CLEAN HARBORS
GRASSY MOUNTAIN FACILITY

LANDFILL CELLS 8 THROUGH 13
DESIGN ENGINEERING REPORT

(HAL Project No.: 064.85.100)

AUGUST 2018 Rev 1

APPENDIX A

Landfill Cells 8 - 13
Permit Drawings

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY

LANDFILL CELLS 8-13

PERMIT DRAWINGS

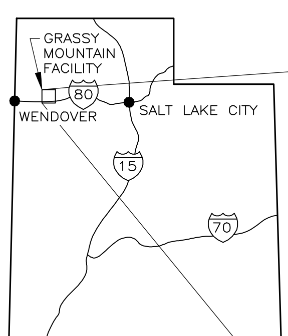
AUGUST 2018 REV 1

FACILITY LOCATION

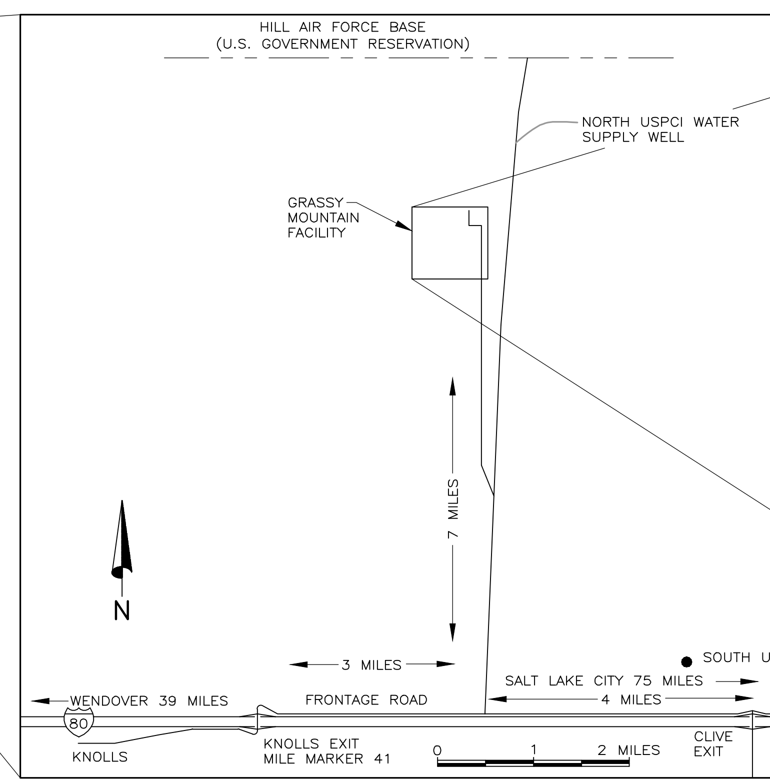
KNOLLS, UTAH
Phone: (435) 884-8900

REGIONAL HEADQUARTERS

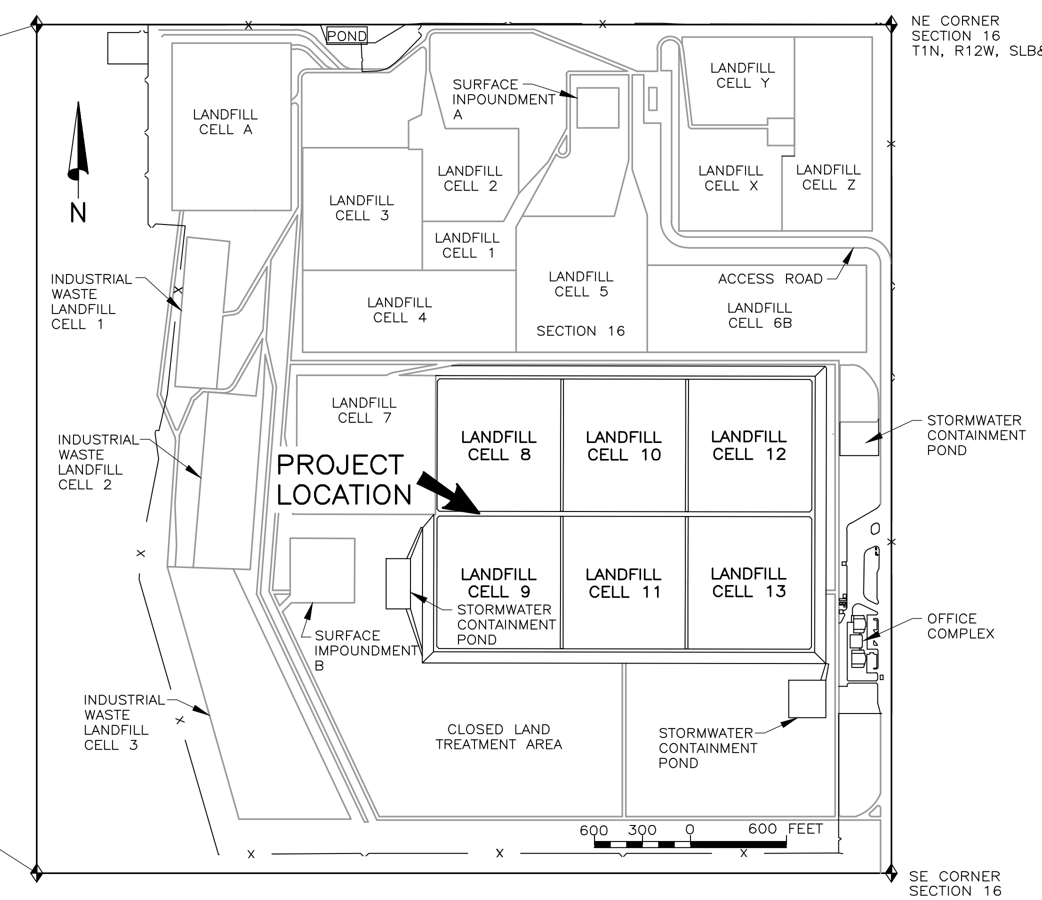
42 LONGWATER DRIVE
NORWELL, MA 02061
Phone: (781) 792-5000



STATE OF UTAH



VICINITY MAP



PROJECT LOCATION

PROFESSIONAL ENGINEER
GORDON L. JONES
No. 5048470-2202
8/6/2018
STATE OF UTAH

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\G-1 COVER__R1.DWG
FILE DATE: 8.6.2018 10:40:54 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

CONSULTANTS
ENGINEERS

Salt Lake City
Utah

7/95

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\G-2 INDEX SHEET__R1.DWG
FILE DATE: 8.6.2018 11:01:16 (CAH)

GENERAL NOTES

1. COORDINATES AND ELEVATIONS PROVIDED ARE BASED ON SITE SPECIFIC COORDINATE SYSTEM AND DATUM CONTROL ESTABLISHED AT THE EAST ¼ CORNER OF SECTION 16, T1N, R2W (N 0.00, E 0.00, EL. 4238.66). ELEVATIONS ARE APPROXIMATE FEET ABOVE MEAN SEA LEVEL.
2. ALL ELEVATIONS PROVIDED ARE BASED ON ORIGINAL EMBANKMENT DESIGN AND CONSTRUCTION ELEVATIONS. ADJUSTMENTS SHALL BE MADE PRIOR TO CLOSURE TO ACCOUNT FOR SETTLEMENT.

LINING SYSTEM SUBGRADES & SOIL FILL

1. ALL SURFACES PROVIDING SUBGRADES FOR LINING SYSTEMS SHALL BE PROOF ROLLED FOR SOFT AND/OR YIELDING SURFACES. SOFT AND/OR YIELDING SURFACES SHALL BE COMPACTED TO PROVIDE A FIRM SUBGRADE FOR LINING SYSTEMS.
2. ALL CLAY LINER MATERIALS SHALL BE COMPACTED TO 95% OF ASTM D–698 AT A MOISTURE CONTENT TYPICALLY BETWEEN MINUS 2% AND PLUS 4% OF OPTIMUM. ALL CLAY LINER SHALL MEET THE REQUIRED PERMEABILITY OF 1 X 10–7 CM/SEC.
3. THE SUB–GRADE FOR THE GEOSYNTHETIC MATERIALS SHALL BE FREE OF PROTRUDING ROCKS AND DEBRIS THAT MAY POTENTIALLY CAUSE DAMAGE TO THE GEOSYNTHETIC MATERIALS. THE SUBGRADE SHALL ALSO BE ROLLED WITH A SMOOTH DRUM ROLLER TO LEAVE THE SURFACE SMOOTH.
4. ALL FILL MATERIALS REQUIRING COMPACTION SHALL BE COMPACTED TO 95% OF ASTM D–698.
5. PIPE BACKFILL AND ANCHOR TRENCH BACKFILL SHALL BE COMPACTED TO 90% OF ASTM D–698.
6. COMPACTED CLAY SOIL ON ABOVE THE HDPE LINER THE PERIMETER SLOPES OF THE CLOSURE CAP HAS NO PERMEABILITY REQUIREMENT AND SHALL BE COMPACTED TO 95% OF ASDM D–698.

GENERAL GEOSYNTHETICS

1. MANUFACTURER'S CERTIFICATIONS SHALL BE PROVIDED FOR ALL RAW AND MANUFACTURED MATERIALS. CERTIFICATIONS SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S MATERIAL SPECIFICATIONS AND PROJECT CQA PLAN CRITERIA AND SHALL INCLUDE ALL TEST DATA FOR MATERIALS DELIVERED AND MEET THE MINIMUM TEST FREQUENCIES DESIGNATED IN THE MANUFACTURER'S QUALITY ASSURANCE MANUALS AND SPECIFICATIONS AND THE CQA PLAN.
2. ALL GEOSYNTHETIC MATERIALS SHALL BE LOADED, TRANSPORTED, OFF–LOADED, STORED, AND HANDLED IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
3. AT A MINIMUM, ALL GEOSYNTHETIC MATERIALS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND INSTALLATION GUIDES AND IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS AND CQA PLAN.

GEOSYNTHETIC CLAY LINER (GCL)

1. ALL GCL MATERIALS SHALL BE NEEDLE PUNCH REINFORCED.
2. GCL SHALL BE DEPLOYED WITH NON–WOVEN GEOTEXTILE SIDE UP.
3. ALL DEPLOYED GCL MATERIALS SHALL BE COVERED BY THE END OF EACH WORK DAY TO MINIMIZE EVAPORATION OF MOISTURE WITHIN THE BENTONITE AND TO PROTECT THE GCL MATERIALS FROM EXPOSURE TO RAINY AND SNOWY WEATHER.
4. SEAMING SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, THE PROJECT SPECIFICATIONS, AND THE CQA PLAN.
5. GCL MATERIALS THAT ARE MANUFACTURED TO PROVIDE SELF–SEALING SEAMS AND DO NOT REQUIRE A BENTONITE BEAD SHALL RECEIVE A BENTONITE BEAD WHEN THE SELF–SEALING DESIGN IS COMPROMISED ON THE ENDS OF PANELS AND WHERE THE SELF–SEALING GROOVE (IF PART OF THE SELF–SEALING DESIGN) HAS BEEN REMOVED FROM PARTIAL WIDTH ROLLS.
6. GCL MATERIALS THAT HAVE NOT BEEN MANUFACTURED TO PROVIDE SELF SEALING SEAMS SHALL RECEIVE A BENTONITE BEAD TO PROVIDE THE SEAM SEAL IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

GEOMEMBRANE LINER

1. ALL GEOMEMBRANE MATERIALS SHALL BE TEXTURED ON BOTH SIDES.
2. NO GEOMEMBRANE MATERIALS SHALL BE DEPLOYED IN SUB–FREEZING TEMPERATURES UNLESS APPROVED BY OWNER WITH AN APPROVED COLD WEATHER DEPLOYMENT PLAN.
3. NO SEAMING SHALL BE ALLOWED IN SUB–FREEZING TEMPERATURES WITHOUT OWNER APPROVAL OF AN APPROPRIATE COLD WEATHER SEAMING PLAN AND ONLY AFTER PROPER DEMONSTRATION OF PRE–QUALIFIED TEST SEAMS.
4. FIELD TESTING AND QUALITY CONTROL SHALL FOLLOW, AT A MINIMUM, THE REQUIREMENTS PROVIDED IN THE MOST RECENT VERSION MANUFACTURERS INSTALLATION PROCEDURES, AND/OR THE PROJECT SPECIFICATIONS AND CQA PLAN, WHICHEVER IS MOST STRINGENT.

GEOCOMPOSITE

1. GEOCOMPOSITE SHALL HAVE A TRANSMISSIVITY OF 6.0 X 10^{-4} M^2/SEC.
2. DOUBLE–SIDED GEOCOMPOSITE SHALL CONSIST OF 8 OZ. NON–WOVEN GEOTEXTILE BONDED TO BOTH SIDES OF GEONET.
3. GEOMEMBRANE MATERIALS SHALL BE CLEANED OF DIRT AND DEBRIS PRIOR TO DEPLOYMENT OF GEOCOMPOSITE.
4. GEOCOMPOSITE SHALL BE FASTENED OR SECURED WITH HEAT BONDING, SEWING OR OTHER APPROVED METHOD, BETWEEN GEOTEXTILE FABRIC MATERIALS ALONG THE ENTIRE LENGTH OF THE SEAMS.
5. OVERLAPS OF SEAMS SHALL BE, AT A MINIMUM, THE DIMENSIONS RECOMMENDED BY THE MANUFACTURES.

PROTECTIVE SOIL COVER

1. CARE SHALL BE EXERCISED DURING PLACEMENT OF PROTECTIVE SOIL COVER MATERIALS. A MINIMUM COVER THICKNESS AS DESIGNATED IN THE PROJECT SPECIFICATIONS AND/OR THE CQA PLAN SHALL BE MAINTAINED AT ALL TIMES BETWEEN THE TIRES OR TRACKS OF EQUIPMENT AND THE UNDERLYING GEOSYNTHETIC MATERIALS.
2. NO SHARP, ABRUPT, OR PIVOTING TURNS SHALL BE ALLOWED BY EQUIPMENT USED ABOVE THE PROTECTIVE SOIL COVER THAT MAY CAUSE SOIL DISPLACEMENT AND DAMAGE TO UNDERLYING GEOSYNTHETIC MATERIALS.
3. ANY WAVES OR WRINKLES THAT BEGIN TO FORM SHALL BE TRAPPED BY PLACING SUFFICIENT PROTECTIVE SOIL COVER BEYOND THE WAVES OR WRINKLES TO HOLD THEM IN PLACE AND KEEP THEM FROM COMBINING INTO LARGER WAVES OR WRINKLES.

GRAVEL ARMOR PLATING (STONE MULCH)

1. STONE MULCH SHALL BE PLACED TO A MINIMUM THICKNESS OF 6 INCHES ON ALL SURFACES.
2. MINIMUM D50 SIZE FOR STONE MULCH SHALL BE 1.0 INCH AND SHALL BE VERIFIED BY TESTING.

STORM DRAINAGE SYSTEM

1. ALL MANHOLES, LIDS, AND RINGS AND COVERS SHALL BE RATED FOR H20 LOADINGS.
2. RINGS AND COVERS AND GRATED COVERS SHALL PROVIDE A MINIMUM OPENING FOR ACCESS OF 30 INCHES.
3. GRATED COVERS SHALL BE USED FOR EMBANKMENT DRAINAGE DITCH INLETS
4. A 10' X 10' CONCRETE APRON SHALL BE PLACED AROUND ALL MANHOLE COVERS.
5. RIPRAP APRON AT CONCRETE BAFFLED OUTLETS TO EXTEND A MINIMUM DISTANCE OF 5 FEET, TO BE 12 INCHES THICK, AND HAVE A D_{50}=3".

CLOSURE GCL COMPATIBILITY

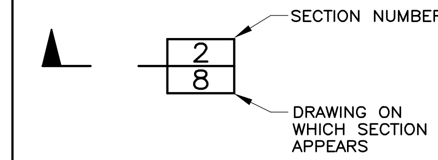
1. BORROW SOURCES FOR 6–INCH THICK SAND LAYER AND 2–FOOT THICK PROTECTIVE SOIL COVER LAYERS TO BE APPROVED BASED ON THE FOLLOWING TESTS USING LIQUID OBTAINED FROM SYNTHETIC LEACHATE PRODUCED USING BORROW SOURCE SOILS: 1. SCREENING CLAY PORTION OF GEOSYNTHETIC CLAY LINER FOR CHEMICAL COMPATIBILITY TO LIQUIDS (ASTM D6141); TESTING RESULTS SHALL DEMONSTRATE THAT THE MAXIMUM HYDRAULIC CONDUCTIVITY OF GCL SHALL MEET AN EQUIVALENCY OF A 2–FOOT THICK COMPACTED CLAY LINER WITH A HYDRAULIC CONDUCTIVITY OF 1X10–7 CM/SEC.

INDEX OF DRAWINGS

SECTION & DETAIL IDENTIFICATION

SECTION IDENTIFICATION

SECTION CUT ON DRAWING NO. 6 AND SHOWN ON DRAWING NO. 8
ON DRAWING NO. 6 THIS SECTION IS REFERENCED AS:



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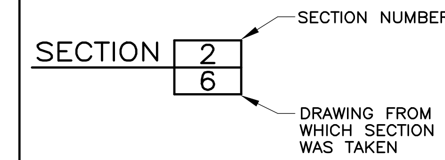

DETAIL IDENTIFICATION

DETAIL CALL–OUT ON DRAWING NO. 6 AND SHOWN ON DRAWING NO. 8
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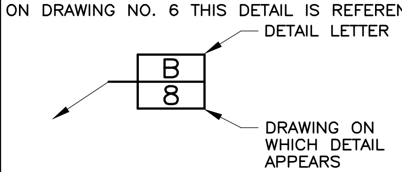

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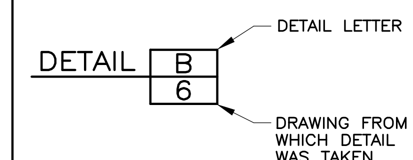


NOTES:
1. IF SECTION AND DETAILS ARE SHOWN ON THE SAME DRAWING AS SECTION CUTS AND SECTION OR DETAIL CALL–OUTS DRAWING NUMBER IS REPLACED BY A LINE.
2. DETAIL LETTERS "I" AND "O" NOT USED.

