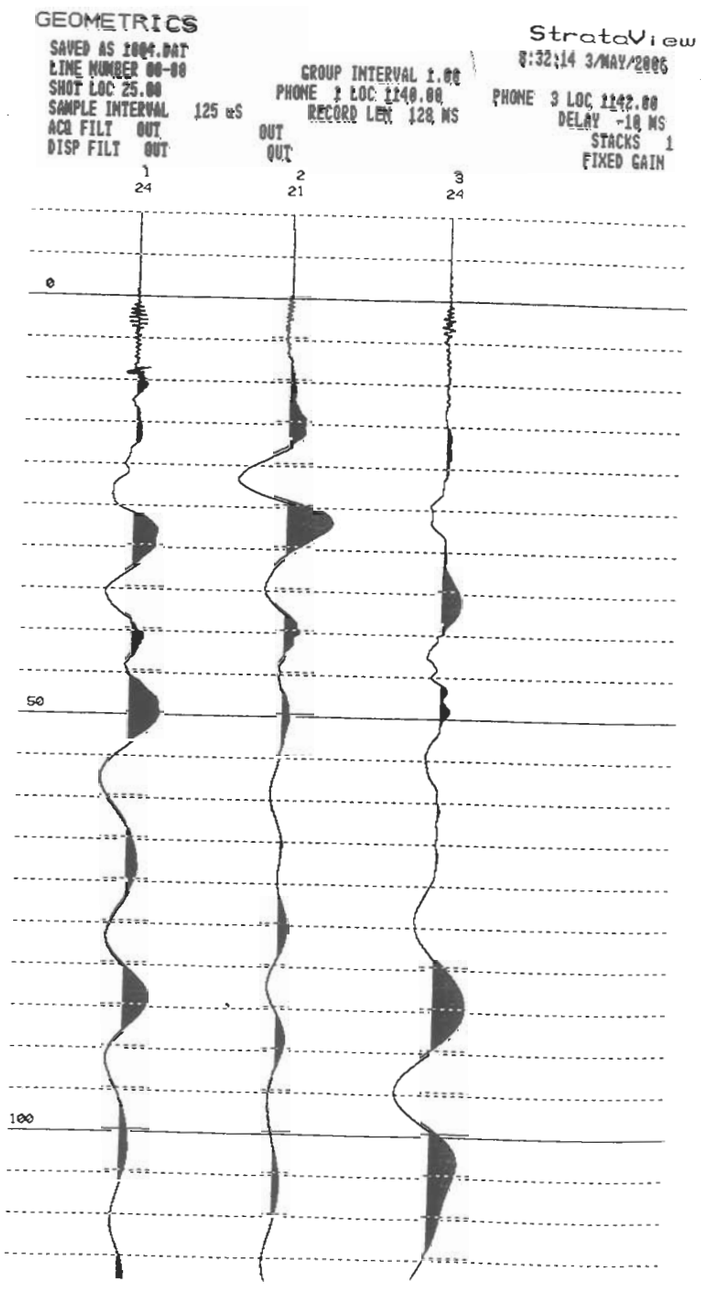

S-3
45'

GEOMETRICS StrataView

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DISP FILT OUT

GROUP INTERVAL 1.00
PHONE 1 LOC 1165.00
RECORD LEN 128 MS
OUT
OUT

8:40:38 3/MAY/2006
PHONE 3 LOC 1167.00
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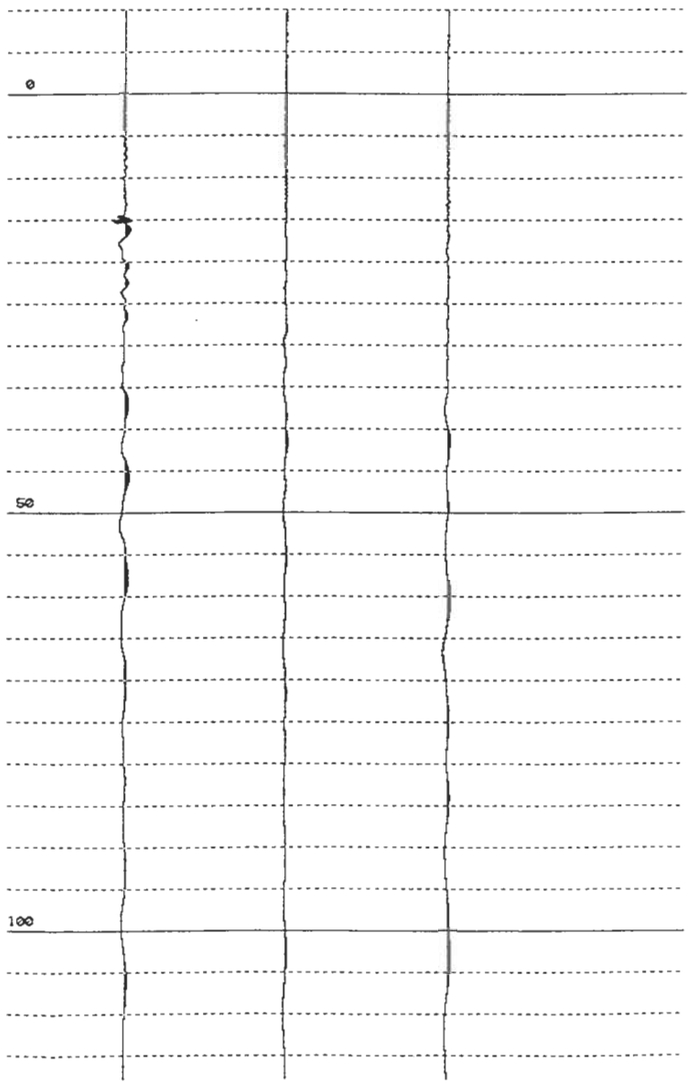
STACKS 1
FIXED GAIN

1 2 3
24 21 24



S-3
40'

GEOMETRICS StrataView

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DISP FILT OUT

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RECORD LEN 128 MS
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OUT

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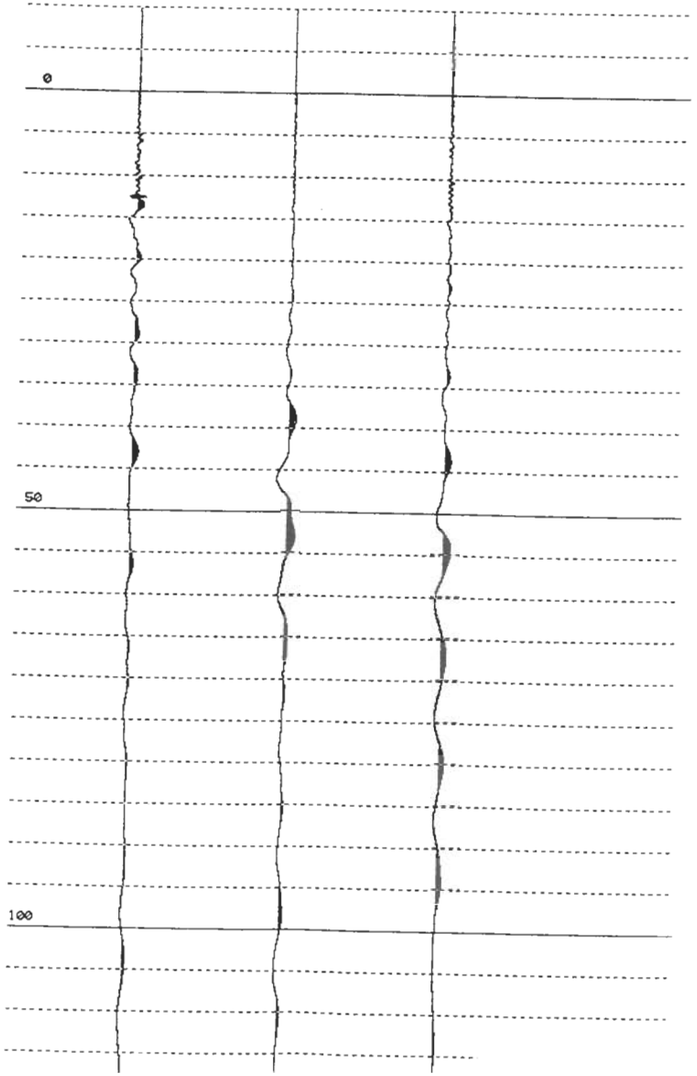
DELAY -10 MS
STACKS 1
FIXED GAIN

1 2 3
24 21 24



S-3
35'

GEOMETRICS StrataView

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DISP FILT OUT

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OUT
OUT

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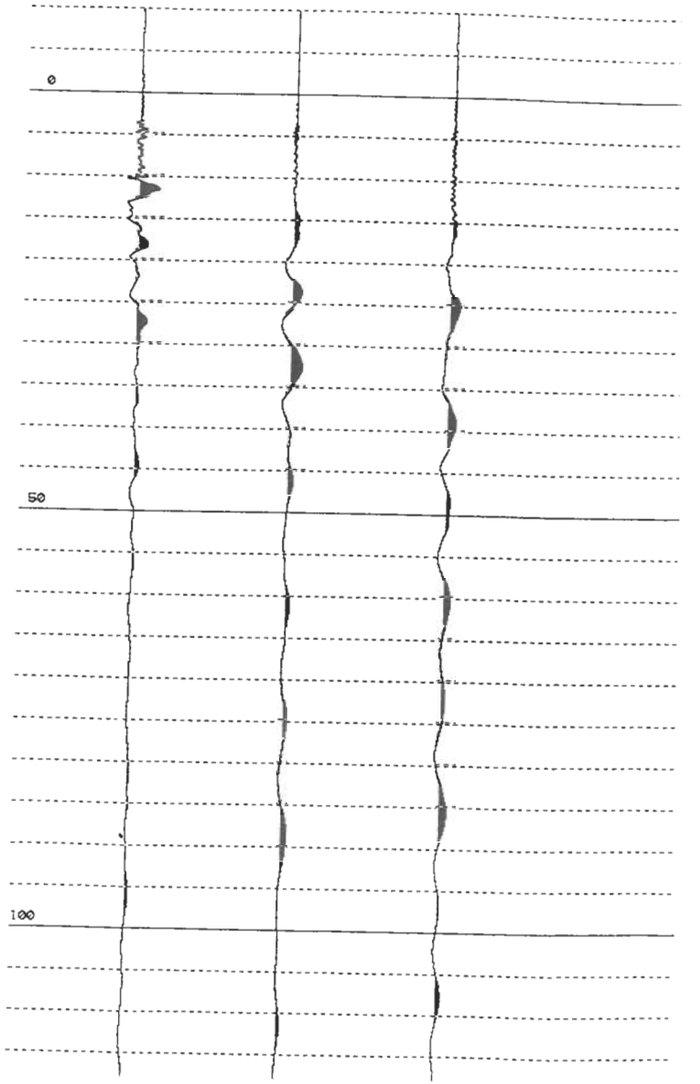
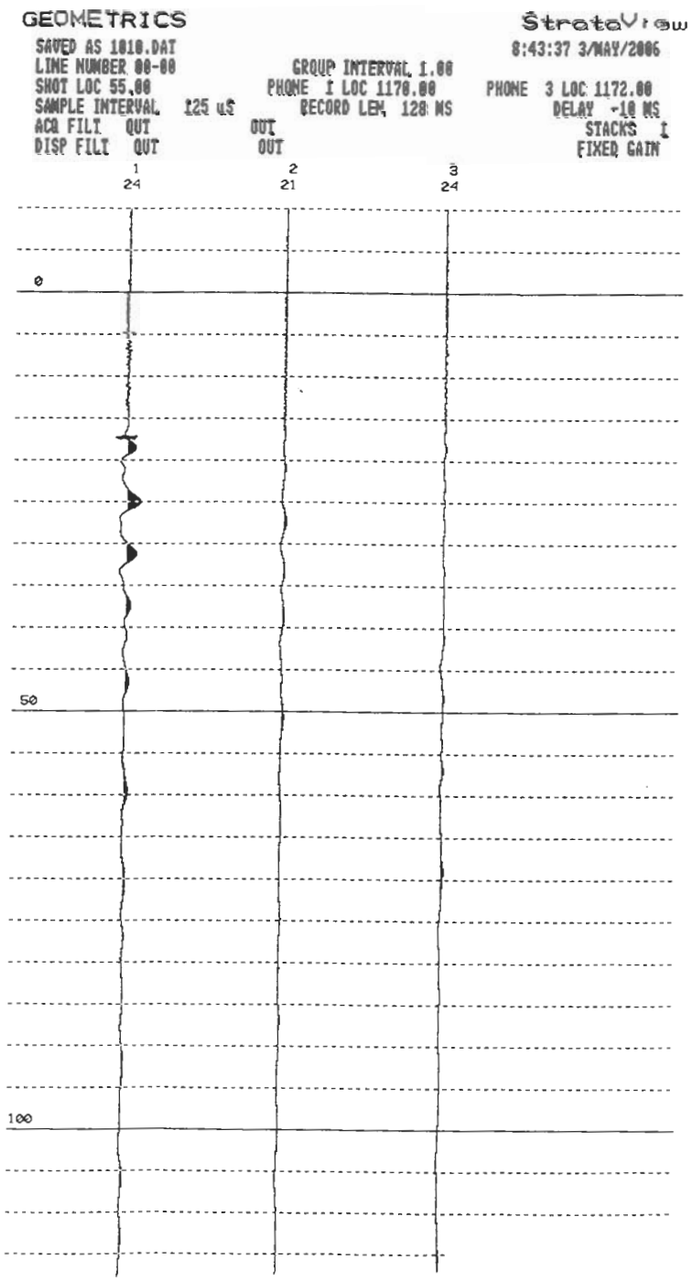
DELAY -10 MS
STACKS 1
FIXED GAIN

1 2 3
24 21 24



S-3
49'


GEOMETRICS
StrataView
SAVED AS 1818.DAT
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SHOT LOC 55.00
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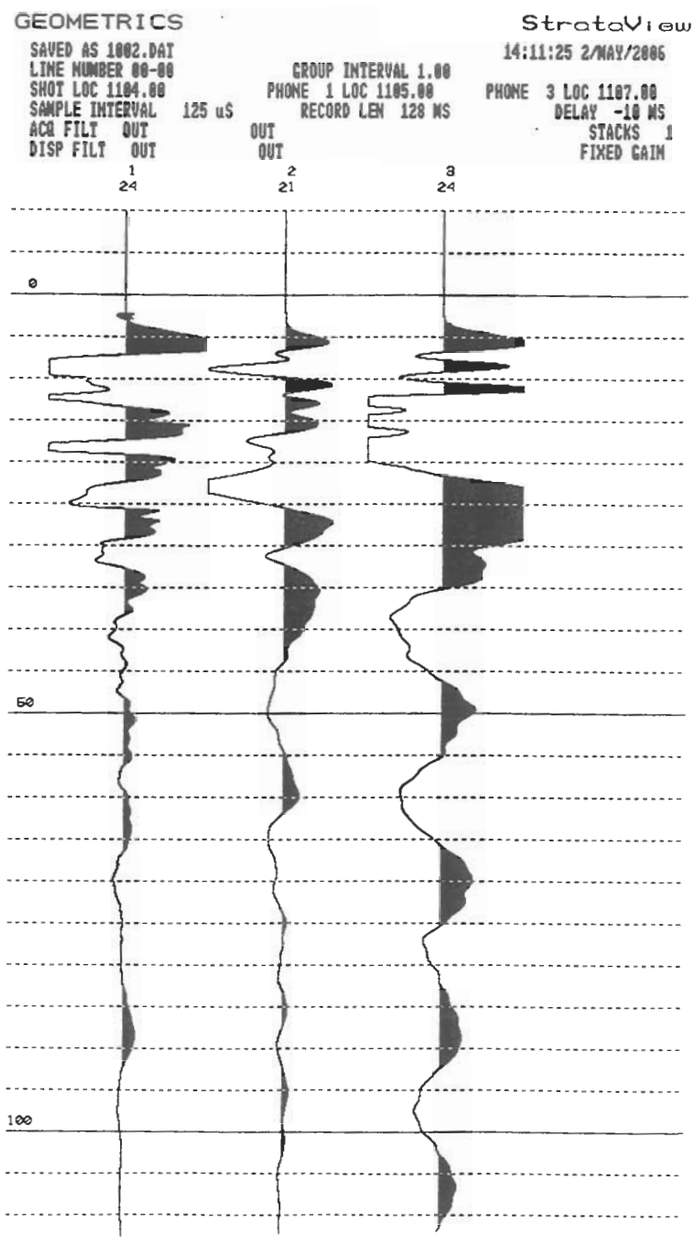
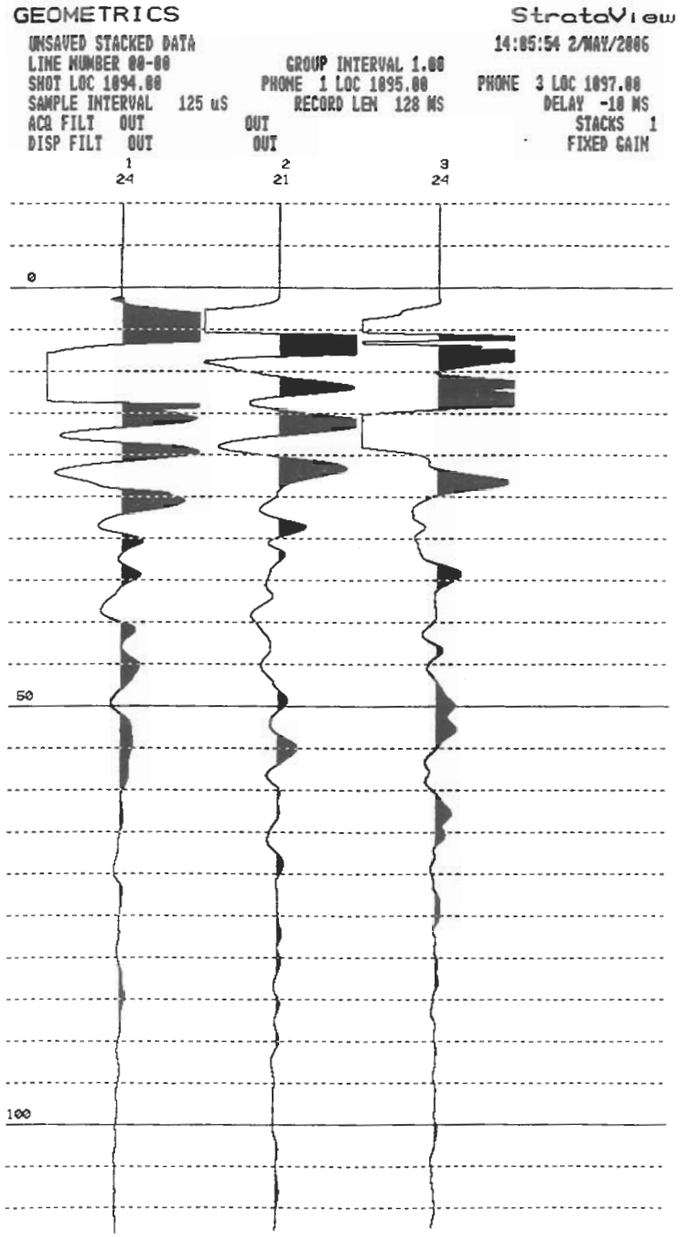
PHONE 3 LOC 1172.00
SAMPLE INTERVAL 125 uS
RECORD LEN 128 MS
DELAY -10 MS
ACQ FILT OUT
OUT
STACKS 1
DISP FILT OUT
OUT
FIXED GAIN
1
24
2
21
3
24
0
50
100

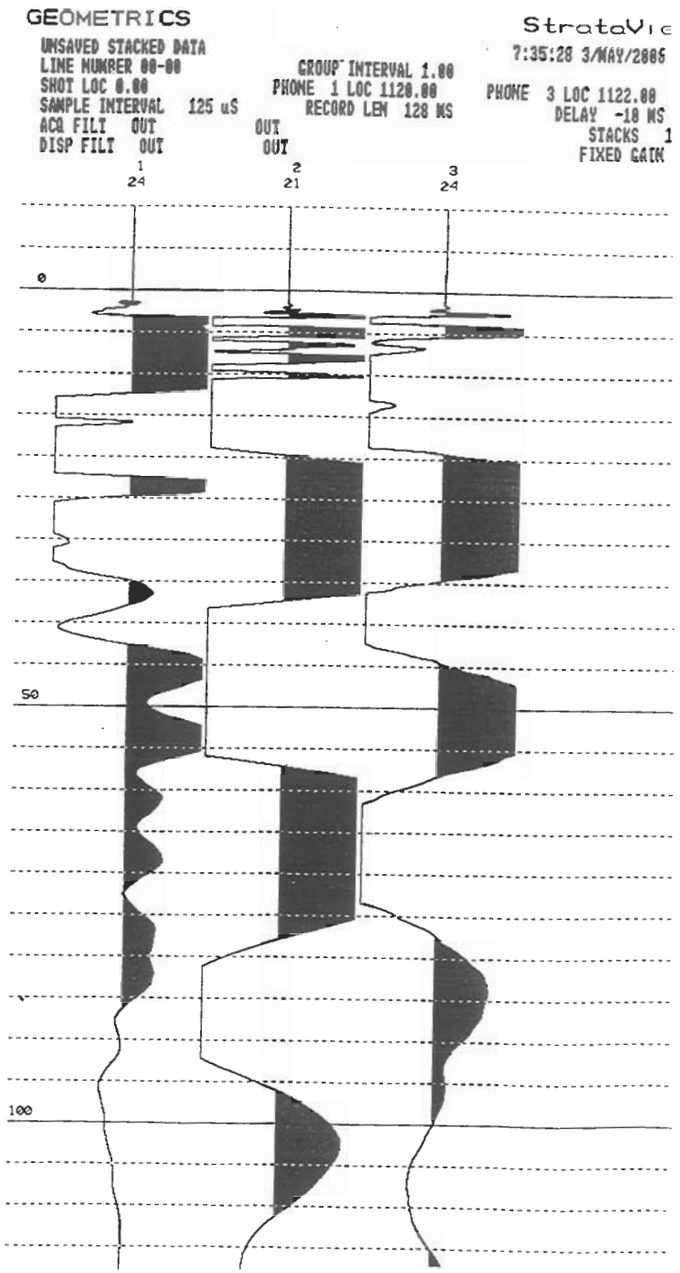
S-5
10'