TABLE OF ABBREVIATIONS

●	= AIR GAS VENT		MH	=	MANHOLE
@	= AT		MIN.	=	MINIMUM
AVG.	= AVERAGE		N.	=	NORTH
C.C.	= CENTER TO CENTER		N.T.S.	=	NOT TO SCALE
℄	= CENTER LINE		O.C.	=	ON CENTER
CLR.	= CLEARANCE		PC	=	POINT OF CURVE
CONT.	= CONTINUOUS		PI	=	POINT OF INTERSECTION
CPP	= CORRUGATED POLYETHYLENE PIPE		PSI	=	POUND PER SQUARE INCH
DIA.	= DIAMETER		PT	=	POINT OF TANGENT
DWG	= DRAWING		REINF	=	REINFORCEMENT
E.	= EAST		SDR	=	STANDARD DIMENSIONAL RATIO
EF	= EACH FACE		SF	=	SQUARE FEET
EL.	= ELEVATION		SQ.	=	SQUARE
E.W.	= EACH WAY		STA.	=	STATION
FL	= FLOW LINE		TL	=	TOP OF LINER
HDPE	= HIGH DENSITY POLYETHYLENE		T.O.C.	=	TOP OF CONCRETE
ID	= INSIDE DIAMETER		TYP.	=	TYPICAL
MAX.	= MAXIMUM		UBC	=	UNTREATED BASE COURSE

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH
PROJECT ENGINEER

		NO.	DATE	REVISIONS	BY	APVD.
DESIGNED	KCS	3				
DRAFTED	CAH	2				
CHECKED	GLJ	1				
DATE	AUGUST 2018 REV 1					

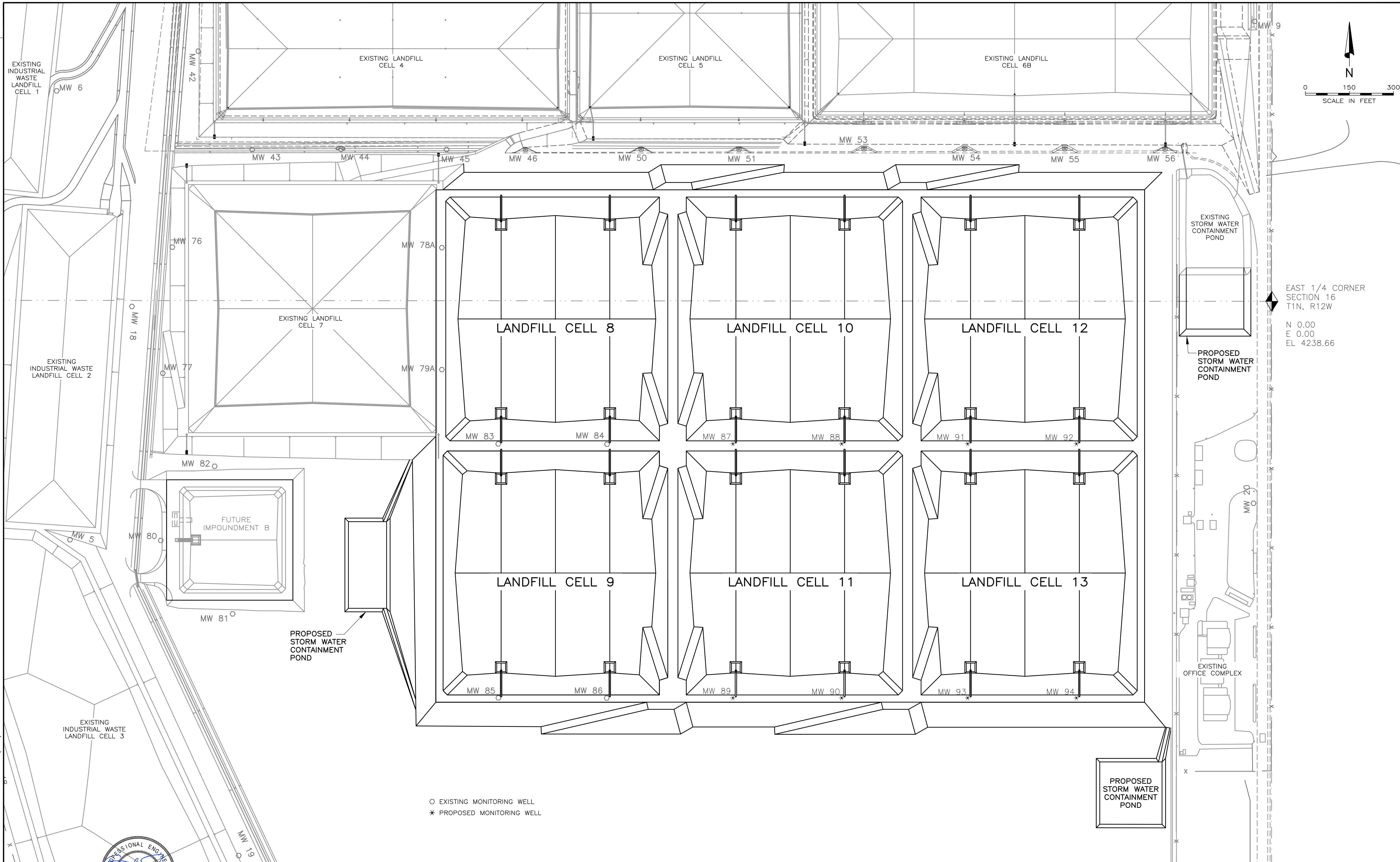
SCALE: NOT TO SCALE

CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13
GENERAL
GENERAL NOTES, LEGEND & INDEX OF DRAWINGS

SHEET G–2
064.85.100

10/07



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FILE DATE: 8.6.2018 11:02:53 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3					
DRAFTED CAH	2					
CHECKED GLJ	1					
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.	

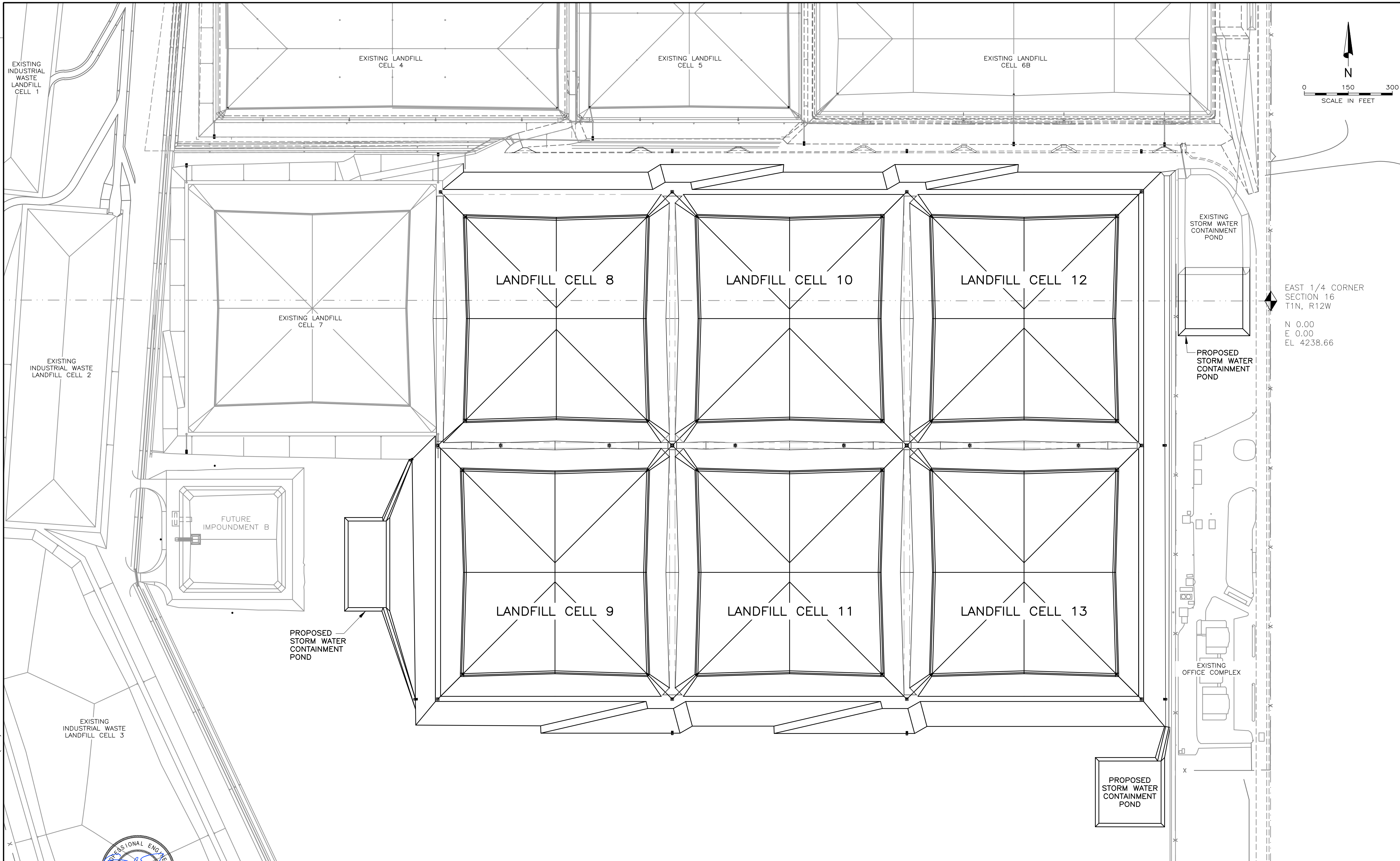
SCALE
NOT TO SCALE

CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13
GENERAL
OVERALL FLOOR PLAN

SHEET
G–3
064.85.100

10/07



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FILE DATE: 8.6.2018 11:03:57 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER No. 5048470-2202 GORDON L. JONES 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3					
DRAFTED CAH	2					
CHECKED GLJ	1					
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.	

SCALE: NOT TO SCALE

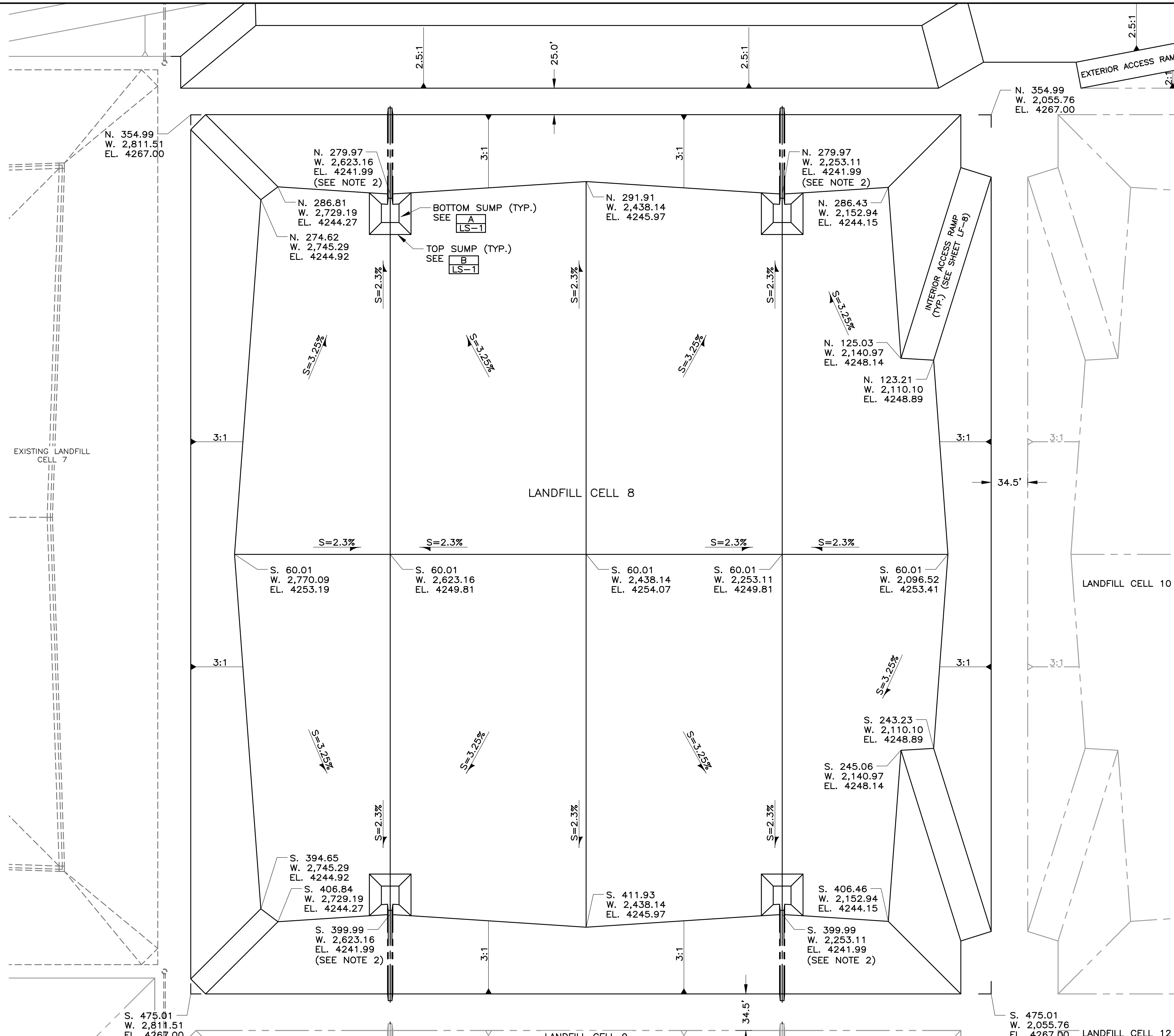
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

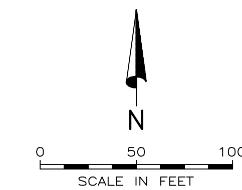
GRASSY MOUNTAIN FACILITY CELLS 8–13
GENERAL
OVERALL CLOSURE PLAN

SHEET G–4

064.85.100

10/07





NOTES:

1. COORDINATES & ELEVATIONS ARE TOP OF COMPACTED CLAY LINER.
2. SUMP REFERENCE POINT SEE SHEET LS-1 FOR SUMP PLAN.
3. ALL LINES SHOWING THE INSIDE OF LANDFILL CELLS ARE DEPICTING TOP OF CLAY SURFACE.

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FILE DATE: 8.6.2018 11:32:47 (CAH)

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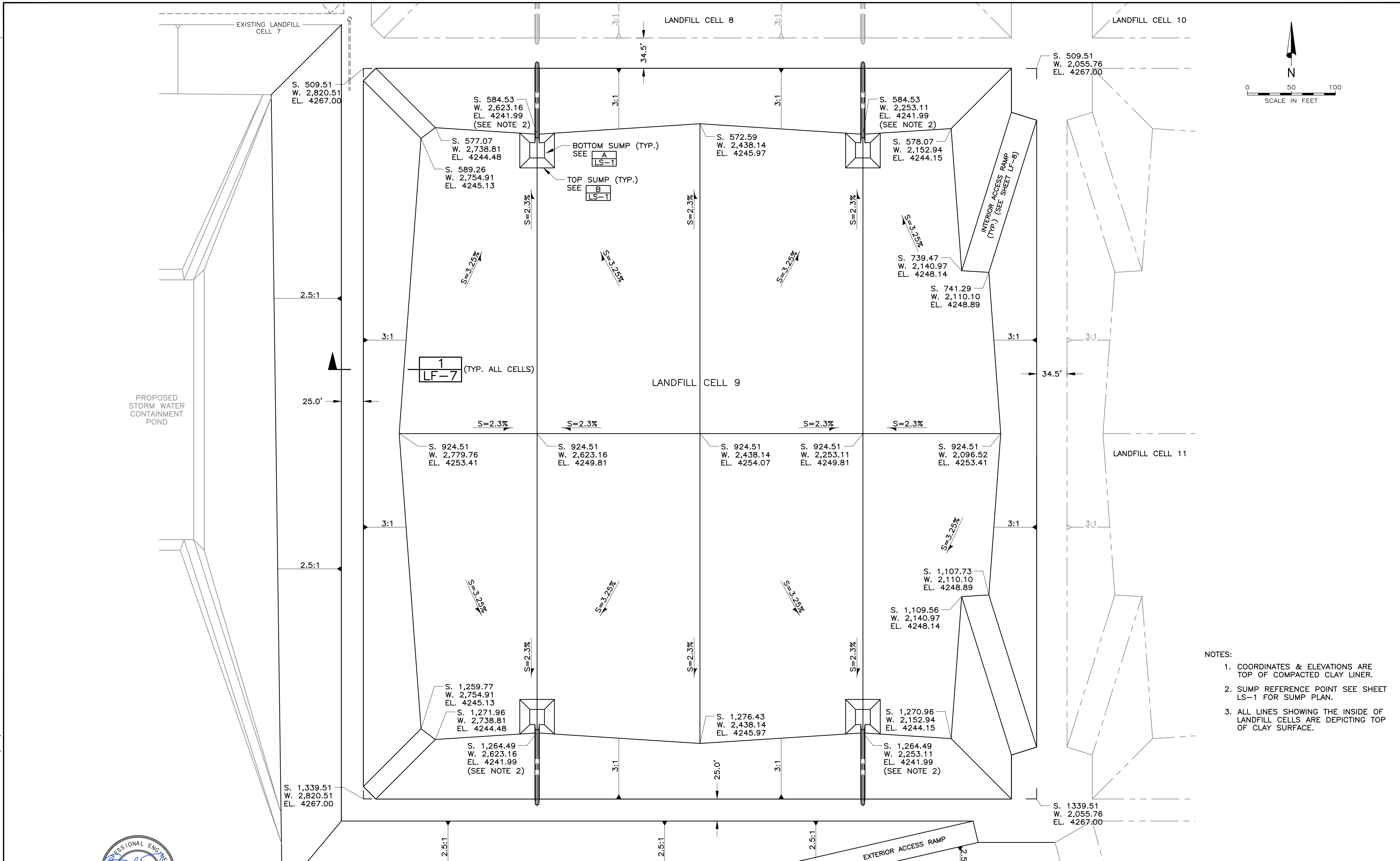
		DRAFTED CAH	2		
		CHECKED GLJ	1		
		DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS — BY — APVD.

SCALE			SHEET
NOT TO SCALE	CleanHarbors ENVIRONMENTAL SERVICES, INC.	GRASSY MOUNTAIN FACILITY CELLS 8–13 LANDFILL PLAN VIEW CELL 8	LF–1
			064.85.100

10/07



NOTES:

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2. SUMP REFERENCE POINT SEE SHEET LS-1 FOR SUMP PLAN.
3. ALL LINES SHOWING THE INSIDE OF LANDFILL CELLS ARE DEPICTING TOP OF CLAY SURFACE.

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FILE DATE: 8.6.2018 11:33:47 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED	KCS	3			
DRAFTED	CAH	2			
CHECKED	GLJ	1			
DATE	AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY / APVD.