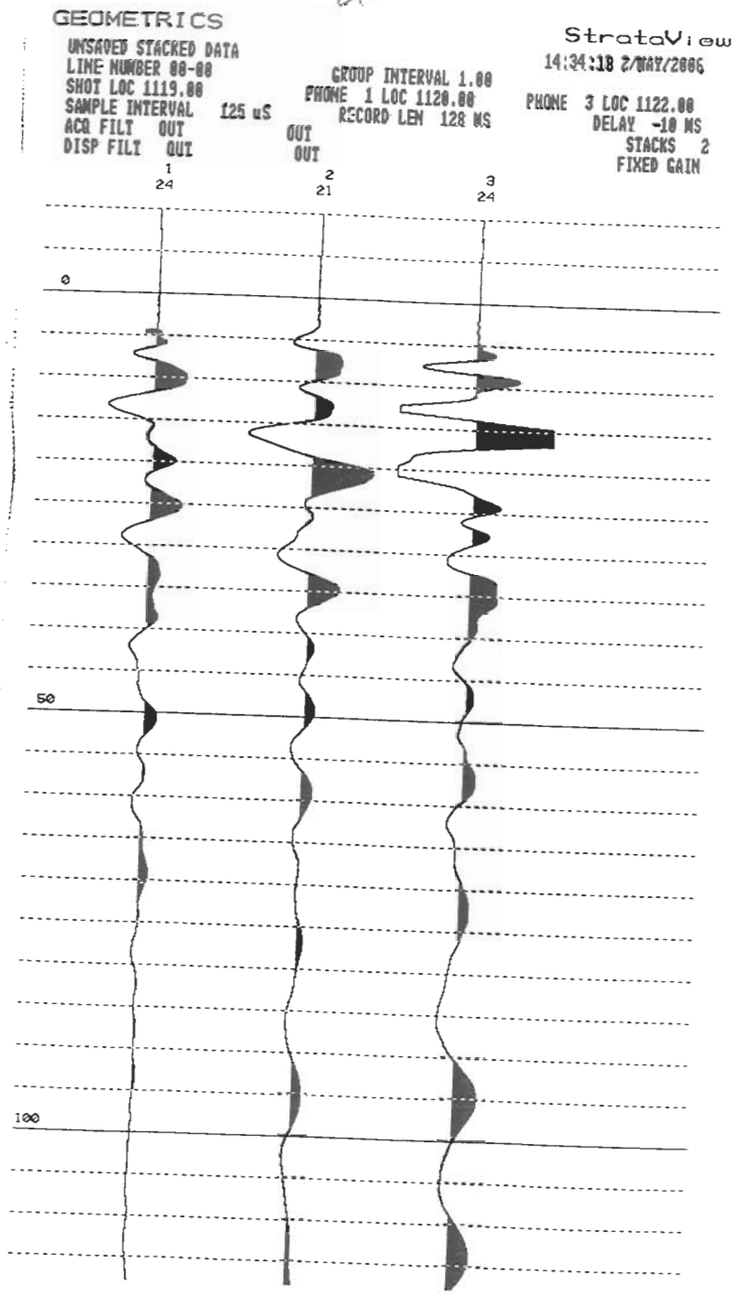
S-5
5'



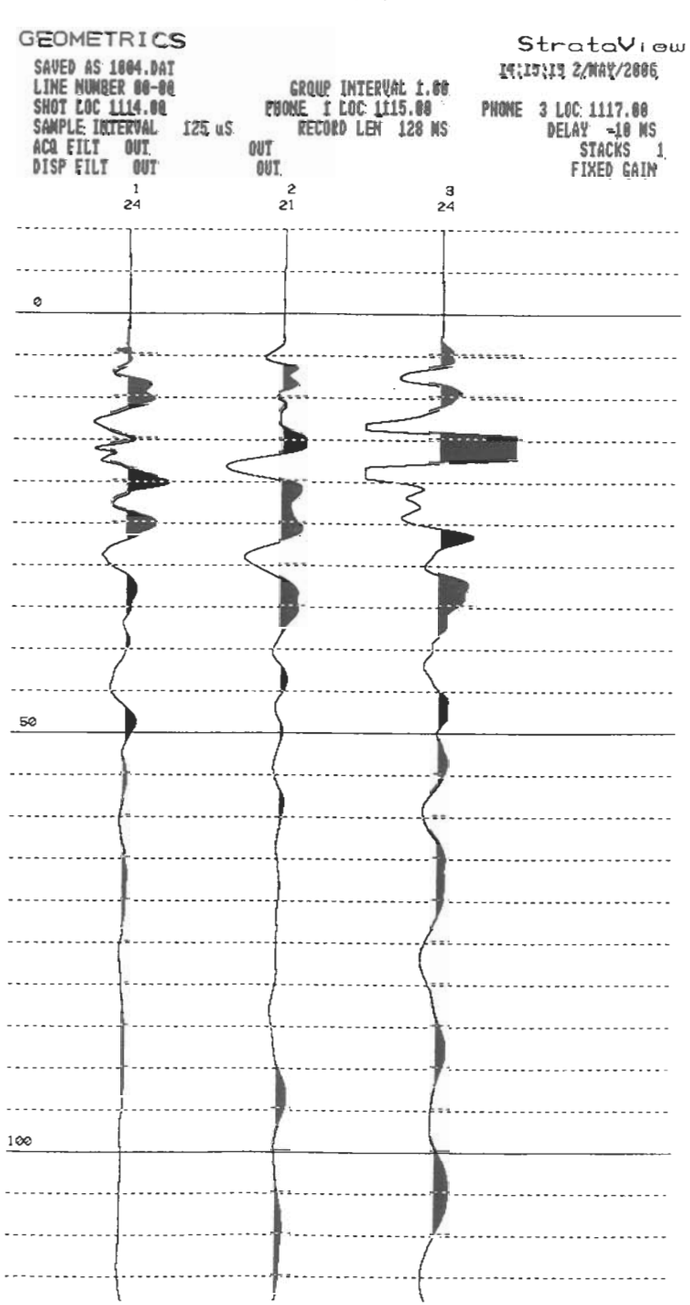
S-5
0.0'



S-5
21'



S-5
20'



S-5
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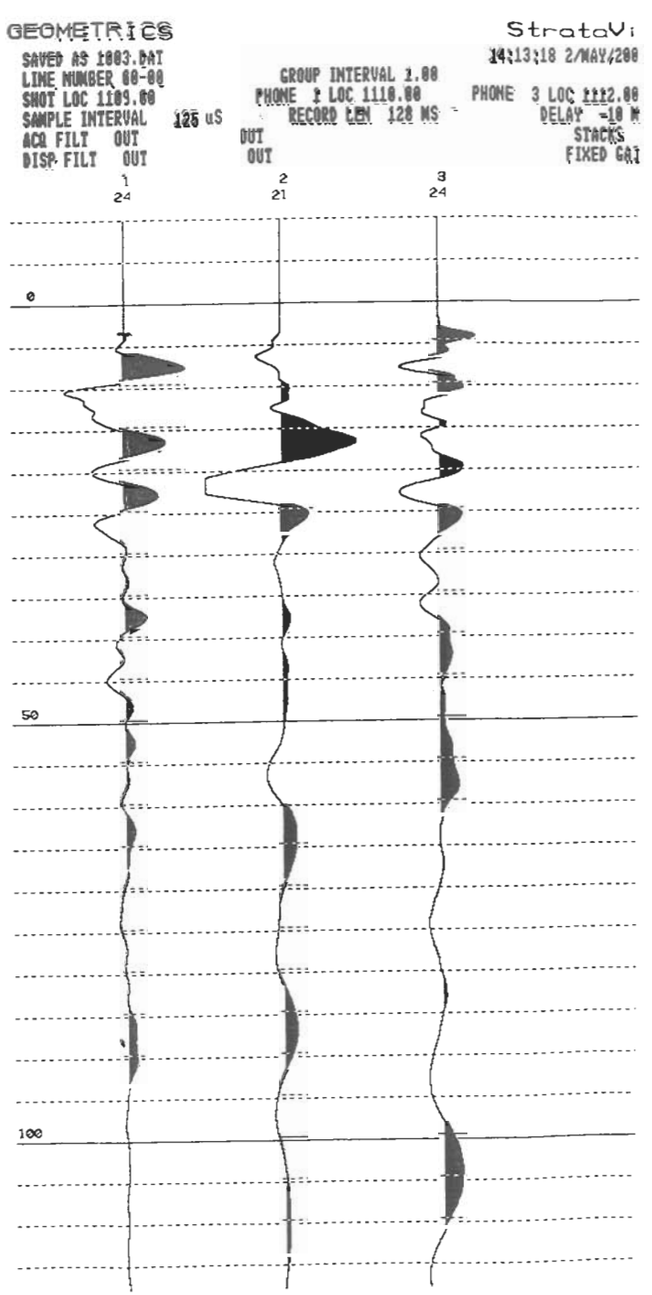

S-5
27'

GEOMETRICS StrataView

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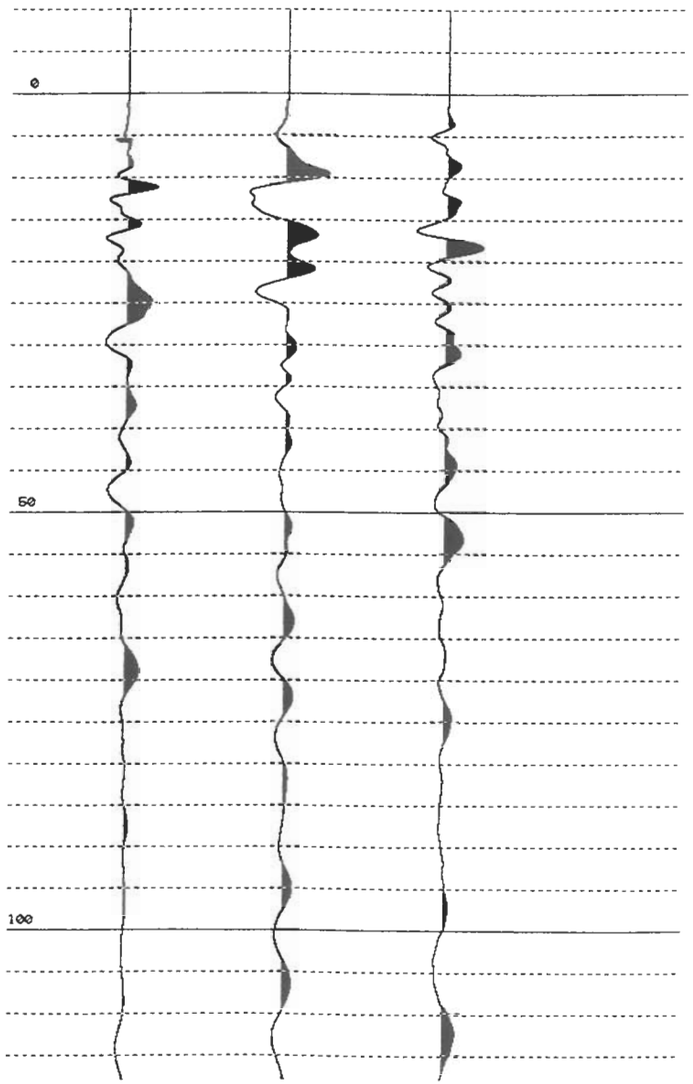
DISP FILT OUT

GROUP INTERVAL 1.00
PHONE 1 LOC 1120.00
RECORD LEN 128 MS
OUT
OUT

14:42:33 2/MAY/2006
PHONE 3 LOC 1122.00
DELAY -10 MS
STACKS 1
FIXED GAIN

1 2 3
24 21 24



S-5
26'

GEOMETRICS StrataView

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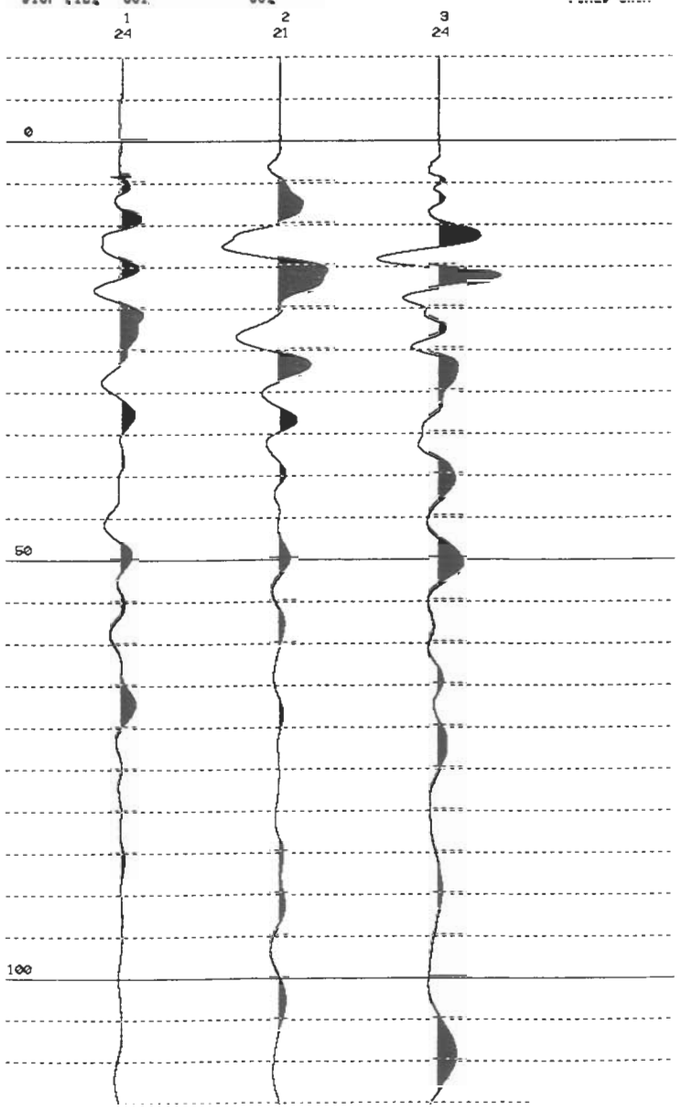
SAMPLE INTERVAL 125 uS
ACQ FILT OUT
DISP FILT OUT

GROUP INTERVAL 1.00
PHONE 1 LOC 1120.00
RECORD LEN 128 MS
OUT
OUT

14:40:49 2/MAY/2006
PHONE 3 LOC 1122.00
DELAY -10 MS
STACKS 1
FIXED GAIN

1 2 3
24 21 24



S-5
25'

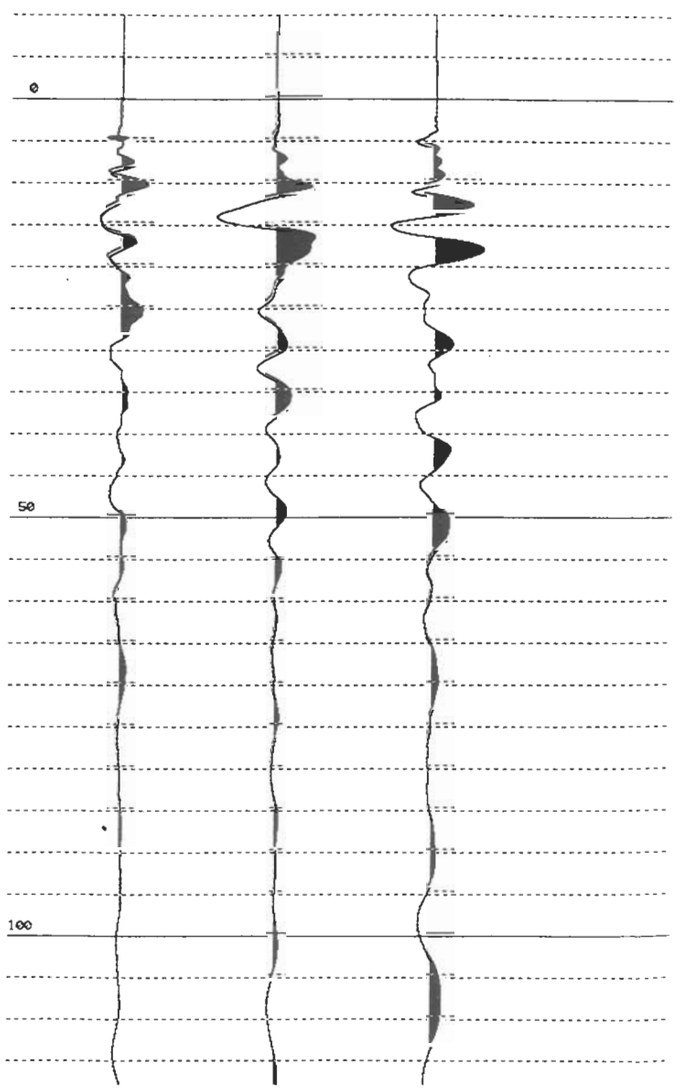
GEOMETRICS StrataView

SAVED AS 1005.DAT
LINE NUMBER 00-00
SHOT LOC 1119.00
SAMPLE INTERVAL 125 uS
ACQ FILT OUT
DISP FILT OUT

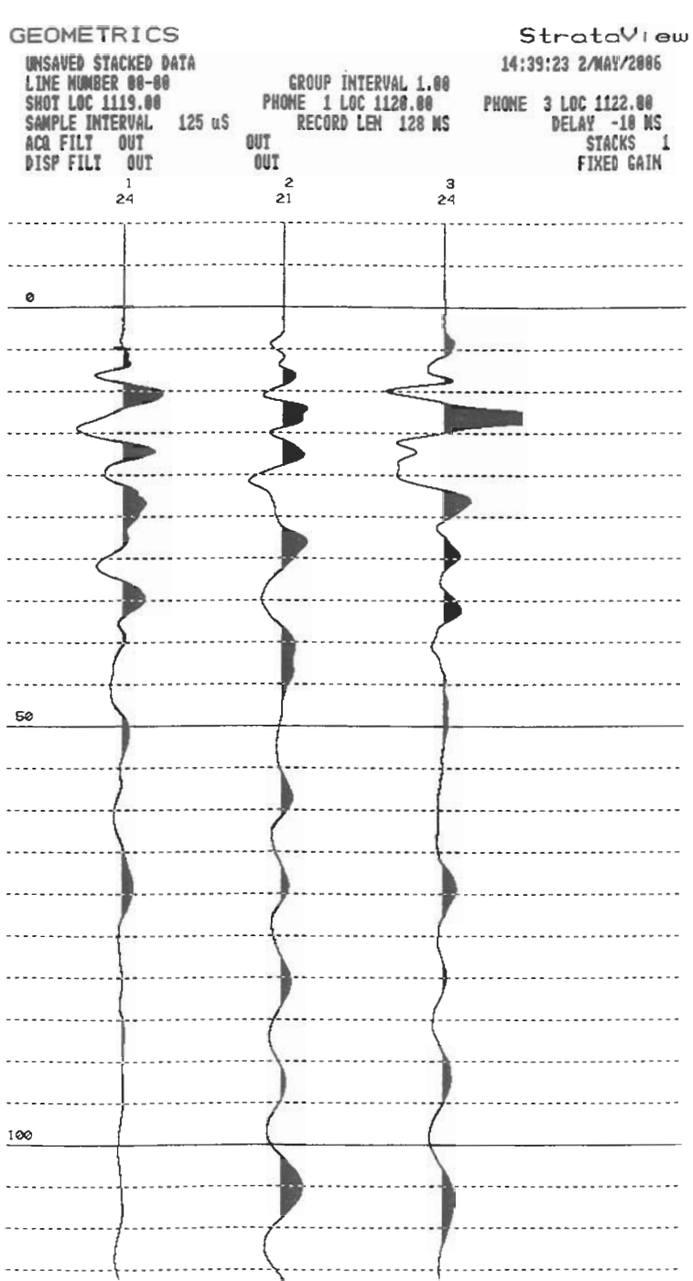
GROUP INTERVAL 1.00
PHONE 1 LOC 1120.00
RECORD LEN 128 MS
OUT
OUT