SCALE: NOT TO SCALE

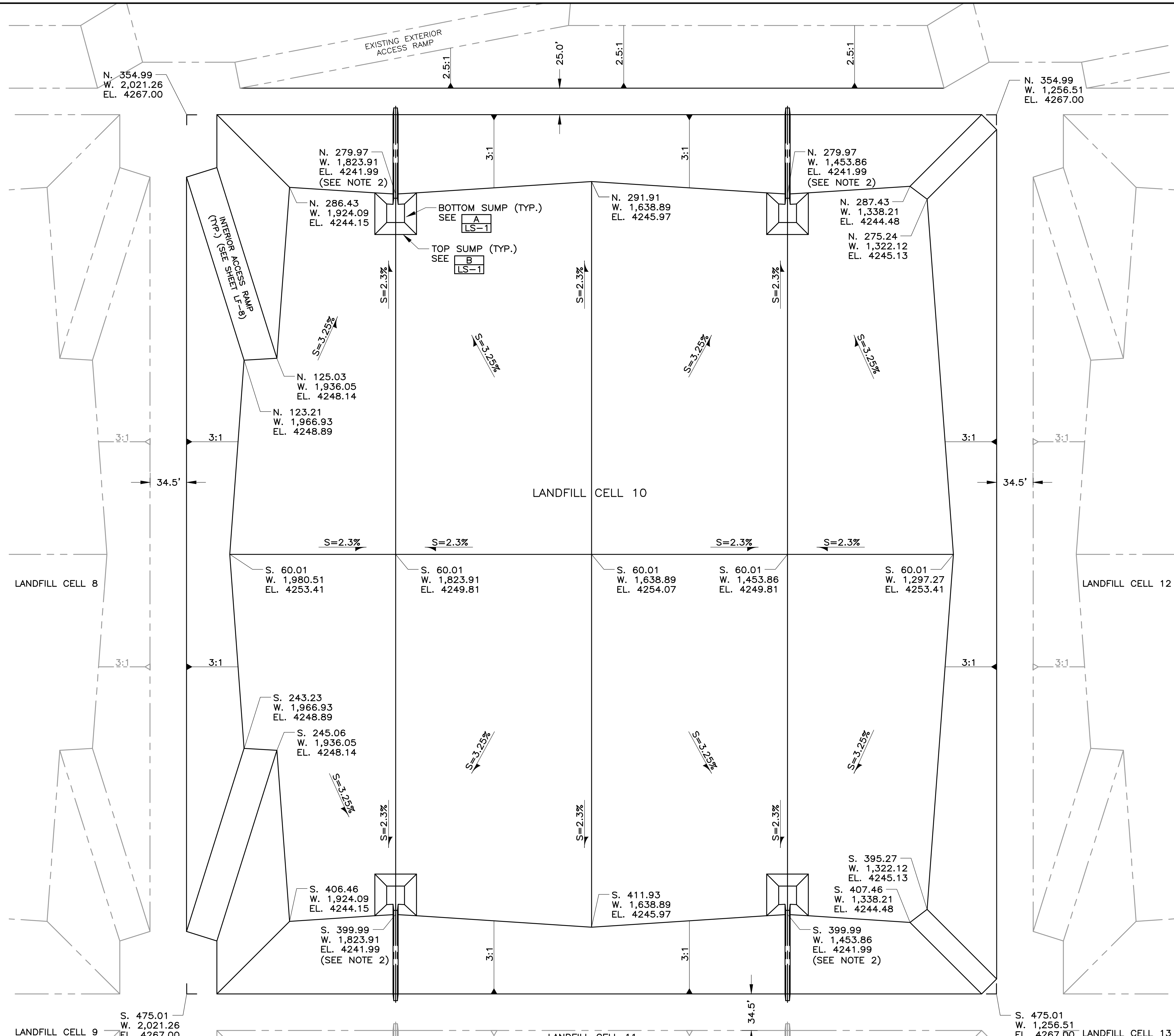
CleanHarbors ENVIRONMENTAL SERVICES, INC.

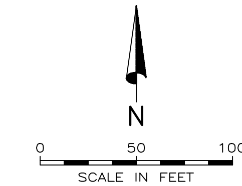
GRASSY MOUNTAIN FACILITY CELLS 8–13
LANDFILL
PLAN VIEW CELL 9

SHEET LF–2

064.85.100

10/07





NOTES:

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2. SUMP REFERENCE POINT SEE SHEET LS-1 FOR SUMP PLAN.
3. ALL LINES SHOWING THE INSIDE OF LANDFILL CELLS ARE DEPICTING TOP OF CLAY SURFACE.

FILE NAME: PROJECTS\064 - CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\WORKING\LF-3 CELL 10 PLAN VIEW__R1.DWG
FILE DATE: 8.6.2018 11:34:33 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED	KCS	3				
DRAFTED	CAH	2				
CHECKED	GLJ	1				
DATE	AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NOT TO SCALE

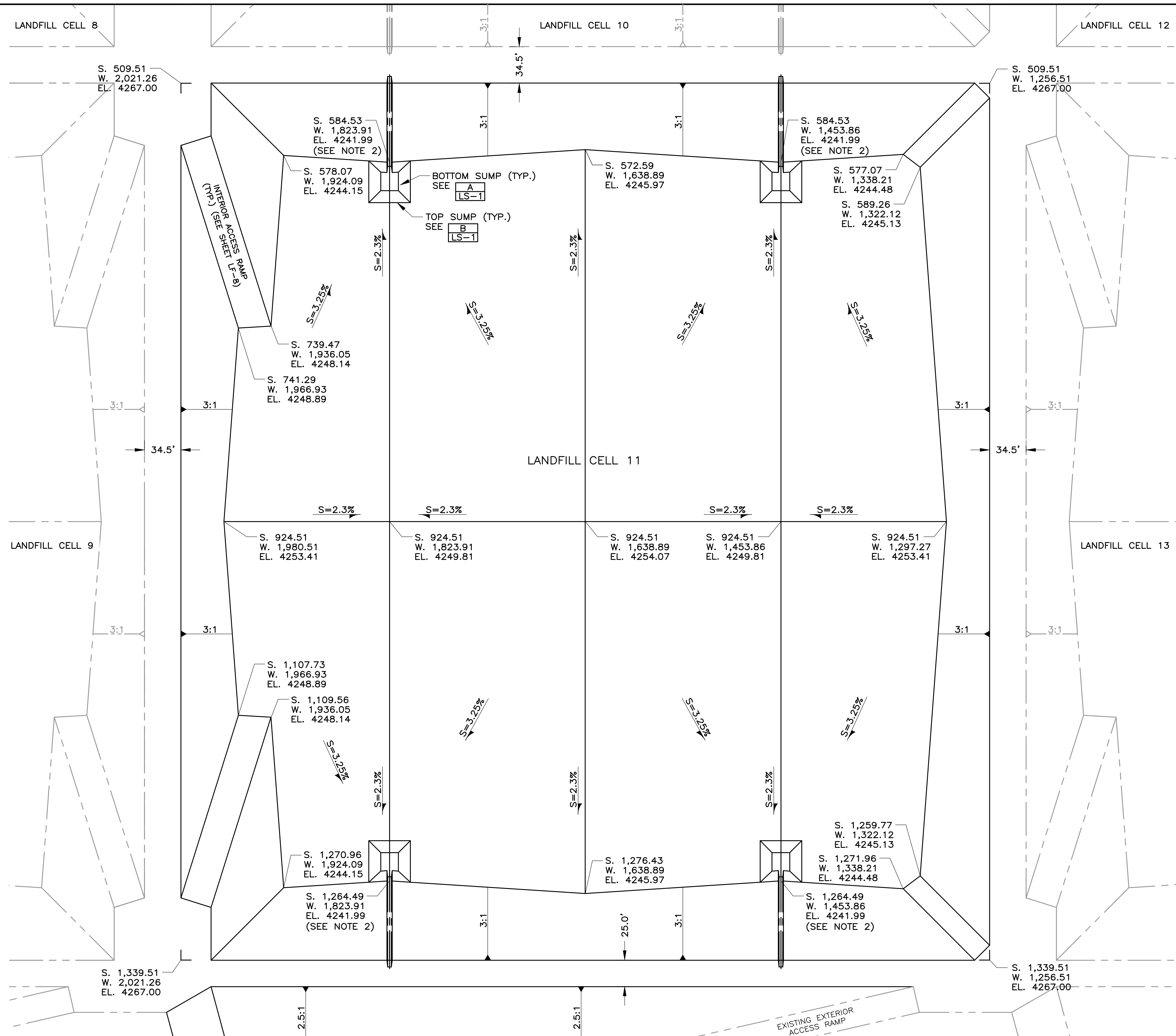
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13
LANDFILL
PLAN VIEW CELL 10

SHEET LF-3

064.85.100

10/07



NOTES:

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2. SUMP REFERENCE POINT SEE SHEET LS-1 FOR SUMP PLAN.
3. ALL LINES SHOWING THE INSIDE OF LANDFILL CELLS ARE DEPICTING TOP OF CLAY SURFACE.

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FILE DATE: 8.6.2018 11:35:36 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NOT TO SCALE

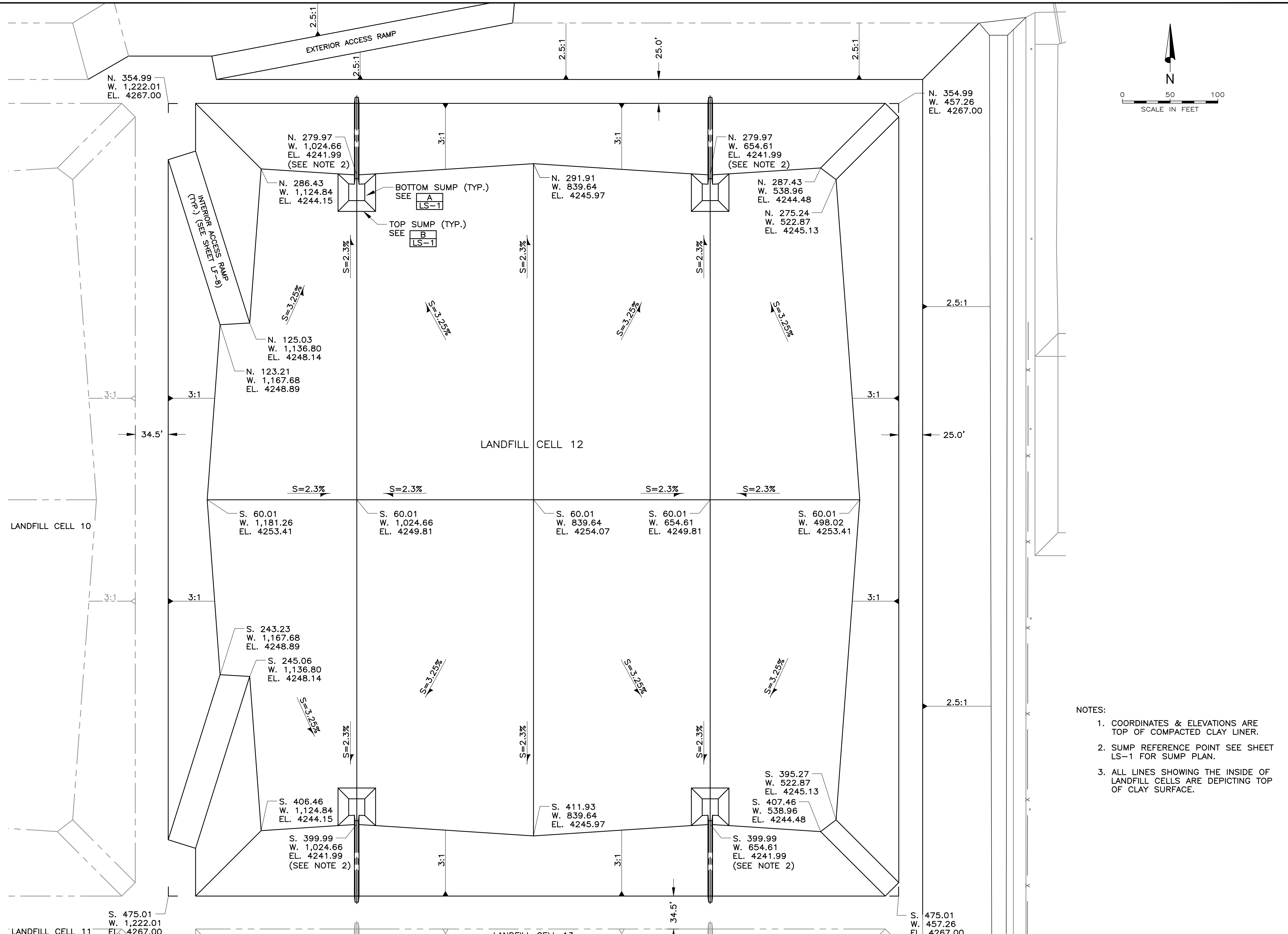
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13
LANDFILL
PLAN VIEW CELL 11

SHEET LF–4

064.85.100

10/07



NOTES:

1. COORDINATES & ELEVATIONS ARE TOP OF COMPACTED CLAY LINER.
2. SUMP REFERENCE POINT SEE SHEET LS-1 FOR SUMP PLAN.
3. ALL LINES SHOWING THE INSIDE OF LANDFILL CELLS ARE DEPICTING TOP OF CLAY SURFACE.

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\LF-5 CELL 12 PLAN VIEW__R1.DWG
FILE DATE: 8.6.2018 11:36:35 (CAH)

HANSEN ALLEN & LUCE inc ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED	KCS	3				
DRAFTED	CAH	2				
CHECKED	GLJ	1				
DATE	AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NOT TO SCALE

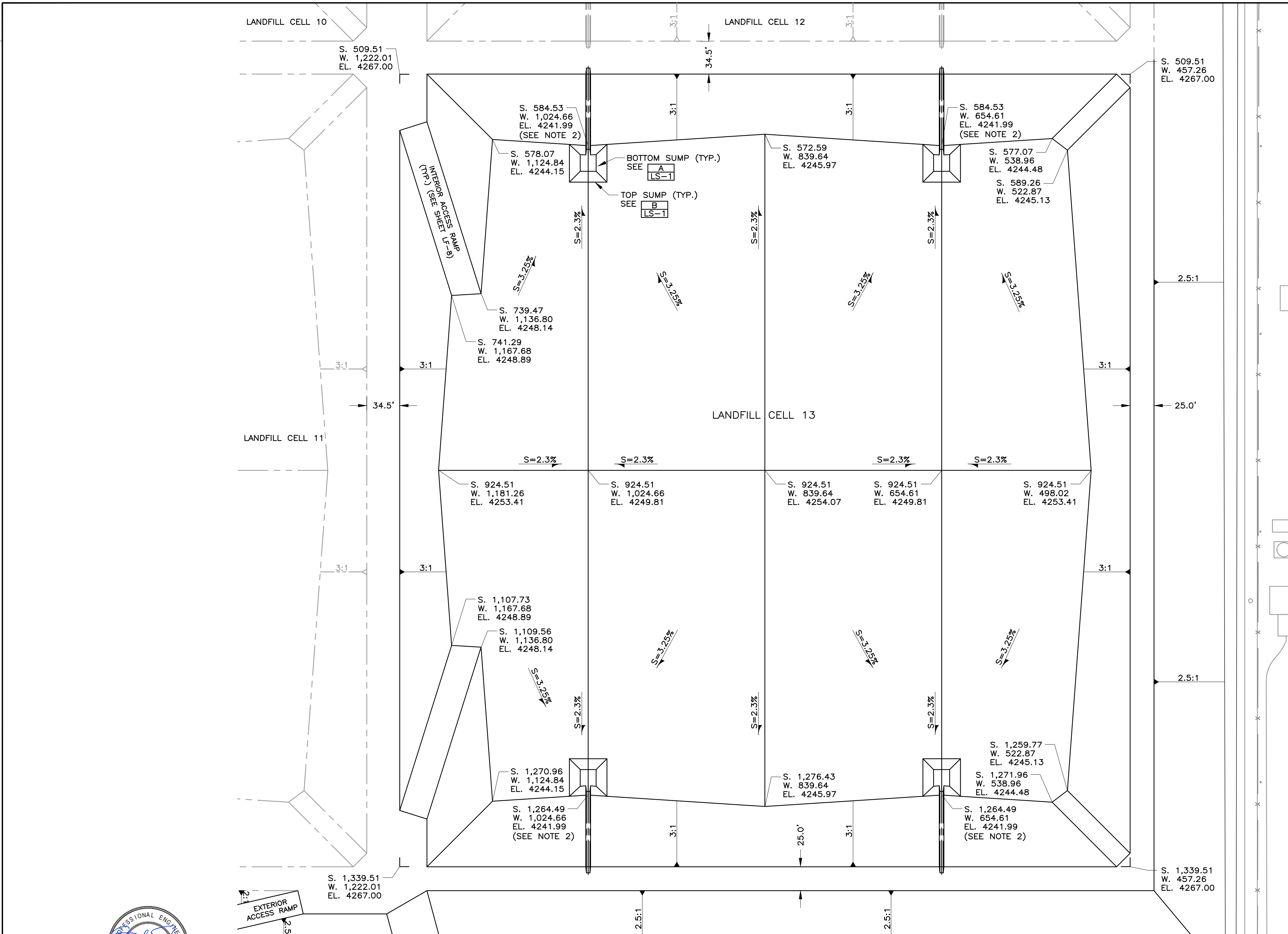
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

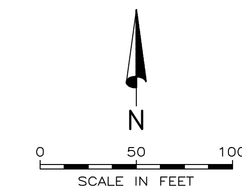
GRASSY MOUNTAIN FACILITY CELLS 8–13
LANDFILL
PLAN VIEW CELL 12

SHEET LF–5

064.85.100

10/07





NOTES:

1. COORDINATES & ELEVATIONS ARE TOP OF COMPACTED CLAY LINER.
2. SUMP REFERENCE POINT SEE SHEET LS-1 FOR SUMP PLAN.
3. ALL LINES SHOWING THE INSIDE OF LANDFILL CELLS ARE DEPICTING TOP OF CLAY SURFACE.

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\LF-6 CELL 13 PLAN VIEW__R1.DWG
FILE DATE: 8.6.2018 11:37:47 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NOT TO SCALE

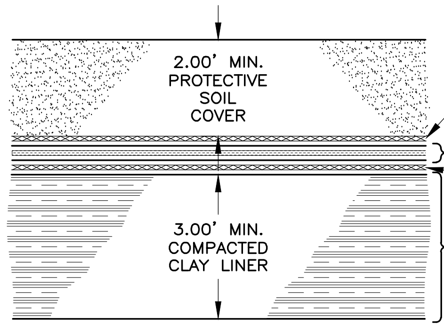
CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13
LANDFILL
PLAN VIEW CELL 13

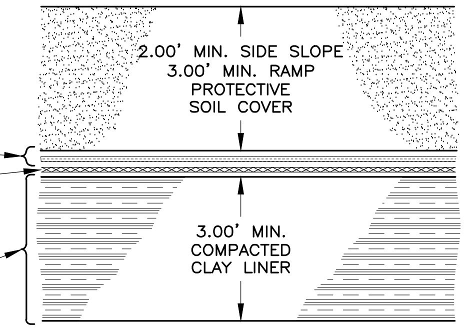
SHEET LF–6

064.85.100

10/07



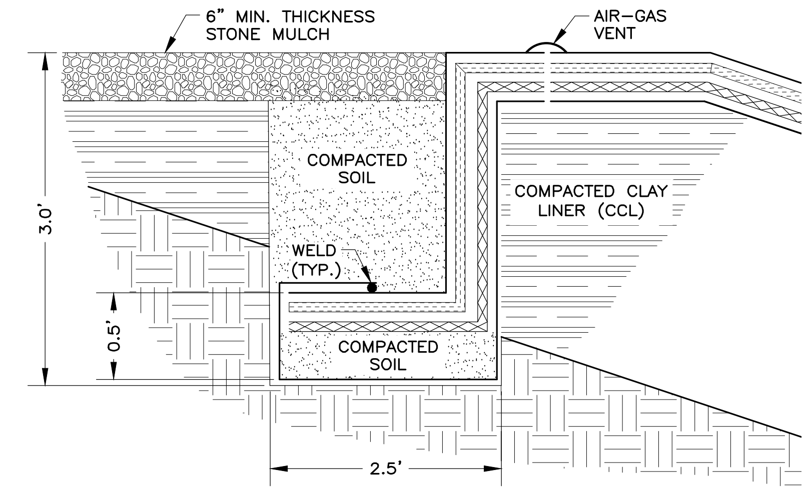
FLOOR LINER SYSTEM DETAIL A/– A/LF–8
N.T.S.