14:16:50 2/MAY/2006
PHONE 3 LOC 1122.00
DELAY -10 MS
STACKS 1
FIXED GAIN

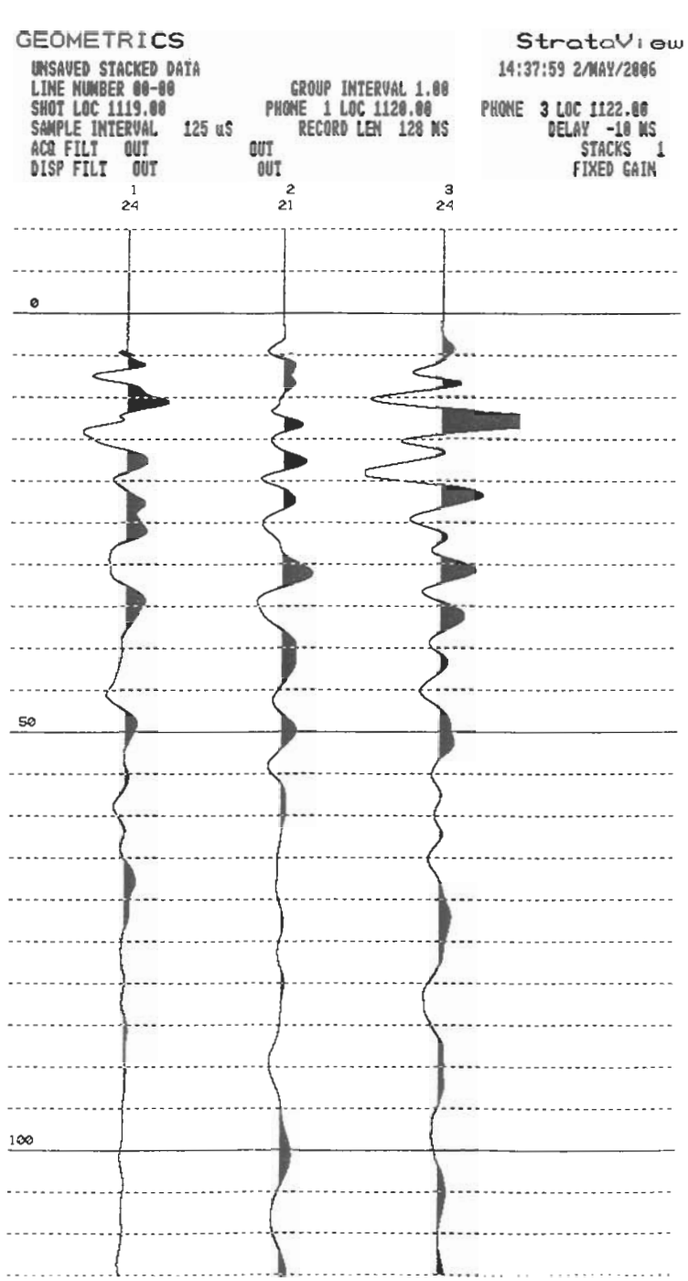
1 2 3
24 21 24



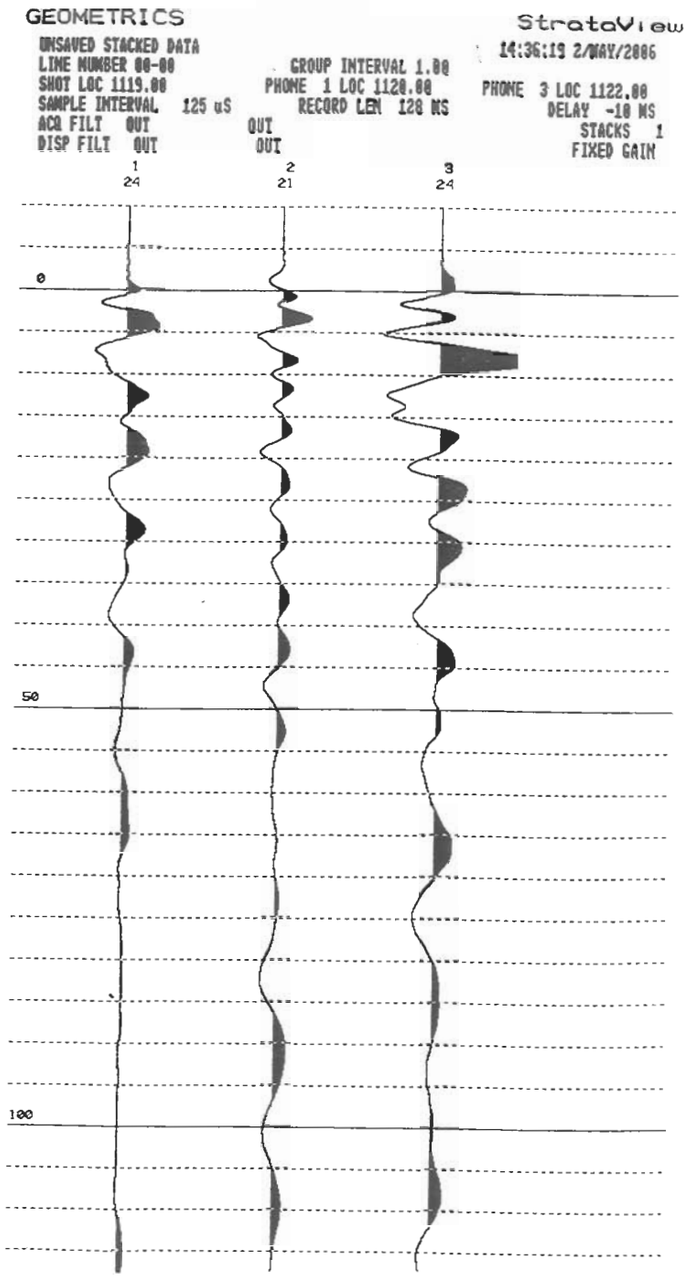
S-5
24'



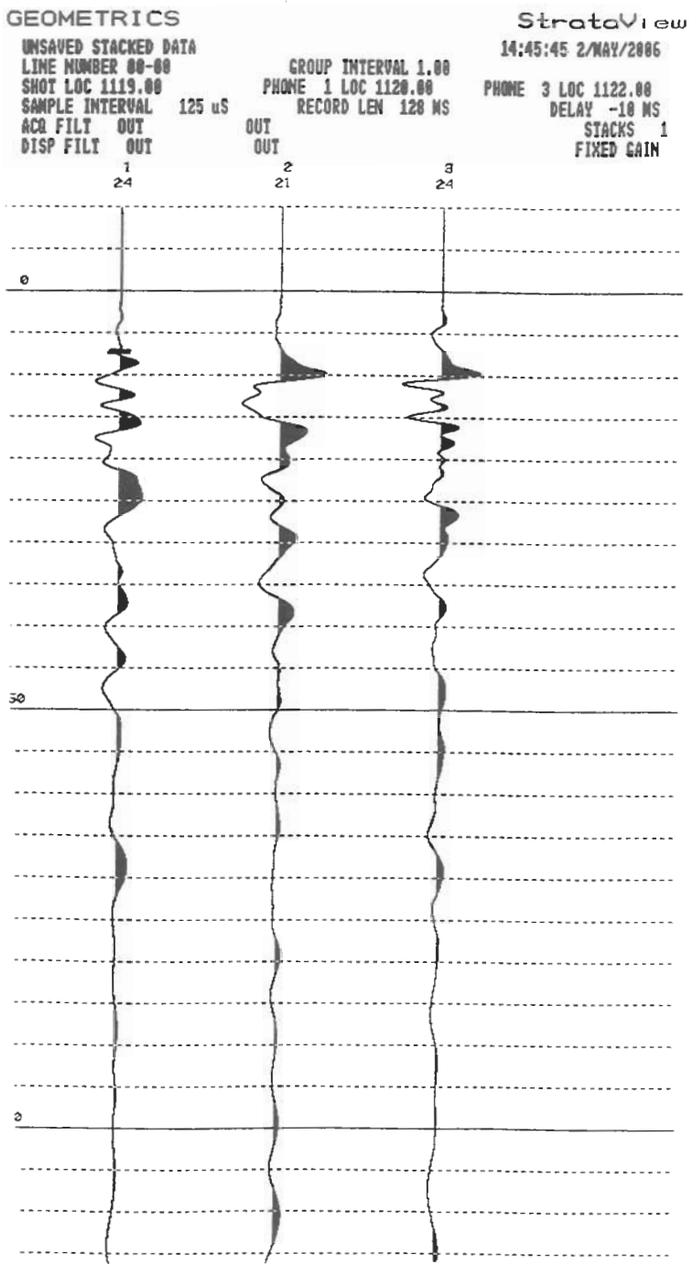
S-5
23'