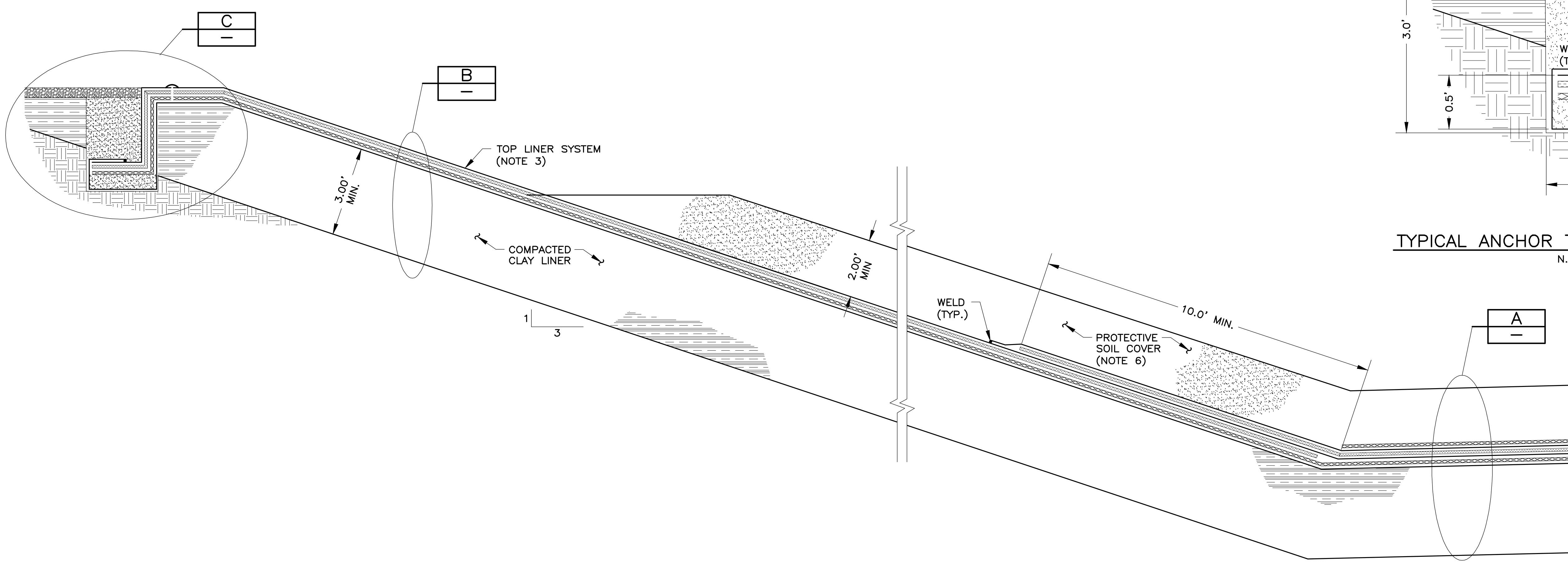
SIDESLOPE LINER SYSTEM DETAIL B/– B/LF–8
N.T.S.

NOTES:

1. TOP LEACHATE COLLECTION SYSTEM CONSISTS OF DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   8 OZ. NON–WOVEN GEOTEXTILE
   GEONET
   8 OZ. NON–WOVEN GEOTEXTILE
   } MIN. GEOCOMPOSITE TRANSMISSIVITY OF 6.0×10^{-4} M^2/SEC, TYP.)
2. TOP COMPOSITE LINER SYSTEM ON THE FLOOR AND TO A DISTANCE OF 10 FEET UP THE INTERIOR SLOPES CONSISTS OF:
   80–MIL HDPE GEOMEMBRANE (TEXTURED)
   GEOSYNTHETIC CLAY LINER (GCL)
   80–MIL HDPE GEOMEMBRANE (TEXTURED)
3. TOP LINER SYSTEM ON THE INTERIOR SIDESLOPES FROM A DISTANCE OF 10 FEET UP THE SLOPES TO THE ANCHOR TRENCH AT THE TOP OF THE SLOPES CONSISTS OF:
   80–MIL HDPE GEOMEMBRANE (TEXTURED)
   GEOSYNTHETIC CLAY LINER (GCL)
4. BOTTOM LEACHATE COLLECTION / LEAK DETECTION SYSTEM CONSISTS OF DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   8 OZ. NON–WOVEN GEOTEXTILE
   GEONET
   8 OZ. NON–WOVEN GEOTEXTILE
   } MIN. GEOCOMPOSITE TRANSMISSIVITY OF 2.7×10^{-4} M^2/SEC, TYP.)
5. BOTTOM COMPOSITE LINER SYSTEM CONSISTS OF:
   60–MIL HDPE GEOMEMBRANE (TEXTURED)
   COMPACTED CLAY LINER (CCL)
6. PROTECTIVE SOIL COVER PLACED ON THE INTERIOR SLOPES SHALL ONLY BE PLACED TO A VERTICAL HEIGHT OF 10–FEET ABOVE THE LEVEL OF THE COVER ON WASTE MATERIALS IN THE LANDFILL CELLS.
7. PROTECTIVE SOIL COVER ON RAMP TO CONSIST OF 18 INCHES OF COMPACTED SOIL (95% ASTM D–698) AND 18 INCHES OF ROAD BASE AGGREGATE AS SHOWN ON SHEET LF–8.
8. PROTECTIVE SOIL COVER ON FLOOR EXTENDING A DISTANCE OF 20 FEET FROM THE BASE OF THE RAMP TO CONSIST OF 12 INCHES OF COMPACTED SOIL (95% ASTM D–698) AND 12 INCHES OF ROAD BASE AGGREGATE AS SHOWN ON SHEET LF–8.



TYPICAL ANCHOR TRENCH DETAIL C/–
N.T.S.



TYPICAL SIDESLOPE LINER SYSTEM DETAILS 1/LF–2
N.T.S.

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\LF–7 DETAILS__R1.DWG
FILE DATE: 8.6.2018 11:38:39 (CAH)

10/07

HANSEN ALLEN & LUCE inc ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

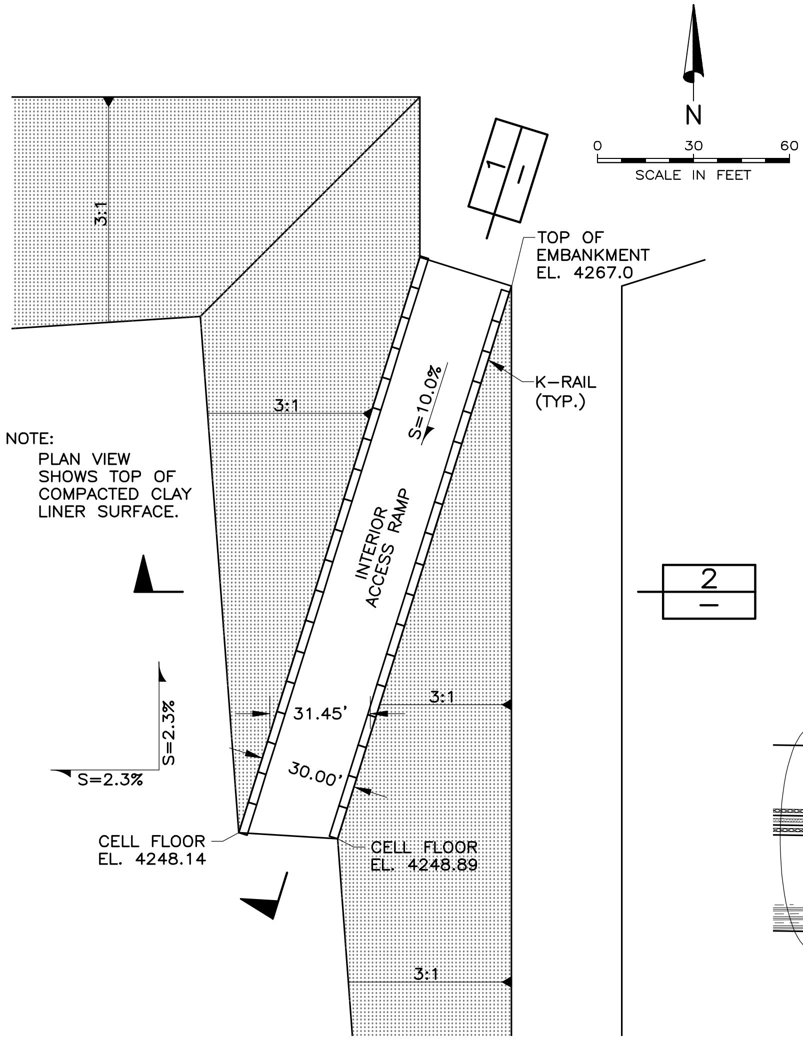
SCALE: AS SHOWN

CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13
LANDFILL
DETAILS

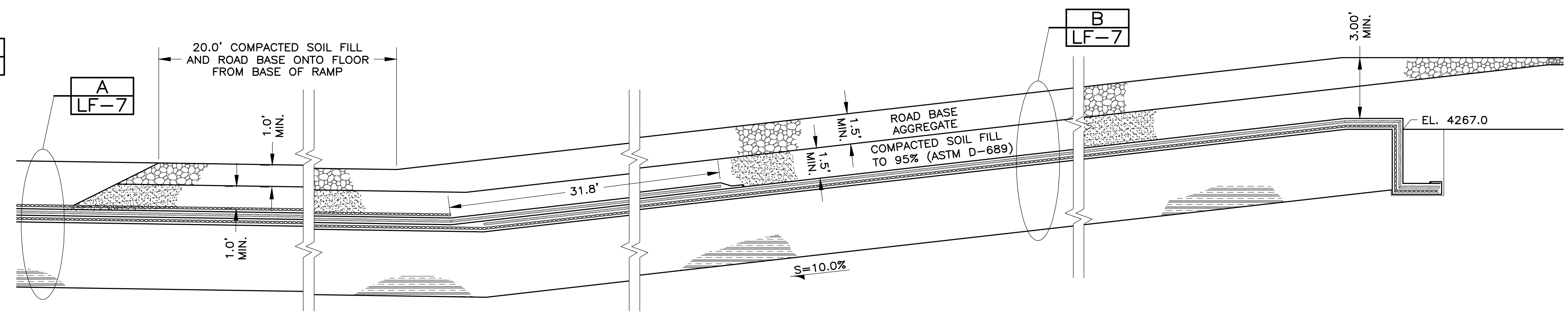
SHEET LF–7

064.85.100



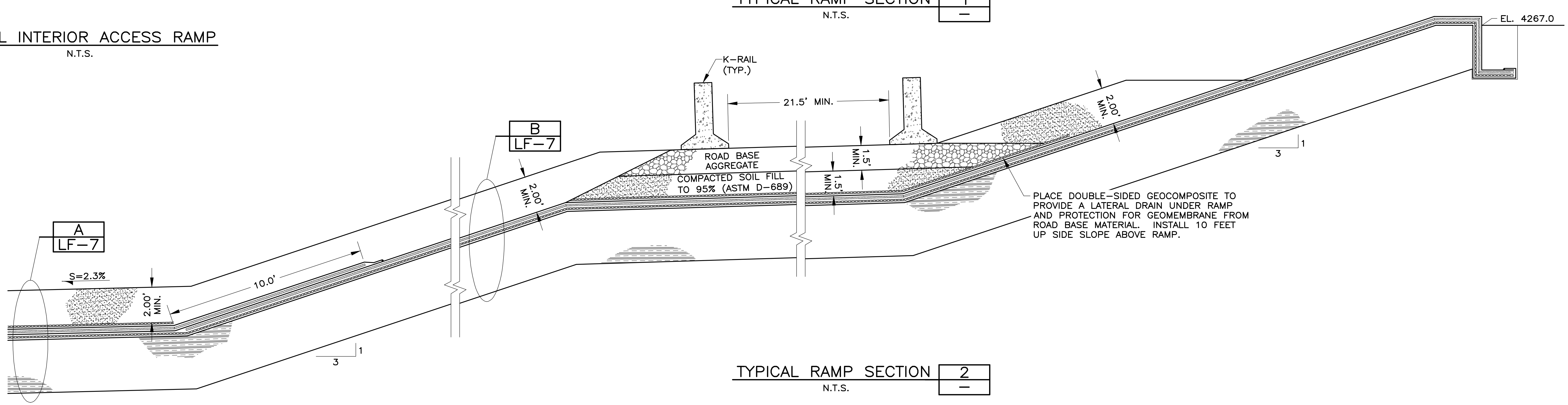
TYPICAL INTERIOR ACCESS RAMP

N.T.S.



TYPICAL RAMP SECTION 1 / —

N.T.S.



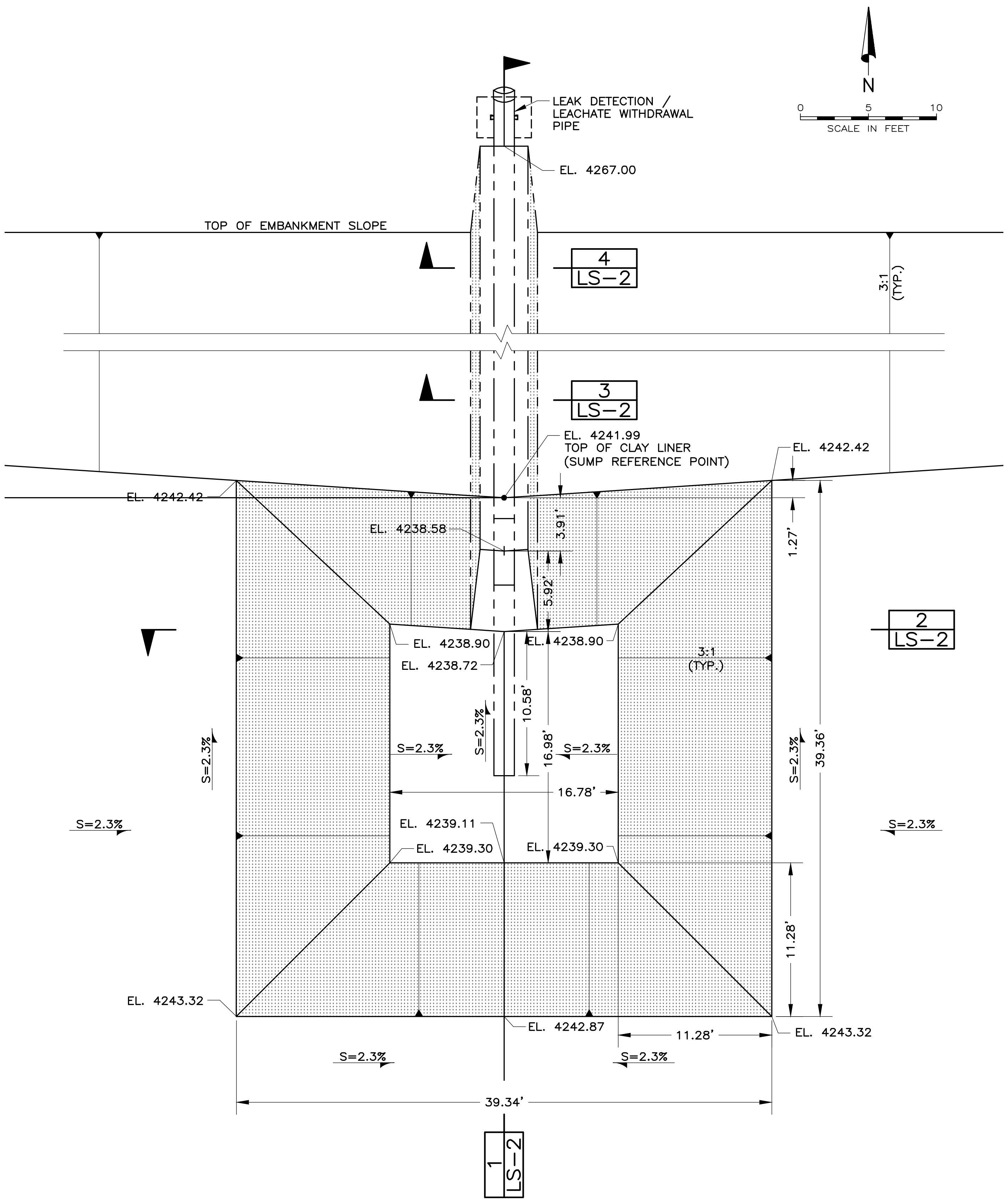
TYPICAL RAMP SECTION 2 / —

N.T.S.

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\LF-8 RAMP SECTIONS__R1.DWG
FILE DATE: 8.6.2018 11:39:28 (CAH)

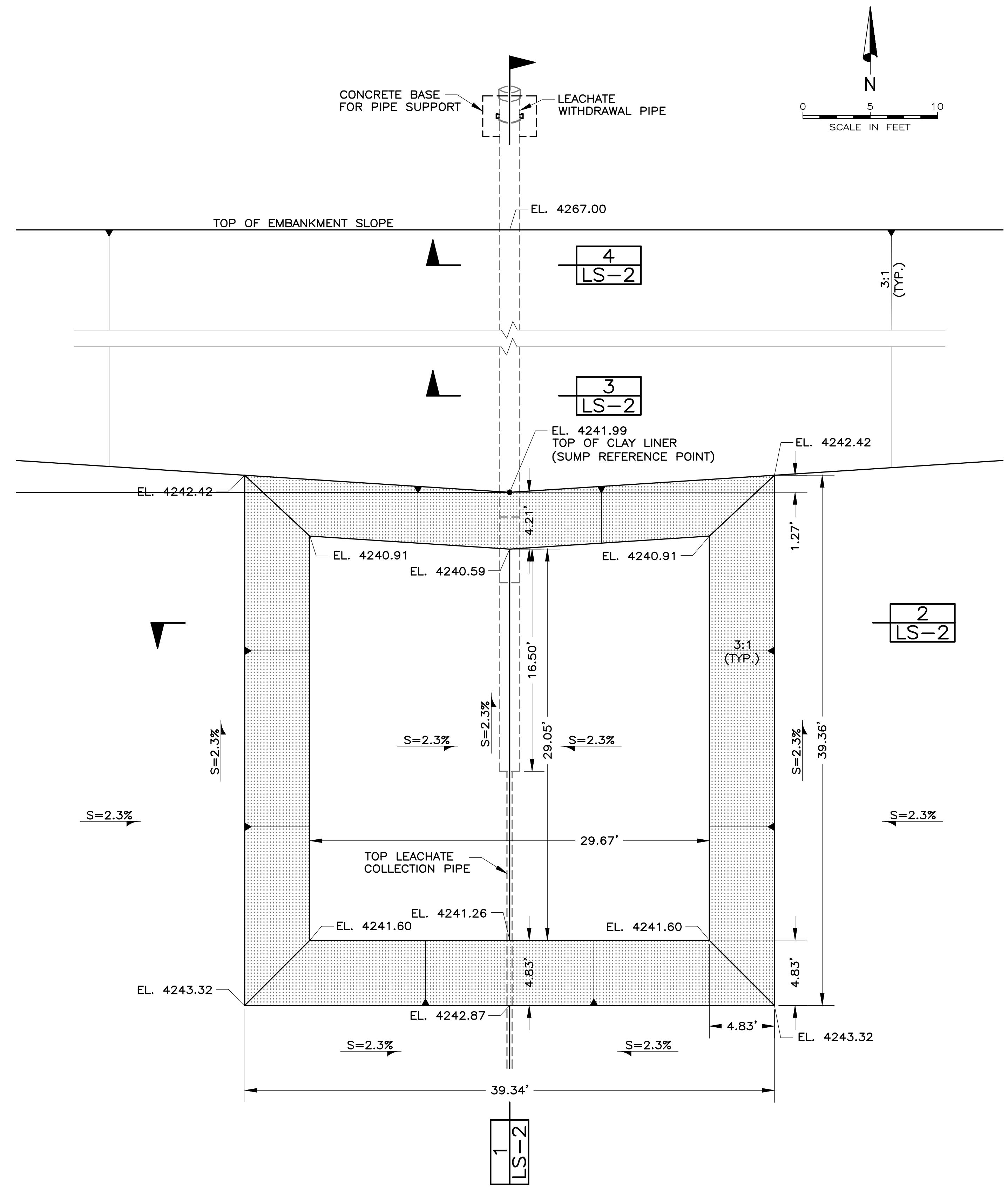
HANSEN ALLEN & LUCE inc ENGINEERS	PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH — PROJECT ENGINEER	DESIGNED KCS	3			SCALE AS SHOWN	CleanHarbors ENVIRONMENTAL SERVICES, INC.
		DRAFTED CAH	2				GRASSY MOUNTAIN FACILITY CELLS 8-13 LANDFILL TYPICAL ACCESS RAMPS
		CHECKED GLJ	1				SHEET LF-8
		DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS / BY / APVD.		064.85.100

10/07



TYPICAL BOTTOM (LEAK DETECTION) SUMP
N.T.S.

A	A	A	A	A	A
LF-1	LF-2	LF-3	LF-4	LF-5	LF-6



TYPICAL TOP (LEACHATE COLLECTION) SUMP
N.T.S.

B	B	B	B	B	B
LF-1	LF-2	LF-3	LF-4	LF-5	LF-6

FILE NAME: PROJECTS\064 - CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\WORKING\LS-1 SUMP PLANS__R1.DWG
FILE DATE: 8.6.2018 11:40:41 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED	KCS	3			
DRAFTED	CAH	2			
CHECKED	GLJ	1			
DATE	AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY / APVD.

SCALE: NOT TO SCALE

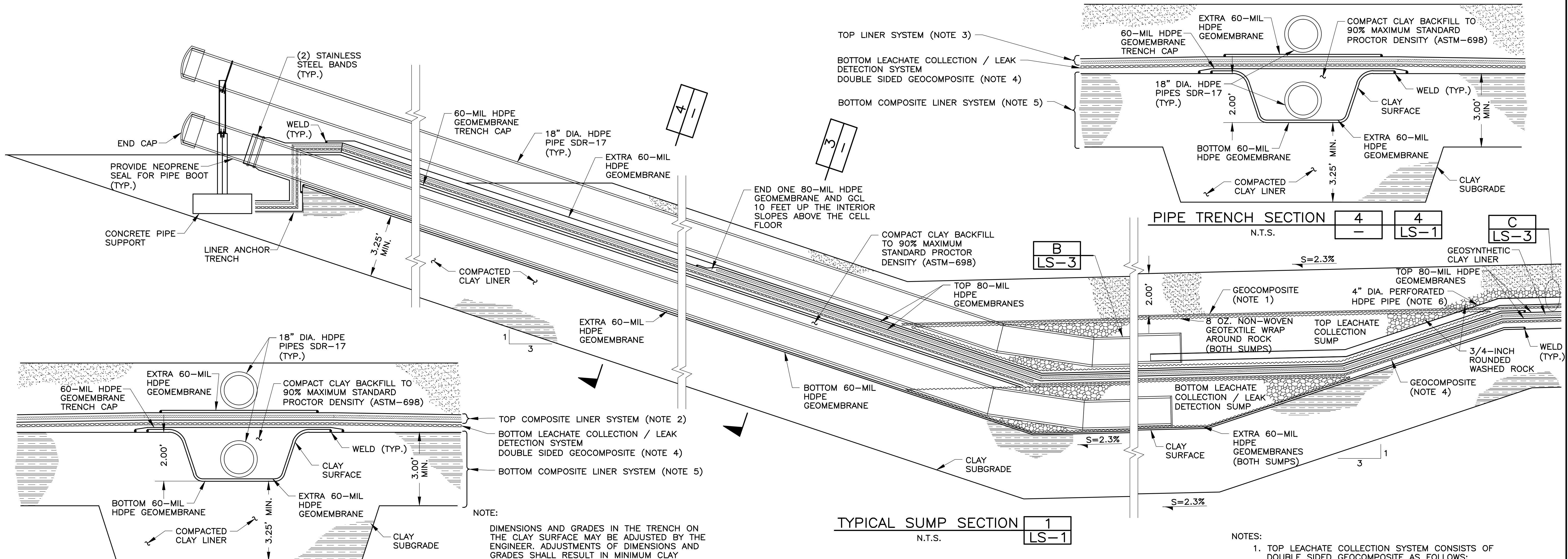
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13
LCRS
SUMP PLANS

SHEET LS-1

064.85.100

10/07



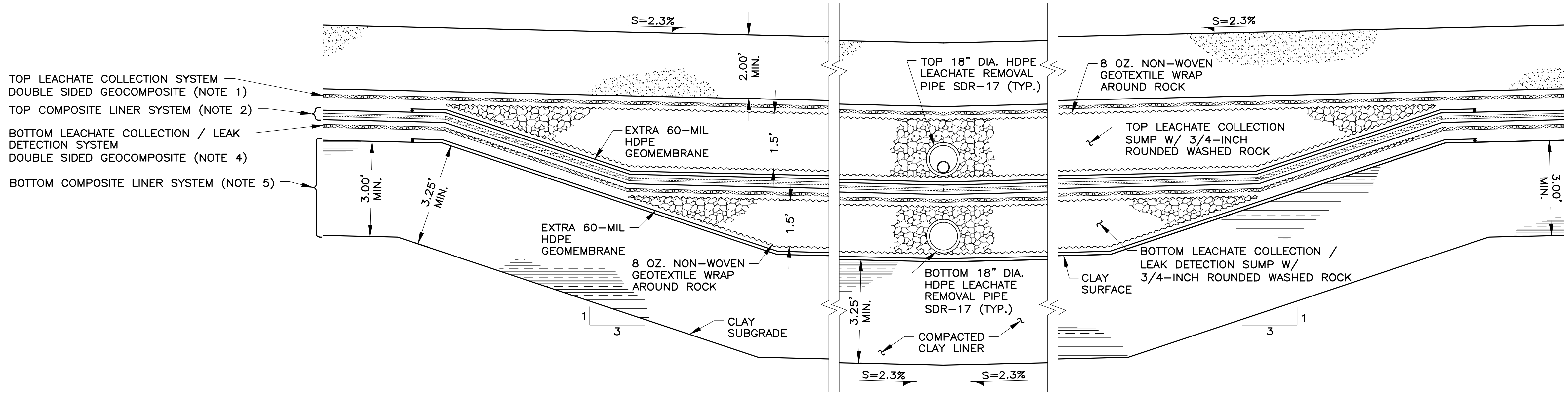
PIPE TRENCH SECTION 4 / – | 4 / LS-1
N.T.S.

TYPICAL SUMP SECTION 1 / LS-1
N.T.S.

PIPE TRENCH SECTION 3 / – | 3 / LS-1
N.T.S.

NOTE:

DIMENSIONS AND GRADES IN THE TRENCH ON THE CLAY SURFACE MAY BE ADJUSTED BY THE ENGINEER. ADJUSTMENTS OF DIMENSIONS AND GRADES SHALL RESULT IN MINIMUM CLAY THICKNESS AS DESIGNATED ON THIS SECTION.



TYPICAL SUMP SECTION 2 / LS-1
N.T.S.

NOTES:

1. TOP LEACHATE COLLECTION SYSTEM CONSISTS OF DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   8 OZ. NON-WOVEN GEOTEXTILE, GEONET, 8 OZ. NON-WOVEN GEOTEXTILE } MIN. GEOCOMPOSITE TRANSMISSIVITY OF 6.0×10^{-4} M^2/SEC, TYP.)
2. TOP COMPOSITE LINER SYSTEM ON THE FLOOR AND TO A DISTANCE OF 10 FEET UP THE INTERIOR SLOPES CONSISTS OF:
   80-MIL HDPE GEOMEMBRANE (TEXTURED)
   GEOSYNTHETIC CLAY LINER (GCL)
   80-MIL HDPE GEOMEMBRANE (TEXTURED)
3. TOP LINER SYSTEM ON THE INTERIOR SIDESLOPES FROM A DISTANCE OF 10 FEET UP THE SLOPES TO THE ANCHOR TRENCH AT THE TOP OF THE SLOPES CONSISTS OF:
   80-MIL HDPE GEOMEMBRANE (TEXTURED)
   GEOSYNTHETIC CLAY LINER (GCL)
4. BOTTOM LEACHATE COLLECTION / LEAK DETECTION SYSTEM CONSISTS OF DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   8 OZ. NON-WOVEN GEOTEXTILE, GEONET, 8 OZ. NON-WOVEN GEOTEXTILE } MIN. GEOCOMPOSITE TRANSMISSIVITY OF 2.7×10^{-4} M^2/SEC, TYP.)
5. BOTTOM COMPOSITE LINER SYSTEM CONSISTS OF:
   60-MIL HDPE GEOMEMBRANE (TEXTURED)
   COMPACTED CLAY LINER (CCL)
6. EXTEND 4" DIA. PERFORATED HDPE PIPE THE FULL LENGTH OF THE VALLEY EXTENDING ACROSS THE CELL FLOOR FROM THE SUMPS.

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\LS-2 SUMP SECTIONS__R1.DWG
FILE DATE: 8.6.2018 11:44:55 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER No. 5048470-2202 GORDON L. JONES 8/6/2018 STATE OF UTAH
PROJECT ENGINEER

DESIGNED KCS	3		
DRAFTED CAH	2		
CHECKED GLJ	1		
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

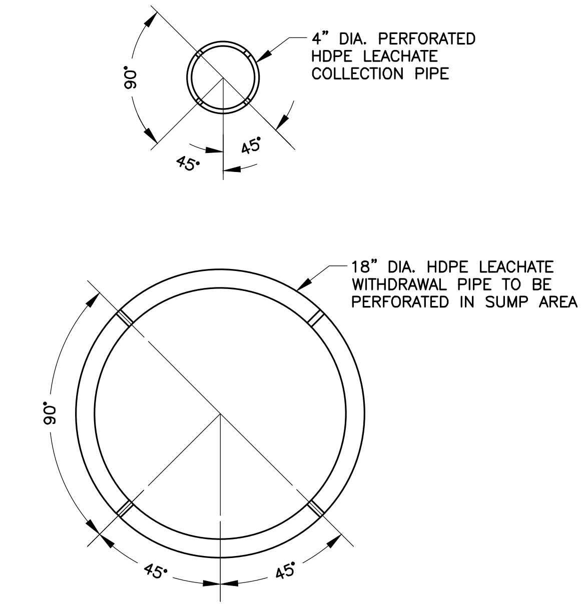
SCALE AS SHOWN

CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13
LCRS
SUMP SECTIONS

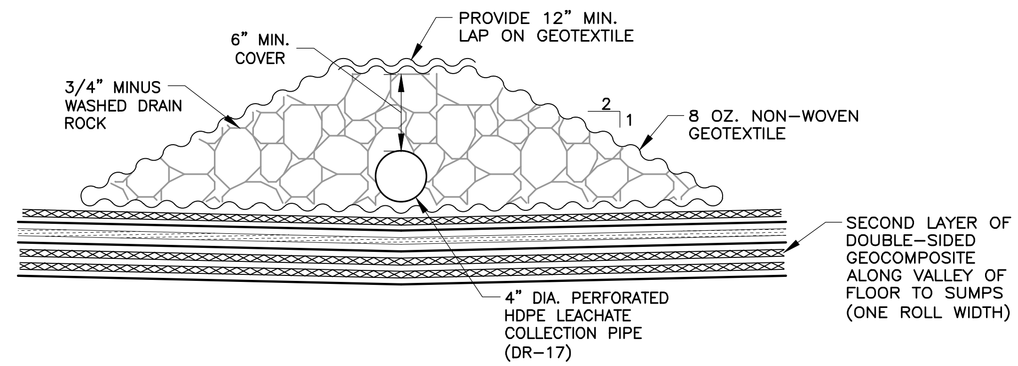
SHEET LS-2
064.85.100

10/07



PERFORATION DETAIL A / –

N.T.S.

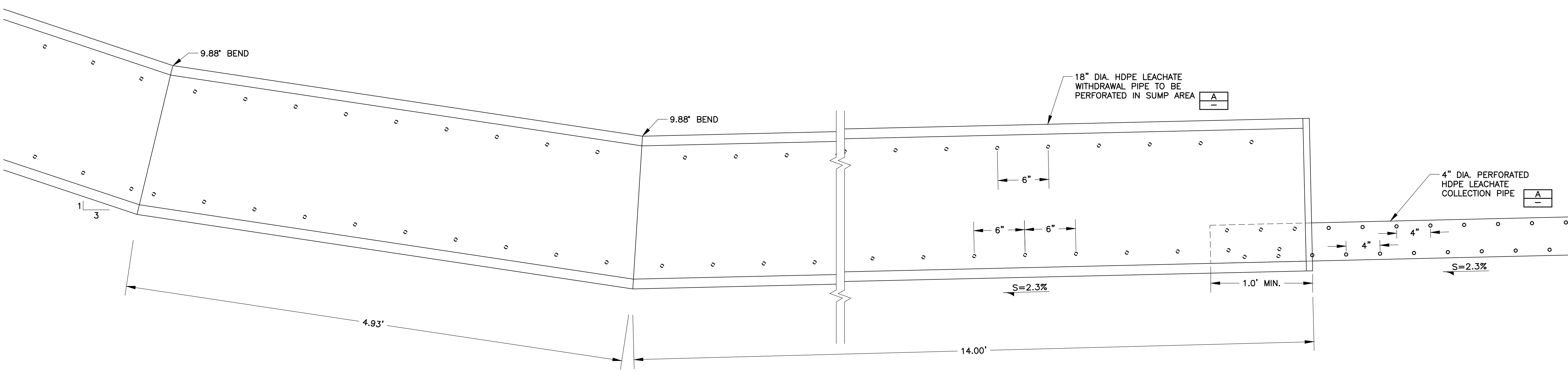


TYPICAL LEACHATE CONVEYANCE PIPE WRAP DETAIL C / LS-2

N.T.S.

NOTES:

1. 3/4" MINUS WASHED DRAIN ROCK TO BE PLACED AROUND PERFORATED HDPE LEACHATE COLLECTION. A MINIMUM COVER OF 6 INCHES TO BE PROVIDED OVER PIPES.
2. PERFORATED HDPE PIPE TO EXTEND ENTIRE LENGTH OF THE VALLEY OF EACH SUMP DRAINAGE AREA.
3. 18-INCH AND 4-INCH DIA. PERFORATED HDPE PIPES TO RECEIVE 4 ROWS OF 3/8-INCH DIA. PERFORATIONS STAGGERRED AS SHOWN. PERFORATIONS IN 18-INCH DIA. HDPE PIPE ONLY REQUIRED FOR THE PORTION OF THE PIPE WITHIN THE SUMPS. PERFORATIONS IN THE 4-INCH DIA. HDPE PIPE TO BE ALONG THE FULL LENGTH OF THE PIPE.



HDPE PIPE "TIE-IN" DETAIL B / LS-2

N.T.S.

FILE NAME: PROJECTS\064 - CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\WORKING\LS-3 LCRS DETAILS__R1.DWG
FILE DATE: 8.6.2018 11:45:47 (CAH)

10/07

HANSEN ALLEN & LUCE inc ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3					
DRAFTED CAH	2					
CHECKED GLJ	1					
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.	

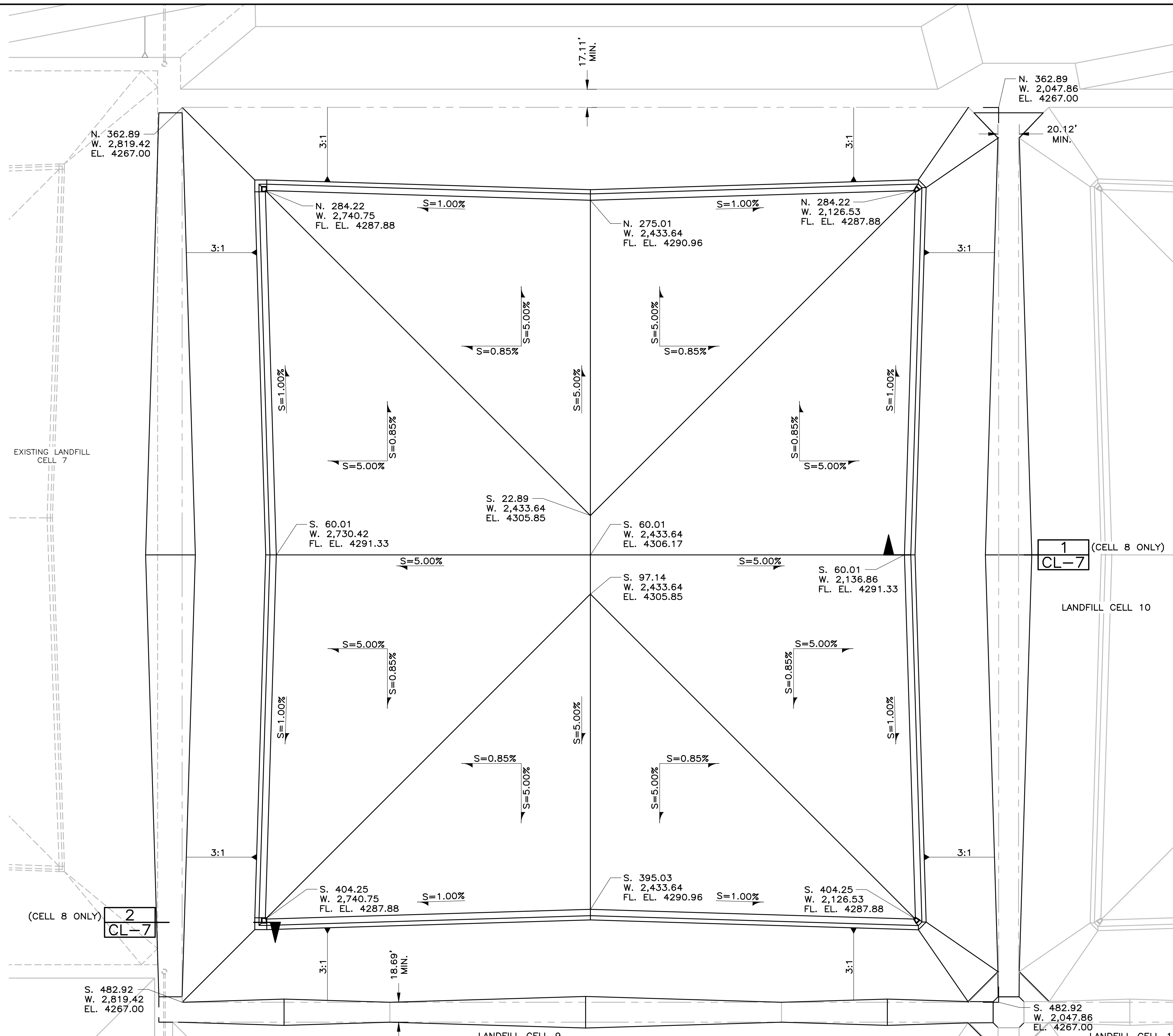
SCALE AS SHOWN

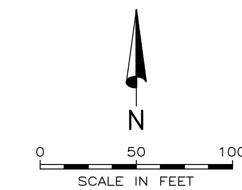
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13
LCRS
LCRS DETAILS

SHEET LS-3

064.85.100





NOTE:

COORDINATES & ELEVATIONS ARE TOP OF FINAL CLOSURE CAP SURFACE (TOP OF STONE MULCH).