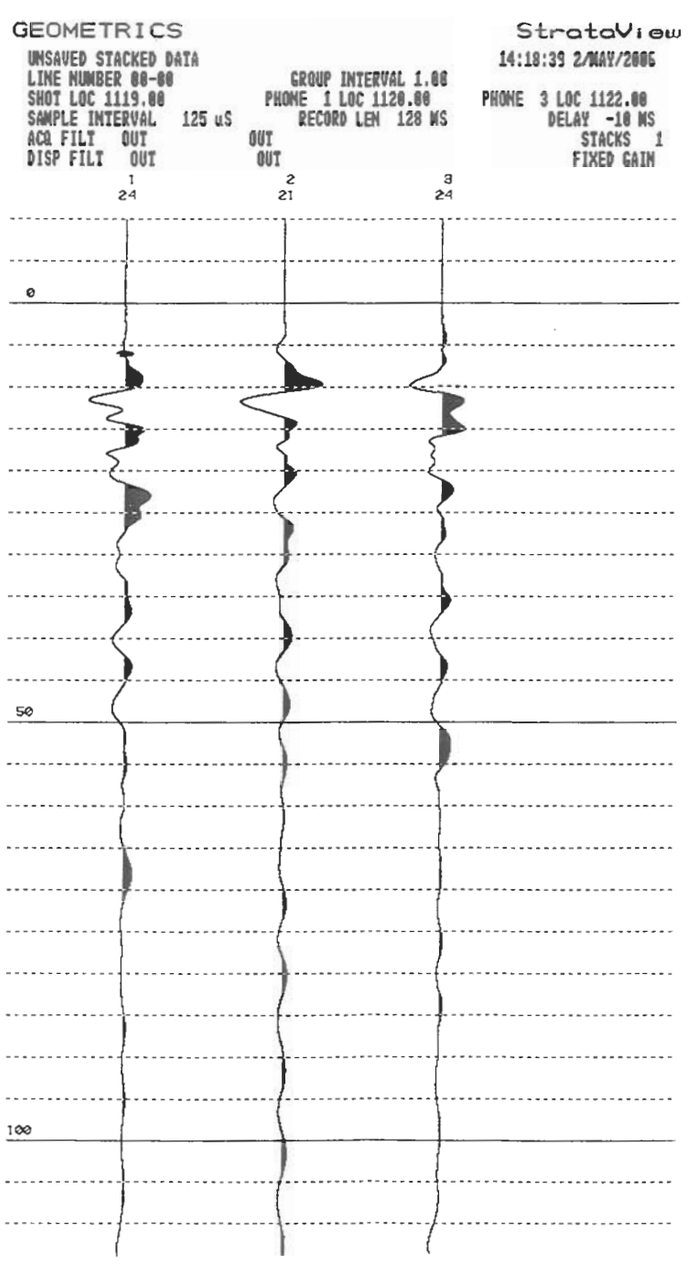
S-5
22



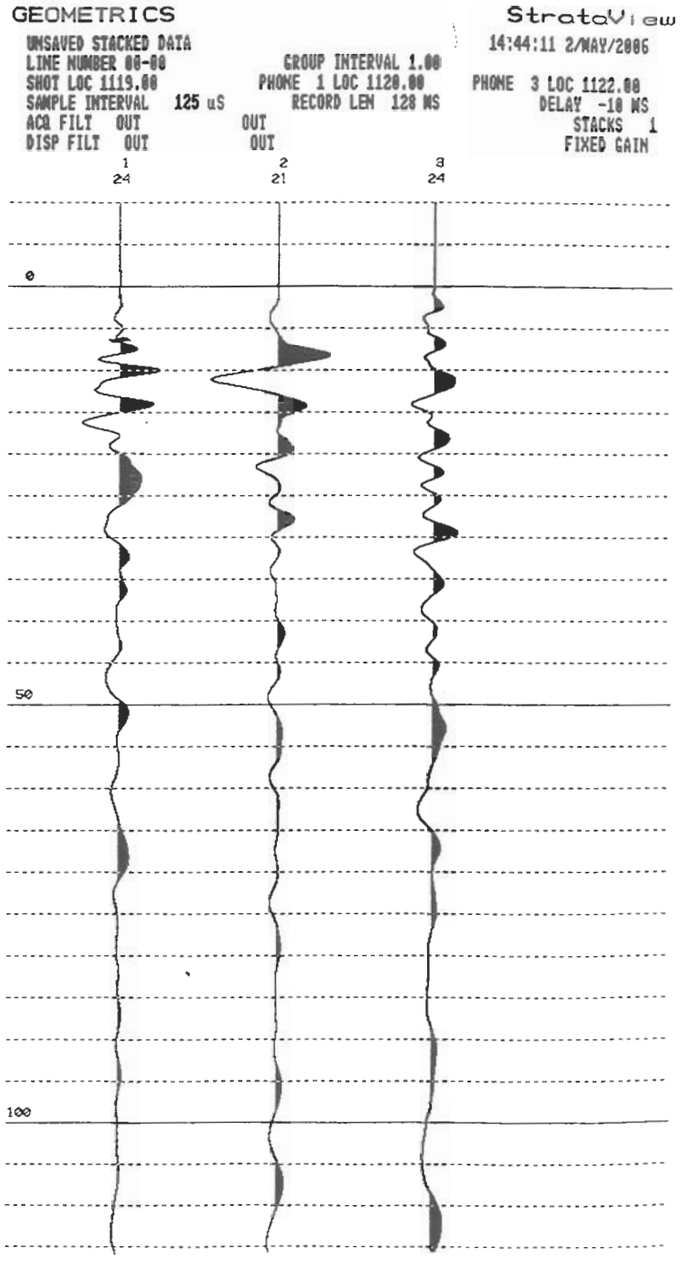
S-5
31'



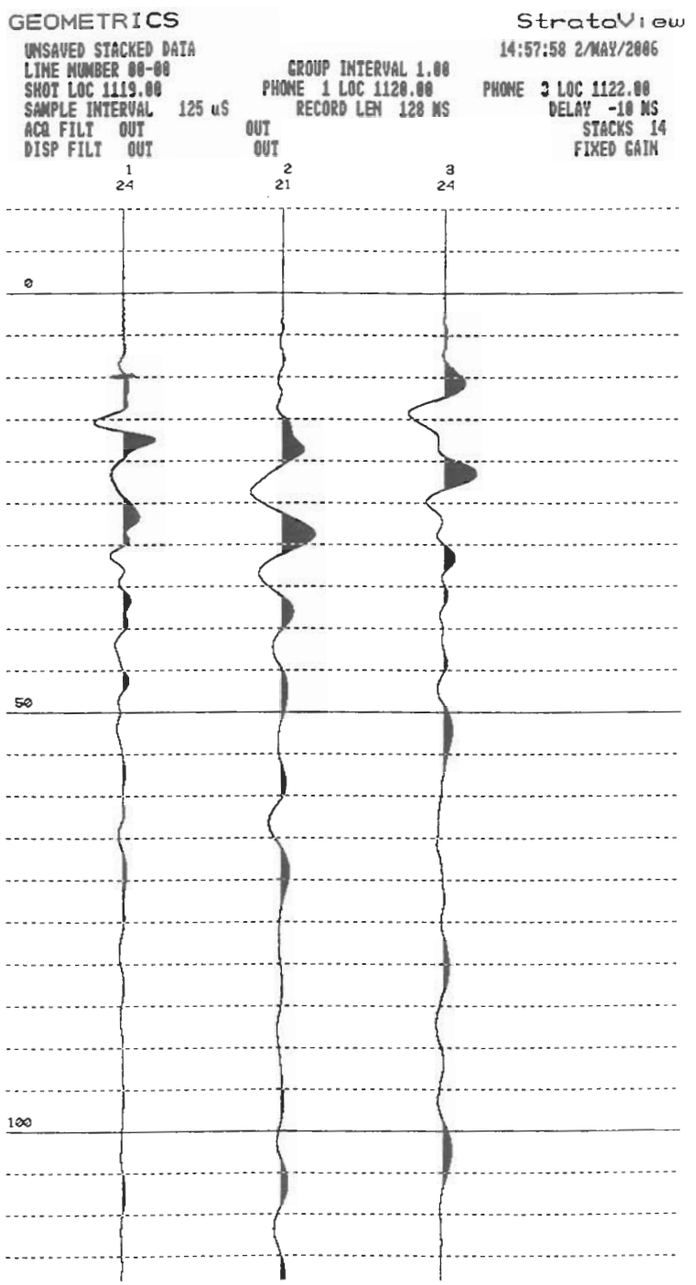
S-5
30'



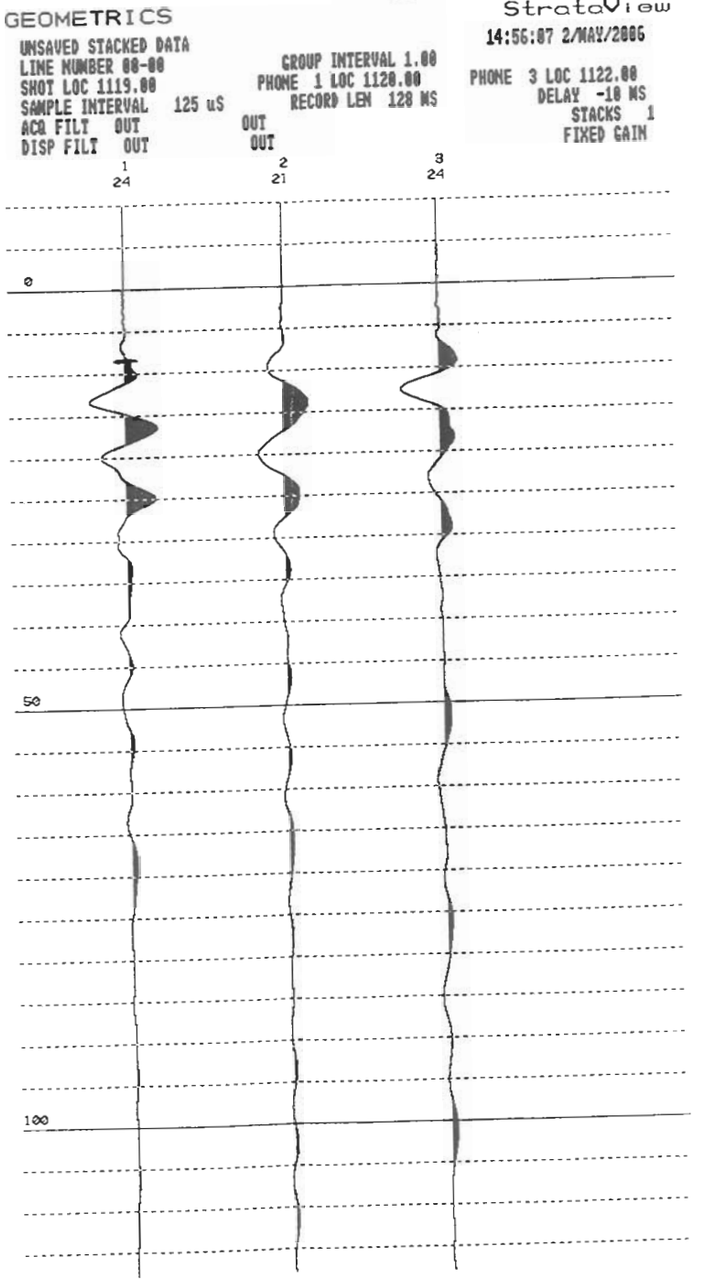
S-5
28'



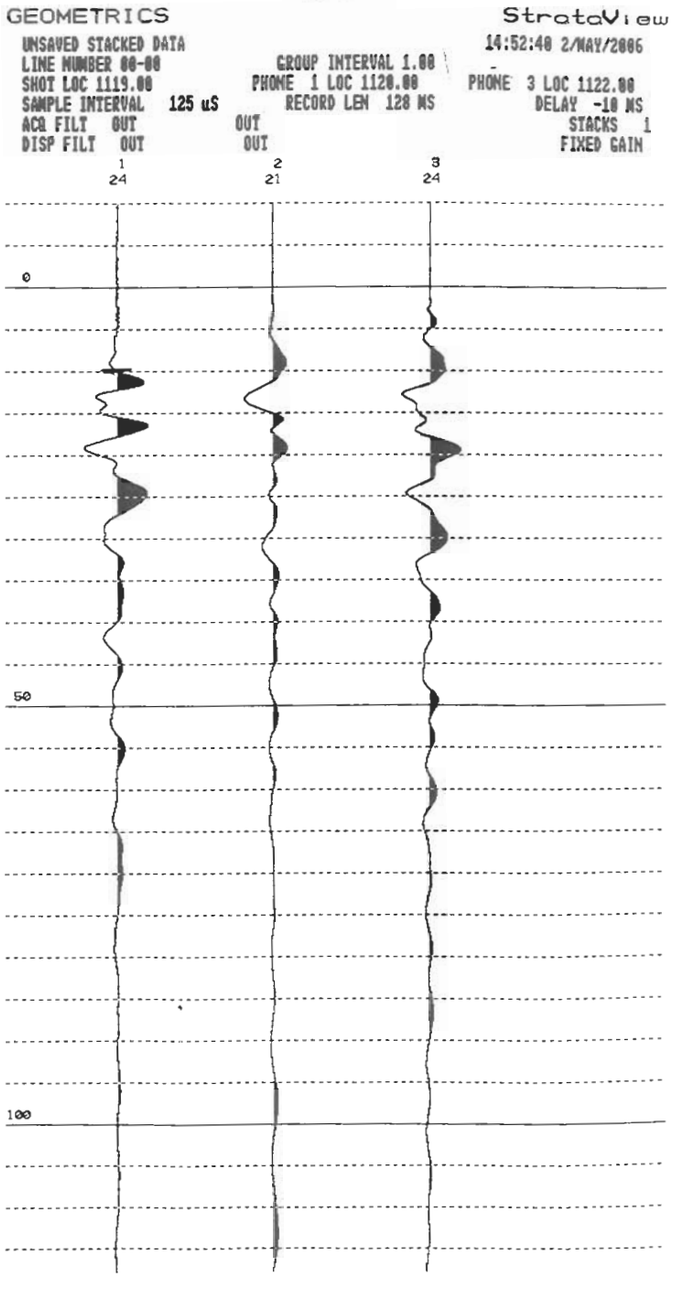
S-5
34'