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\CL-1 CELL 8 CLOSURE PLAN__R1.DWG
FILE DATE: 8.6.2018 11:47:04 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH
PROJECT ENGINEER

DESIGNED	KCS	3	
DRAFTED	CAH	2	
CHECKED	GLJ	1	
DATE	AUGUST 2018 REV 1	NO.	DATE / REVISIONS / BY / APVD.

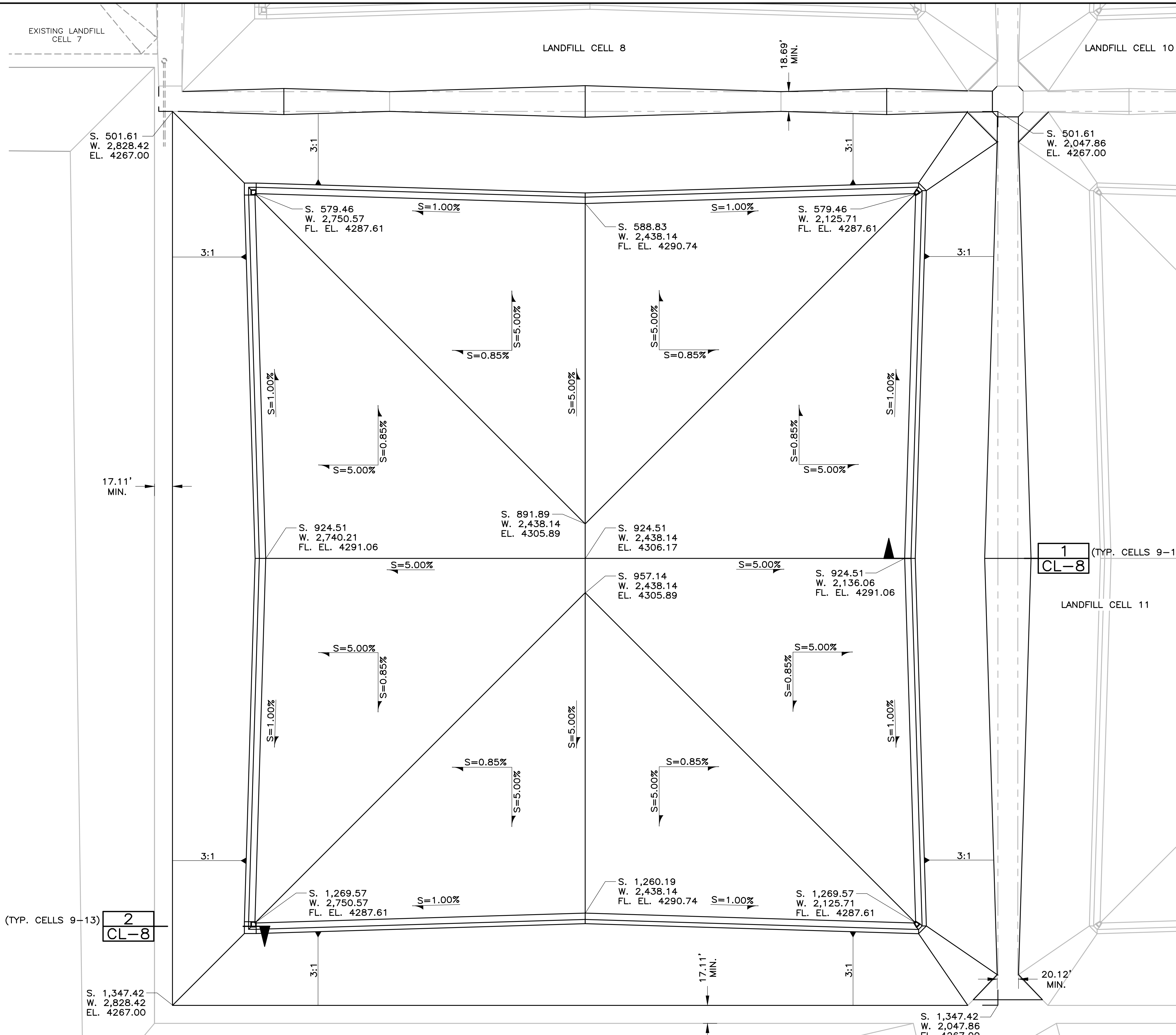
SCALE: NOT TO SCALE

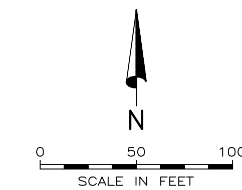
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13
CLOSURE
PLAN VIEW CELL 8

SHEET CL–1
064.85.100

10/07





NOTE:
COORDINATES & ELEVATIONS ARE TOP OF FINAL CLOSURE CAP SURFACE (TOP OF STONE MULCH).

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\CL-2 CELL 9 CLOSURE PLAN__R1.DWG
FILE DATE: 8.6.2018 11:50:50 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH
PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

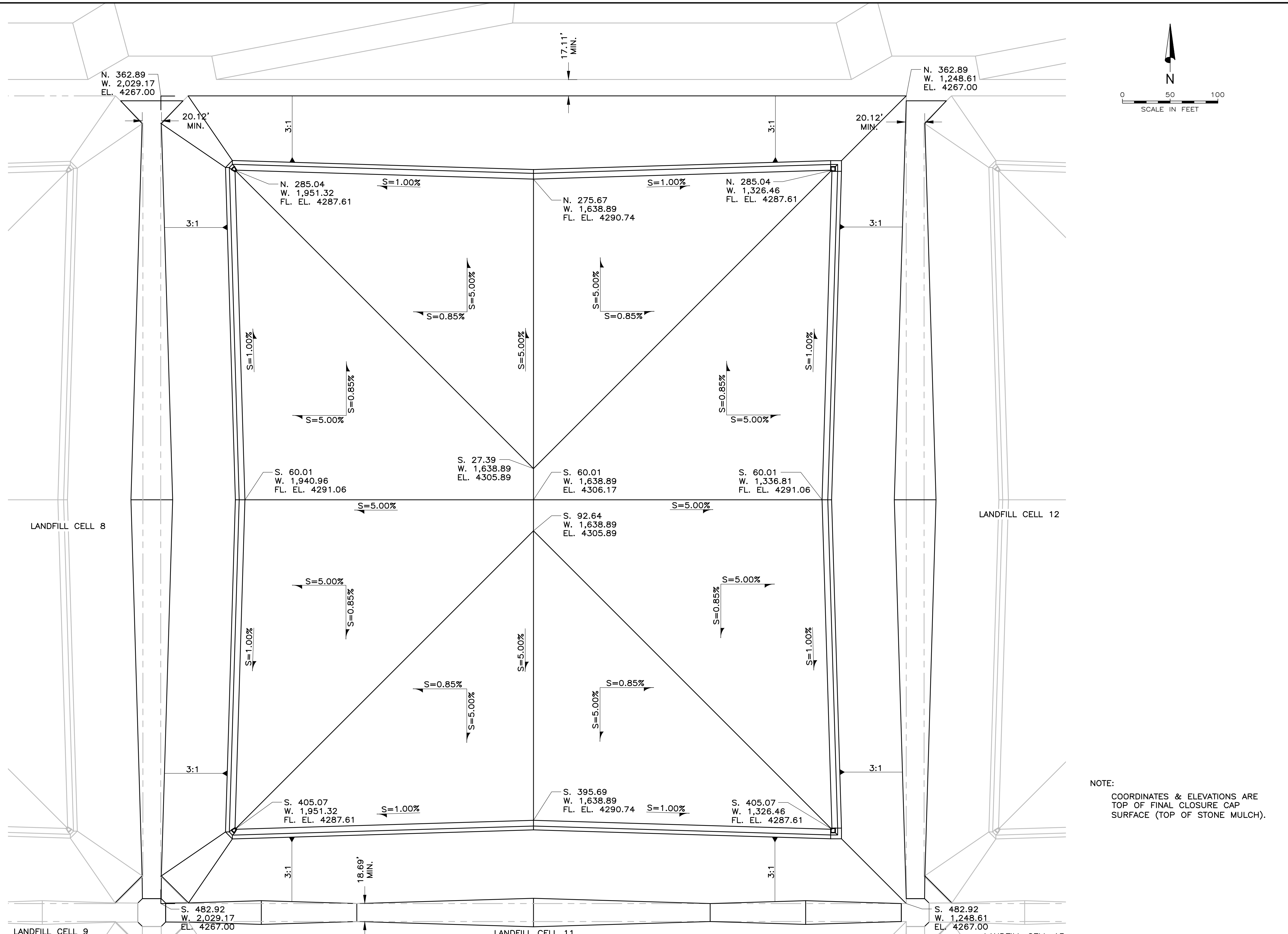
SCALE: NOT TO SCALE

CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13
CLOSURE
PLAN VIEW CELL 9

SHEET CL–2
064.85.100

10/07



NOTE:

COORDINATES & ELEVATIONS ARE TOP OF FINAL CLOSURE CAP SURFACE (TOP OF STONE MULCH).

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\CL-3 CELL 10 CLOSURE PLAN__R1.DWG
FILE DATE: 8.6.2018 11:51:43 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NOT TO SCALE

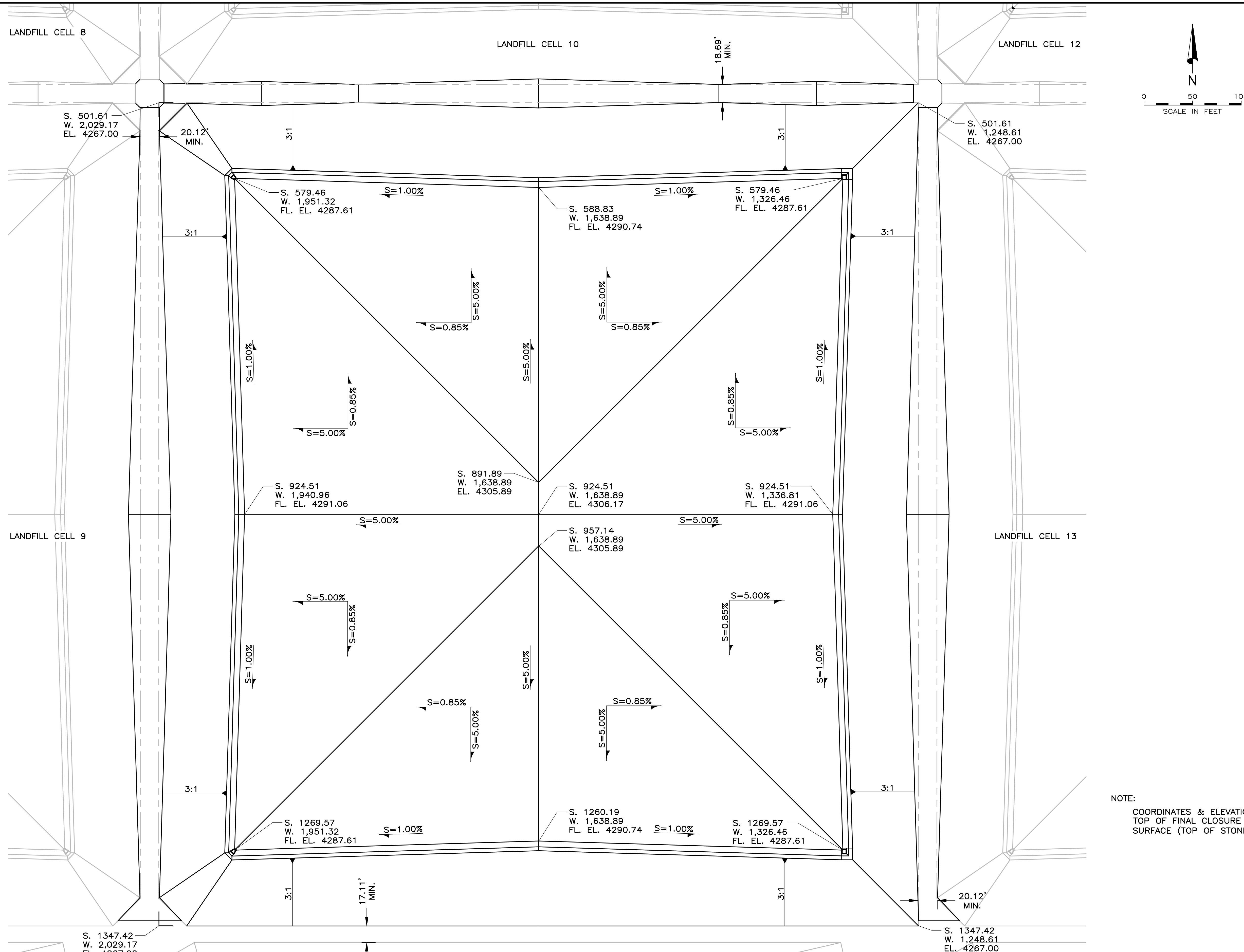
CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13 CLOSURE
PLAN VIEW CELL 10

SHEET CL–3

064.85.100

10/07



NOTE:

COORDINATES & ELEVATIONS ARE TOP OF FINAL CLOSURE CAP SURFACE (TOP OF STONE MULCH).

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\CL-4 CELL 11 CLOSURE PLAN__R1.DWG
FILE DATE: 8.6.2018 11:52:45 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH
PROJECT ENGINEER

DESIGNED	KCS	3				
DRAFTED	CAH	2				
CHECKED	GLJ	1				
DATE	AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NOT TO SCALE

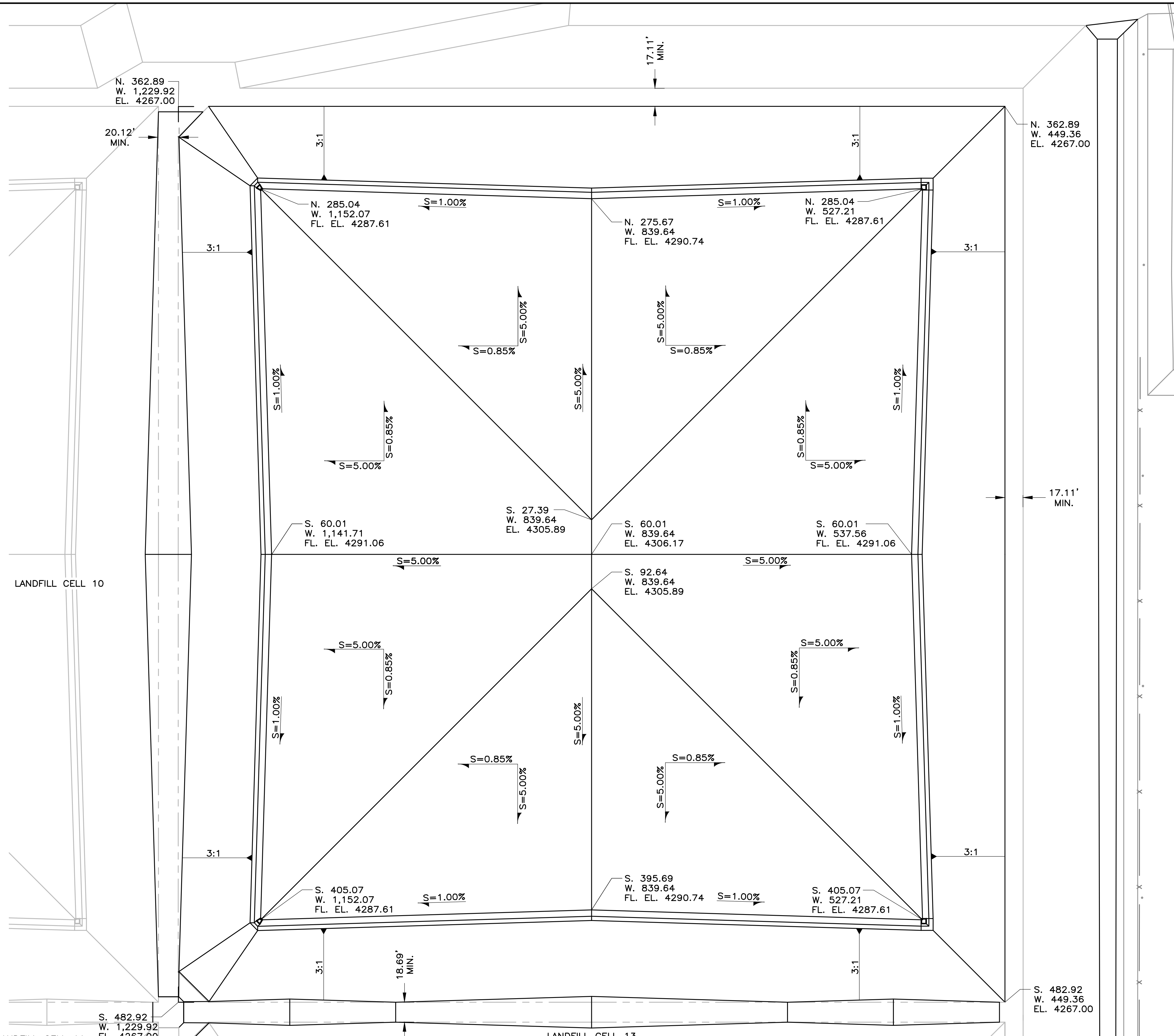
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

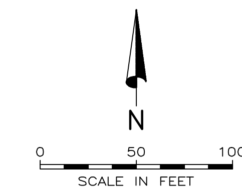
GRASSY MOUNTAIN FACILITY CELLS 8–13
CLOSURE
PLAN VIEW CELL 11

SHEET: CL–4

064.85.100

10/07





NOTE:

COORDINATES & ELEVATIONS ARE TOP OF FINAL CLOSURE CAP SURFACE (TOP OF STONE MULCH).