S-5
33'



S-5
32'



S-5
44'

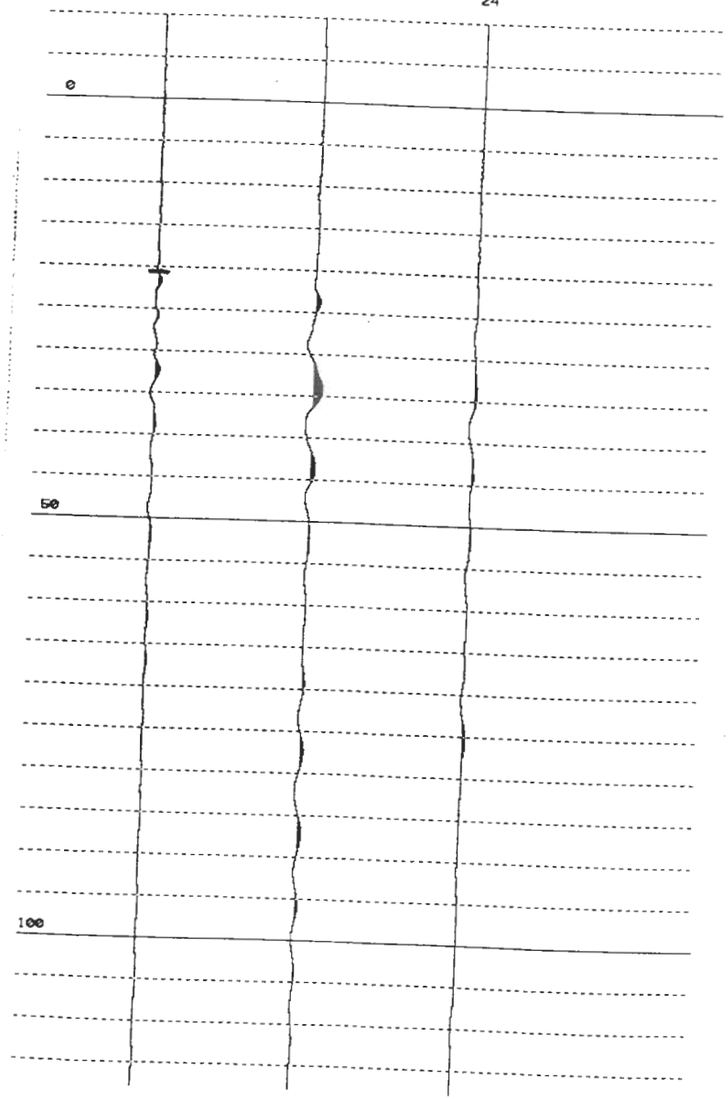
GEOMETRICS

StrataView

UNSAVED STACKED DATA
LINE NUMBER 00-00
SHOT LOC 1119.00
SAMPLE INTERVAL 125 uS
ACQ FILT OUT
DISP FILT OUT

GROUP INTERVAL 1.00
PHONE 1 LOC 1120.00
RECORD LEN 128 MS
OUT
OUT

14:27:22 2/MAY/2006
PHONE 3 LOC 1122.00
DELAY -10 MS
STACKS 1
FIXED GAIN



S-5
40'

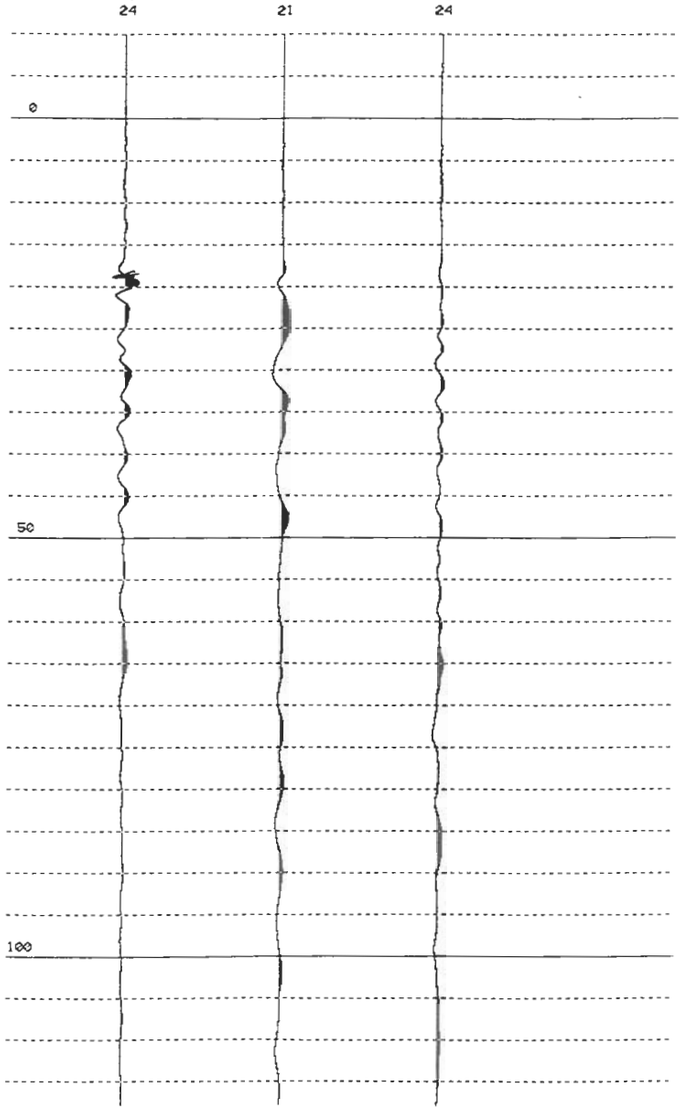
GEOMETRICS

StrataView

UNSAVED STACKED DATA
LINE NUMBER 00-00
SHOT LOC 1119.00
SAMPLE INTERVAL 125 uS
ACQ FILT OUT
DISP FILT OUT

GROUP INTERVAL 1.00
PHONE 1 LOC 1120.00
RECORD LEN 128 MS
OUT
OUT

14:22:43 2/MAY/2006
PHONE 3 LOC 1122.00
DELAY -10 MS
STACKS 1
FIXED GAIN



S-5
35'