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\CL-5 CELL 12 CLOSURE PLAN__R1.DWG
FILE DATE: 8.6.2018 11:53:48 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER No. 5048470-2202 GORDON L. JONES 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NOT TO SCALE

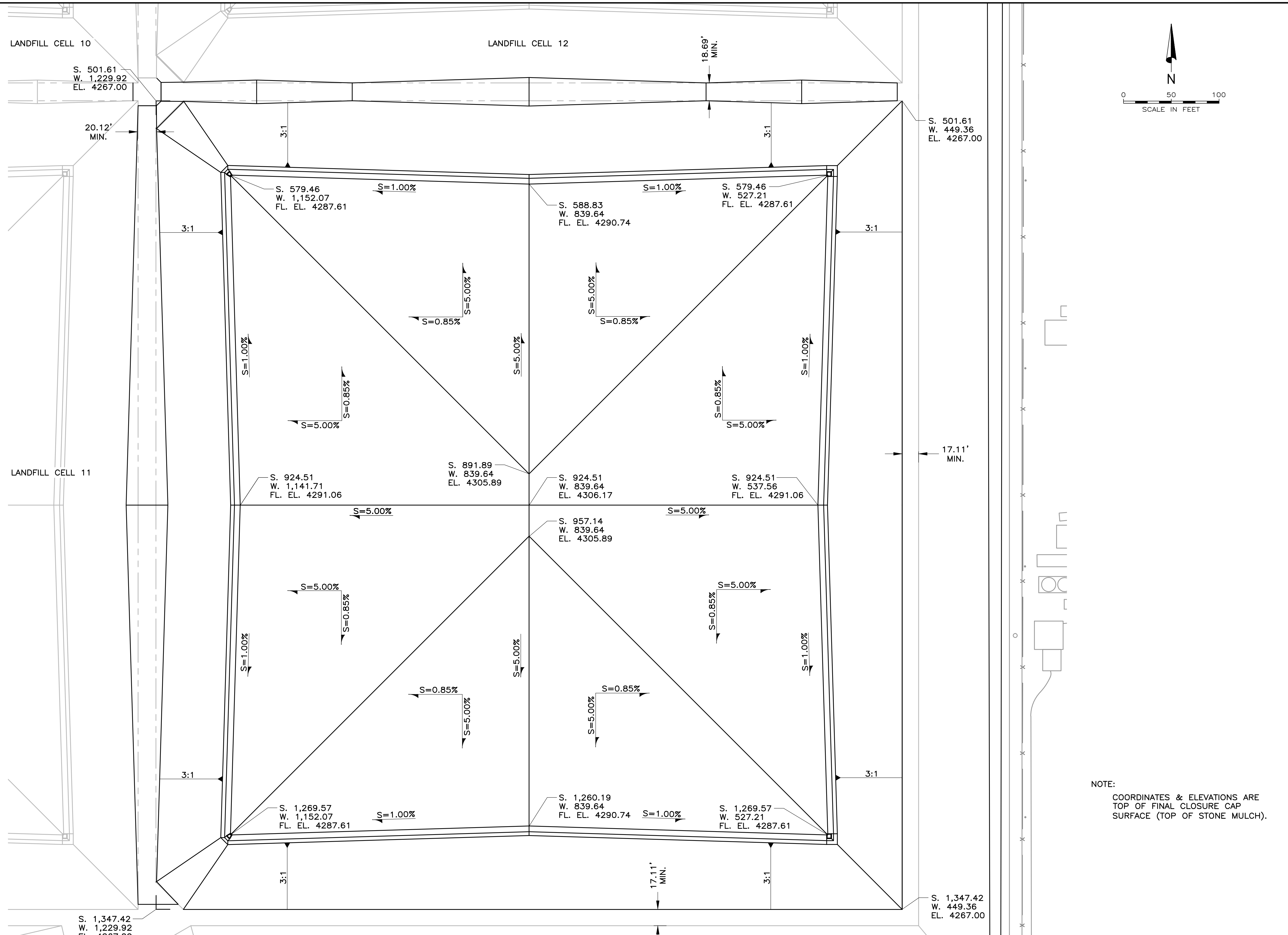
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13
CLOSURE
PLAN VIEW CELL 12

SHEET CL–5

064.85.100

10/07



NOTE:

COORDINATES & ELEVATIONS ARE TOP OF FINAL CLOSURE CAP SURFACE (TOP OF STONE MULCH).

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\CL-6 CELL 13 CLOSURE PLAN__R1.DWG
FILE DATE: 8.6.2018 11:54:59 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

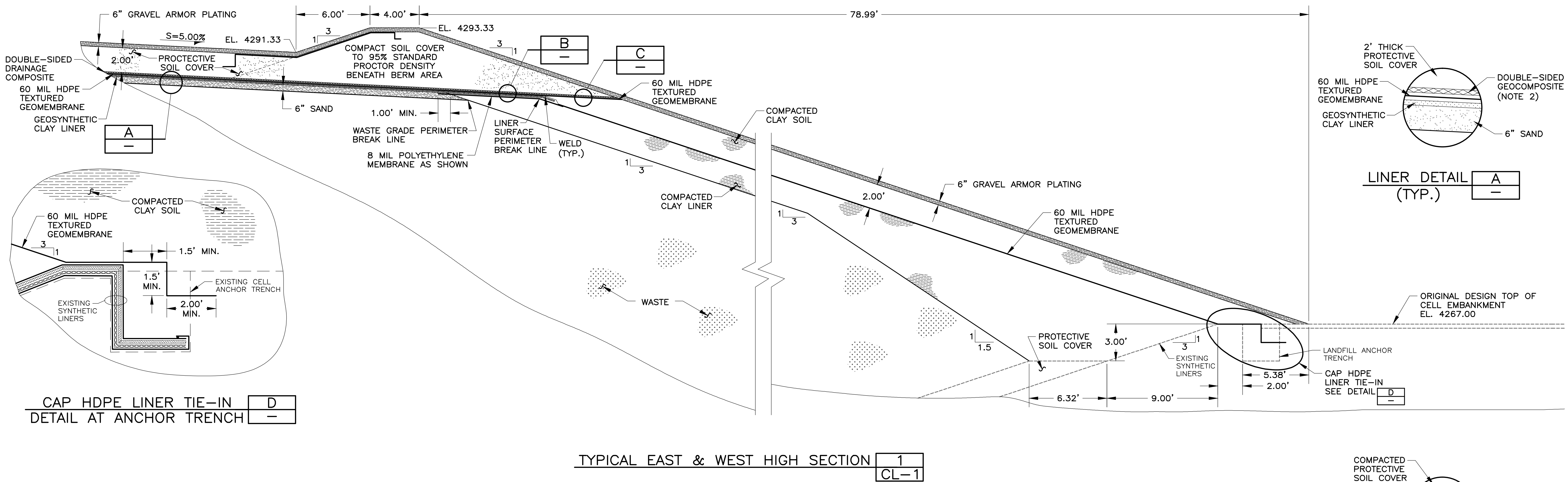
SCALE
NOT TO SCALE

CleanHarbors® ENVIRONMENTAL SERVICES, INC.

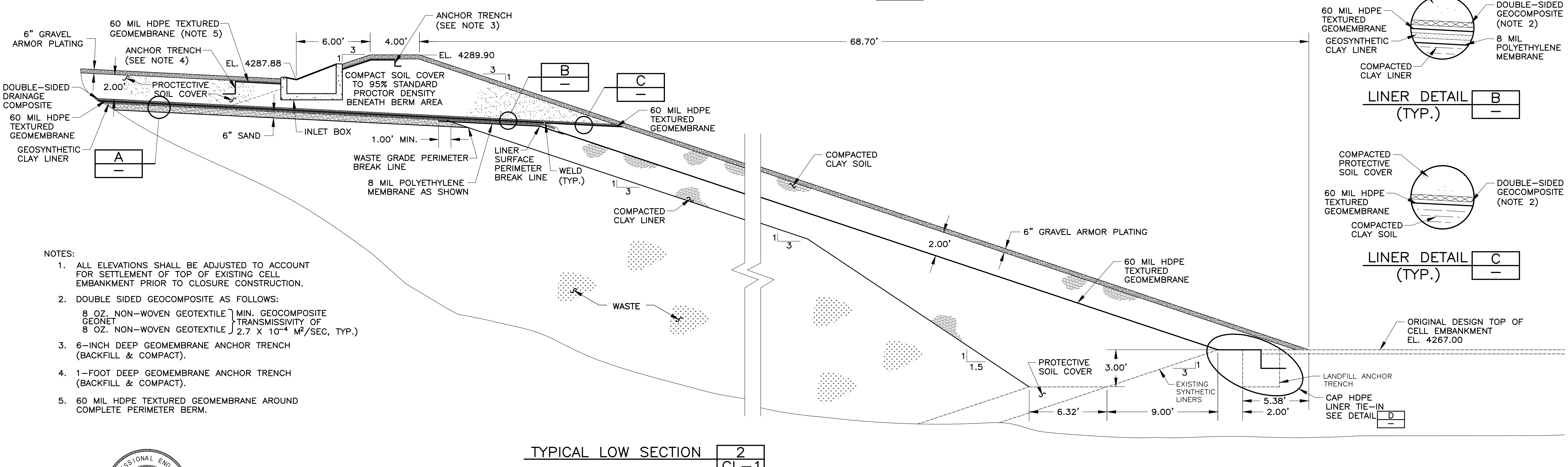
GRASSY MOUNTAIN FACILITY CELLS 8–13
CLOSURE
PLAN VIEW CELL 13

SHEET
CL–6
064.85.100

10/07



TYPICAL EAST & WEST HIGH SECTION 1 CL-1



NOTES:

1. ALL ELEVATIONS SHALL BE ADJUSTED TO ACCOUNT FOR SETTLEMENT OF TOP OF EXISTING CELL EMBANKMENT PRIOR TO CLOSURE CONSTRUCTION.
2. DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   8 OZ. NON-WOVEN GEOTEXTILE / GEONET / 8 OZ. NON-WOVEN GEOTEXTILE } MIN. GEOCOMPOSITE TRANSMISSIVITY OF 2.7×10^{-4} M^2/SEC, TYP.)
3. 6-INCH DEEP GEOMEMBRANE ANCHOR TRENCH (BACKFILL & COMPACT).
4. 1-FOOT DEEP GEOMEMBRANE ANCHOR TRENCH (BACKFILL & COMPACT).
5. 60 MIL HDPE TEXTURED GEOMEMBRANE AROUND COMPLETE PERIMETER BERM.

TYPICAL LOW SECTION 2 CL-1

FILE NAME: PROJECTS\064 - CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\WORKING\CL-7 HIGH LOW SECTIONS 8__R1.DWG
FILE DATE: 8.6.2018 11:55:53 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER No. 5048470-2202 GORDON L. JONES 8/6/2018 STATE OF UTAH
PROJECT ENGINEER

DESIGNED KCS	3					
DRAFTED CAH	2					
CHECKED GLJ	1					
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.	

SCALE NOT TO SCALE

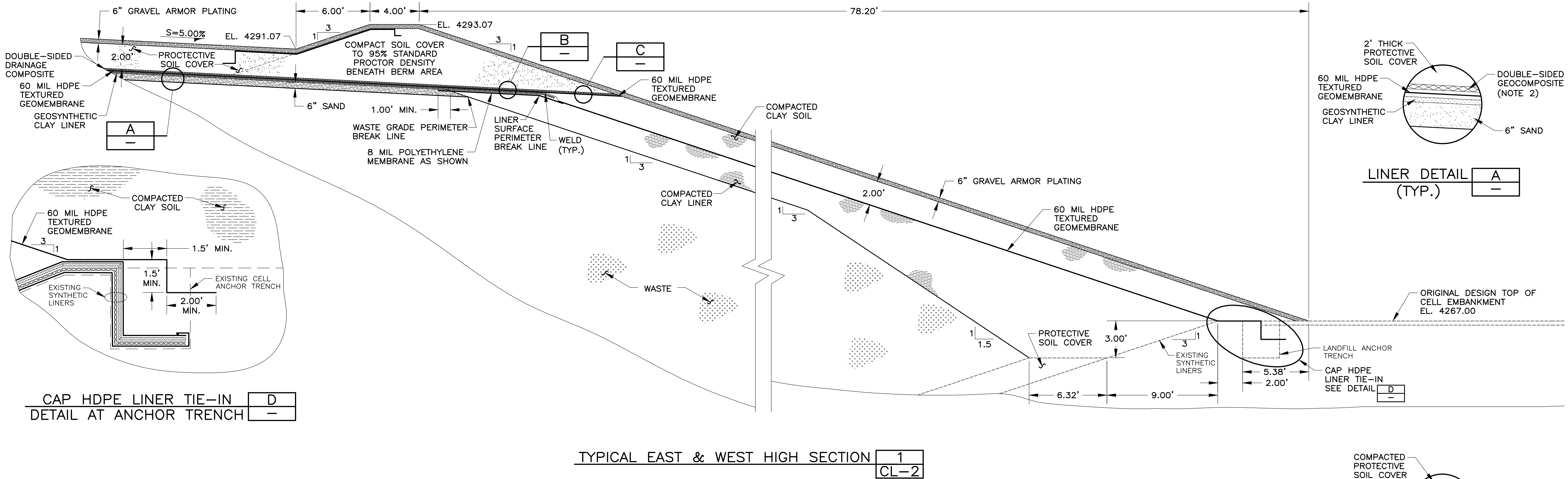
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

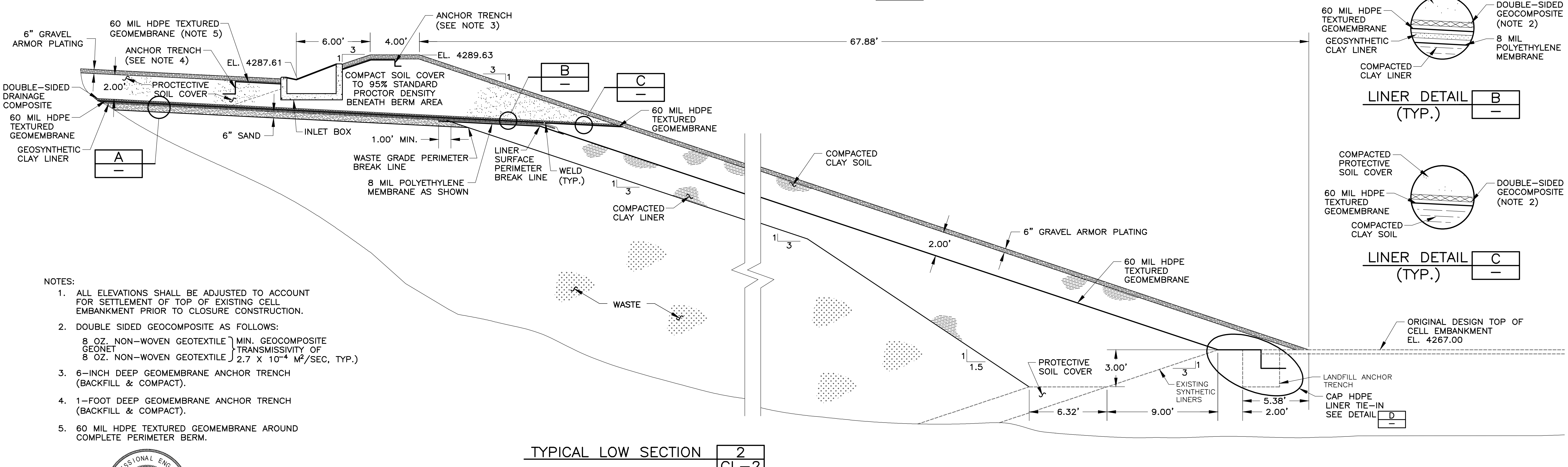
GRASSY MOUNTAIN FACILITY CELLS 8-13 CLOSURE
HIGH-LOW SECTIONS CELL 8

SHEET CL-7

064.85.100

10/07





NOTES:

1. ALL ELEVATIONS SHALL BE ADJUSTED TO ACCOUNT FOR SETTLEMENT OF TOP OF EXISTING CELL EMBANKMENT PRIOR TO CLOSURE CONSTRUCTION.
2. DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   8 OZ. NON-WOVEN GEOTEXTILE
   GEONET
   8 OZ. NON-WOVEN GEOTEXTILE
   } MIN. GEOCOMPOSITE TRANSMISSIVITY OF 2.7×10^{-4} M^2/SEC, TYP.)
3. 6-INCH DEEP GEOMEMBRANE ANCHOR TRENCH (BACKFILL & COMPACT).
4. 1-FOOT DEEP GEOMEMBRANE ANCHOR TRENCH (BACKFILL & COMPACT).
5. 60 MIL HDPE TEXTURED GEOMEMBRANE AROUND COMPLETE PERIMETER BERM.

FILE NAME: PROJECTS\064 - CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\WORKING\CL-8 HIGH LOW SECTIONS 9-13__R1.DWG
FILE DATE: 8.6.2018 11:56:51 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED	KCS	3			
DRAFTED	CAH	2			
CHECKED	GLJ	1			
DATE	AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY / APVD.