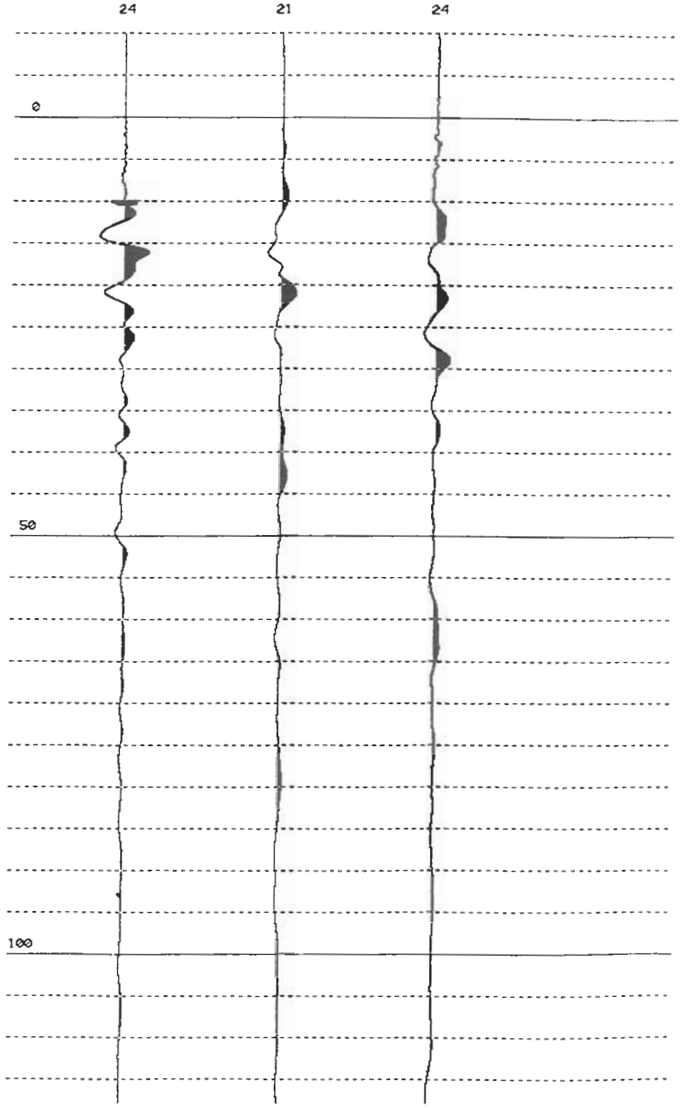
GEOMETRICS

StrataView

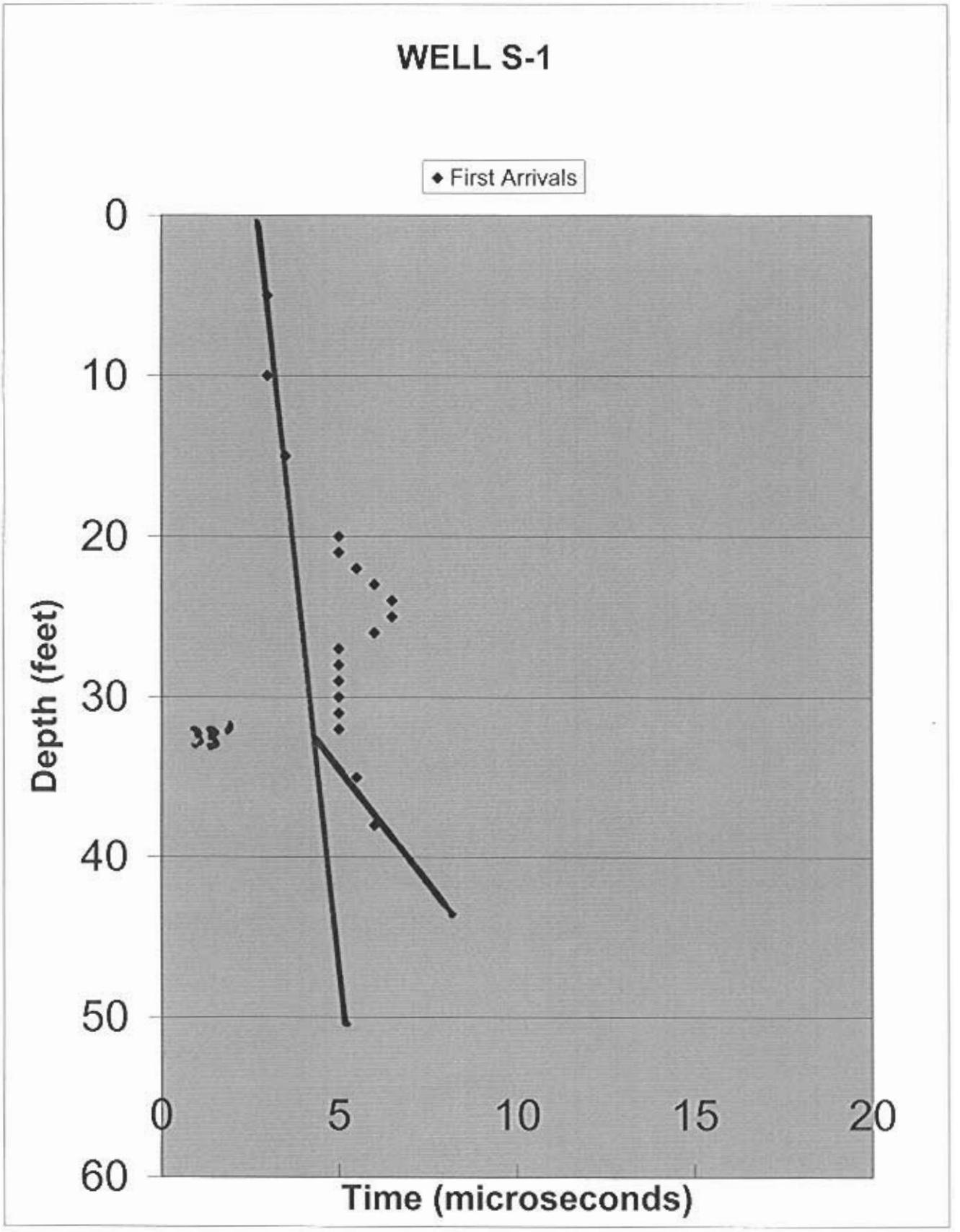
UNSAVED STACKED DATA
LINE NUMBER 00-00
SHOT LOC 1119.00
SAMPLE INTERVAL 125 uS
ACQ FILT OUT
DISP FILT OUT

GROUP INTERVAL 1.00
PHONE 1 LOC 1120.00
RECORD LEN 128 MS
OUT
OUT

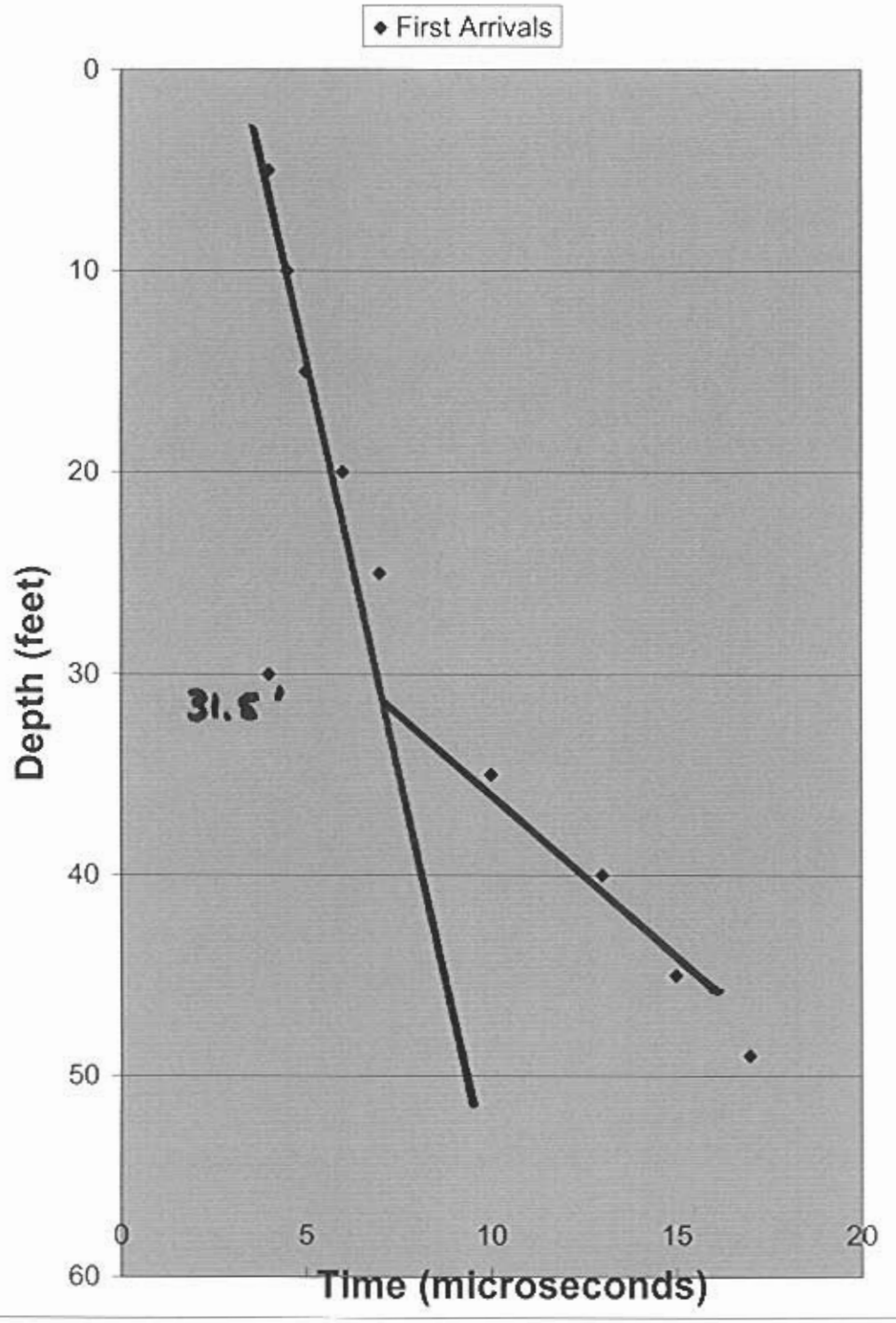
14:20:29 2/MAY/2006
PHONE 3 LOC 1122.00
DELAY -10 MS
STACKS 1
FIXED GAIN



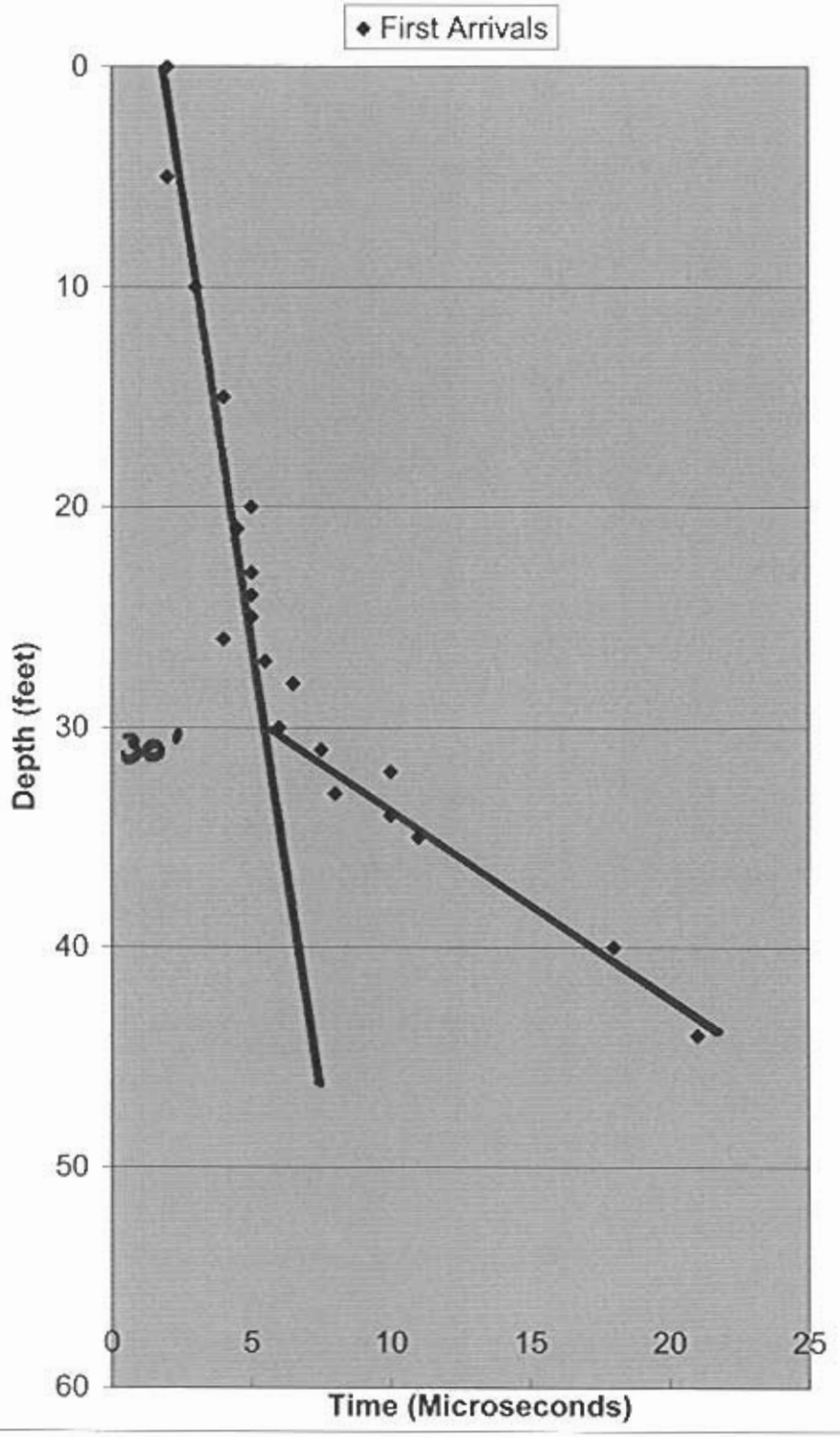
ATTACHMENT 4
GRAPHS OF SURVEY DATA


WELL S-1
First Arrivals
0
10
20
30
40
50
60
Depth (feet)
33'
0
5
10
15
20
Time (microseconds)

WELL S-3


First Arrivals
0
10
20
30
40
50
60
Depth (feet)
31.5'
0
5
10
15
20
Time (microseconds)

WELL S-5


First Arrivals
0
10
20
30
40
50
60
Depth (feet)
30'
0
5
10
15
20
25
Time (Microseconds)