SCALE: NOT TO SCALE

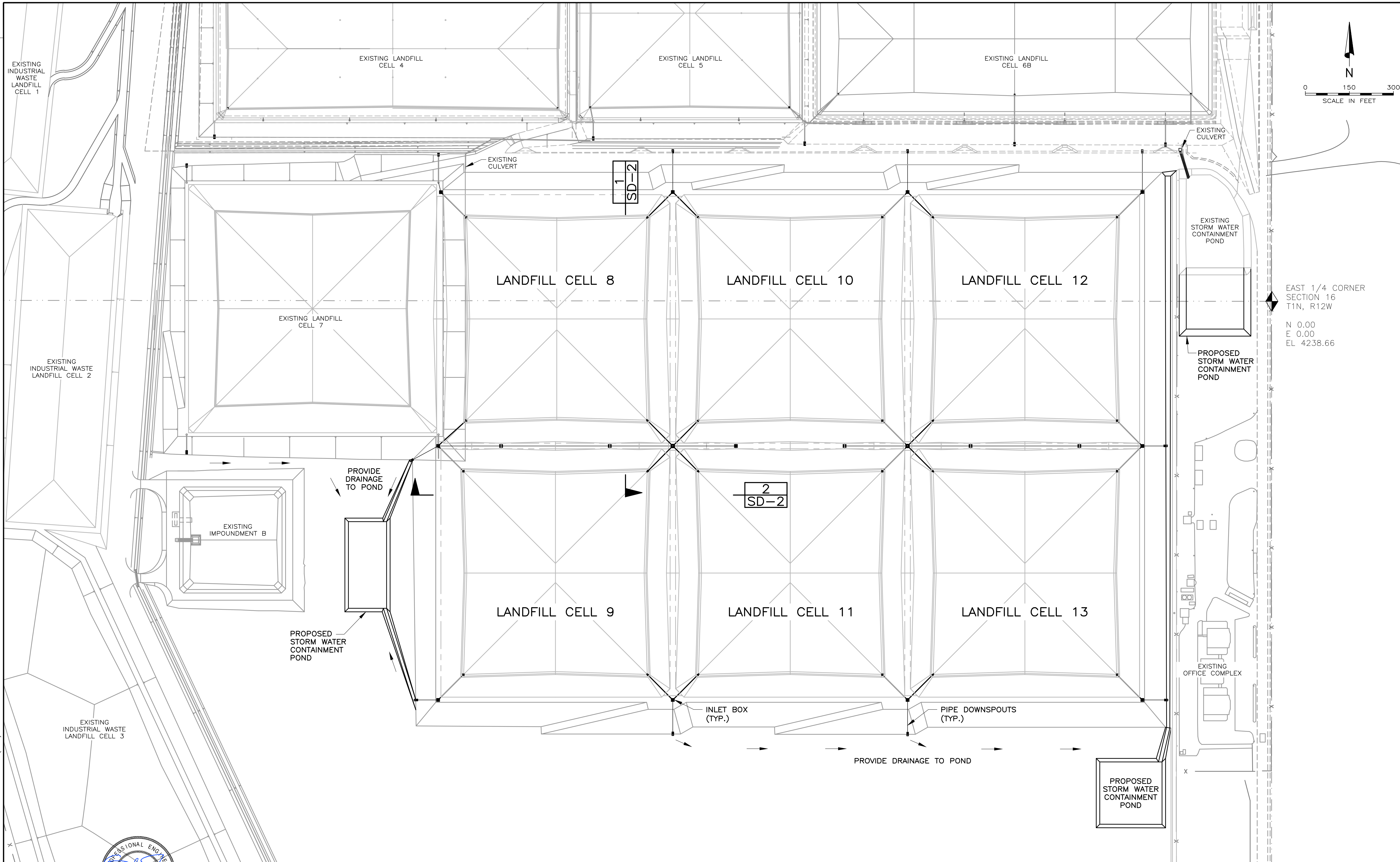
CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13 CLOSURE
HIGH-LOW SECTIONS CELLS 9-13

SHEET CL-8

064.85.100

10/07



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HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3					
DRAFTED CAH	2					
CHECKED GLJ	1					
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.	

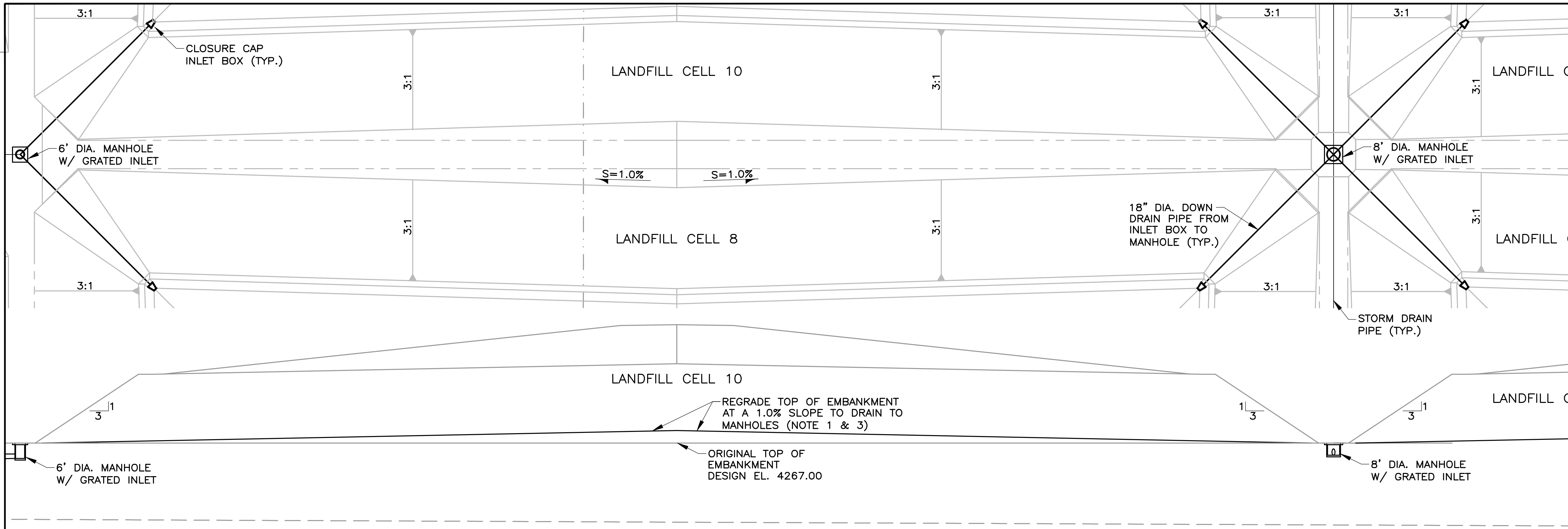
SCALE
NOT TO SCALE

CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13
STORM DRAIN
DRAINAGE PLAN

SHEET
SD-1
064.85.100

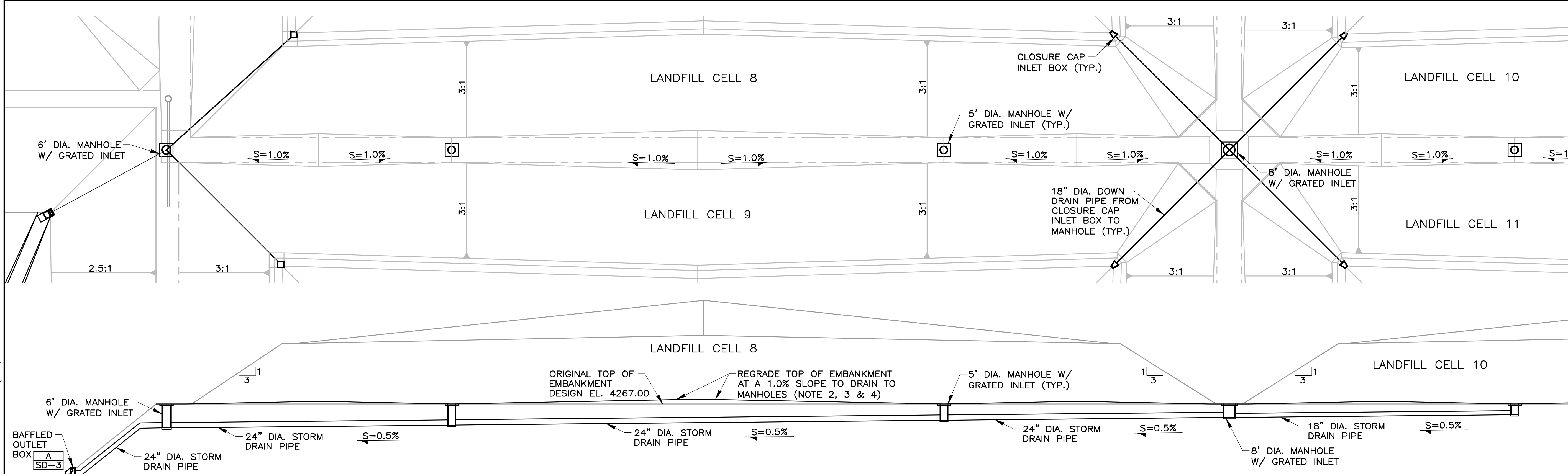
10/07



NORTH & SOUTH SECTION 1 / SD-1

NOTES:

1. TOP OF EMBANKMENT GRADING ON THE NORTH & SOUTH SECTION IS REPRESENTATIVE OF NORTH & SOUTH GRADING BETWEEN ALL CLOSURE CAPS.
2. GRADING AND STORM DRAIN PIPING ON EAST & WEST SECTION IS REPRESENTATIVE OF THE GRADING AND PIPING BETWEEN CELLS 10 & 11 AND 12 & 13.
3. GRADE TOP OF EMBANKMENT AT 1% SLOPE TOWARD MANHOLES UPON COMPLETION OF ADJACENT CLOSURE CAPS.
4. STORM DRAINAGE PIPE AND MANHOLES TO BE INSTALLED AT TIME OF CLOSURE WHEN ADJACENT LANDFILLS ARE MOSTLY FILLED AND DIFFERENTIAL SETTLEMENT HAS MOSTLY OCCURRED.



EAST & WEST SECTION 2 / SD-1

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FILE DATE: 8.6.2018 11:58:43 (CAH)

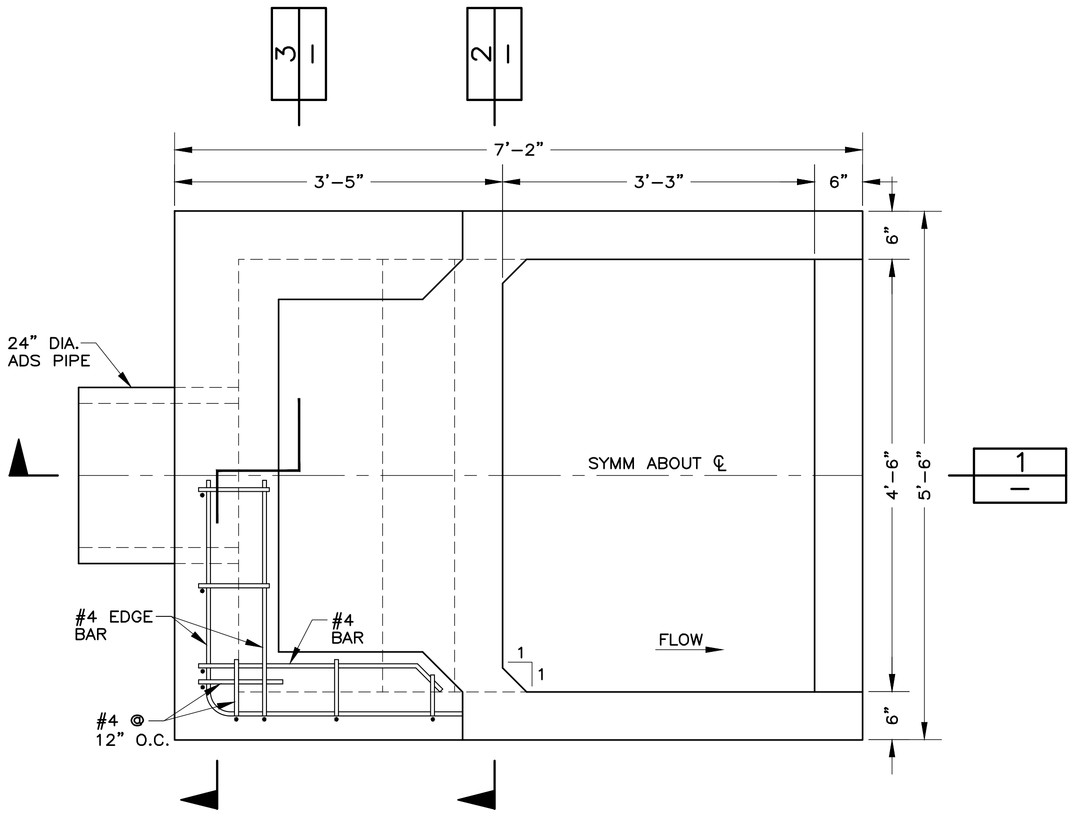
HANSEN ALLEN & LUCE INC ENGINEERS	PROFESSIONAL ENGINEER No. 5048470-2202 GORDON L. JONES 8/6/2018 STATE OF UTAH — PROJECT ENGINEER	DESIGNED KCS / DRAFTED CAH / CHECKED GLJ / DATE AUGUST 2018 REV 1	REVISIONS: 3, 2, 1 — NO. DATE BY APVD.	SCALE AS SHOWN

CleanHarbors ENVIRONMENTAL SERVICES, INC.

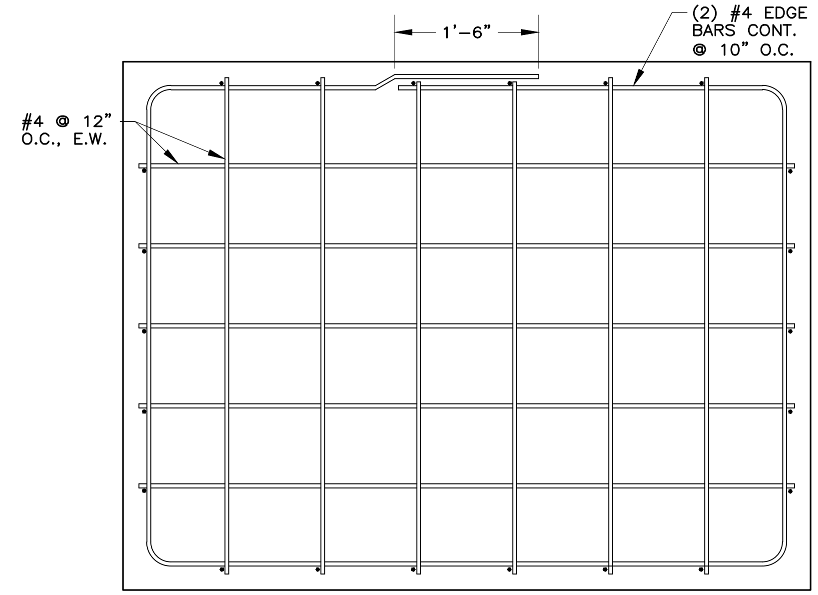
GRASSY MOUNTAIN FACILITY CELLS 8-13
STORM DRAIN
DRAINAGE SECTIONS

SHEET SD-2
064.85.100

10/07



PLAN VIEW A / SD-2
N.T.S.



SECTION 4
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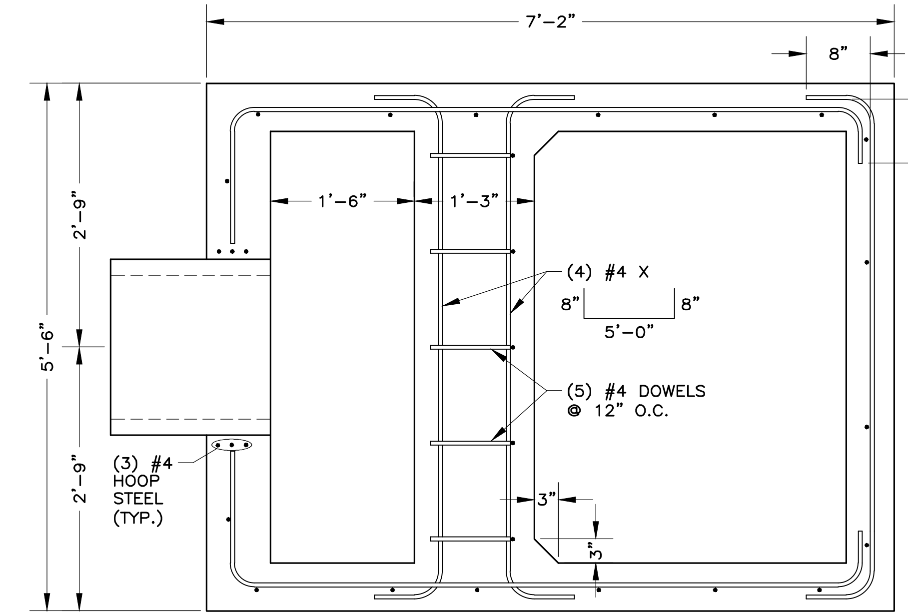

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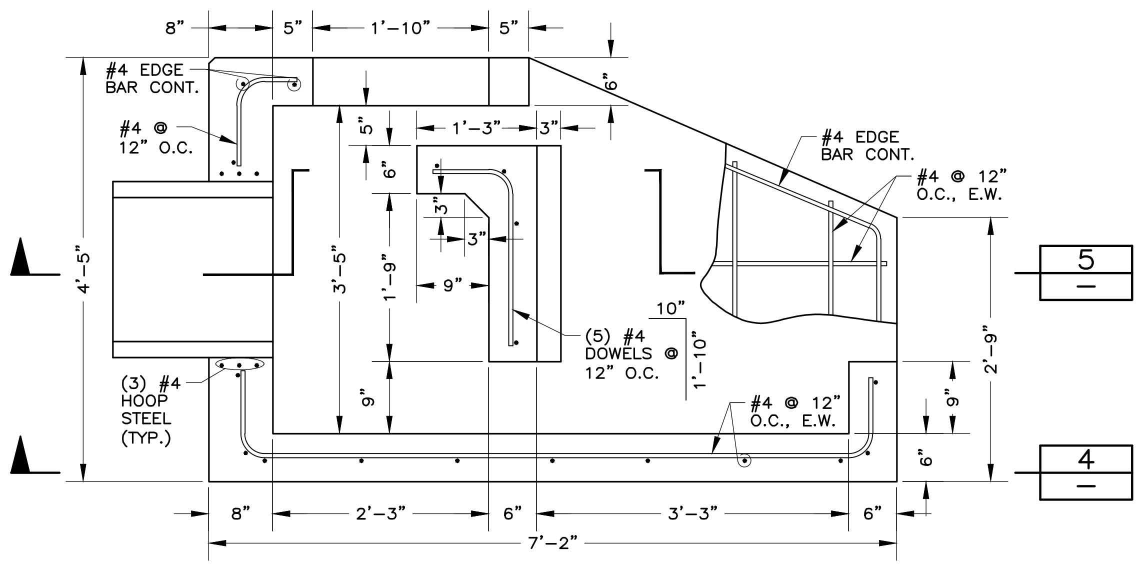
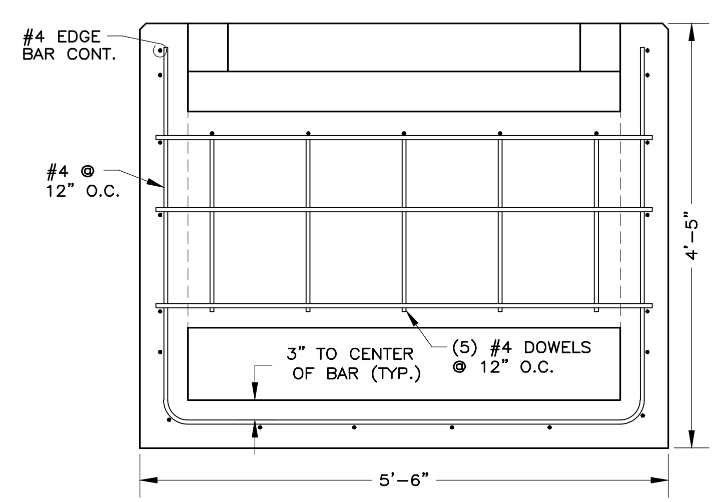
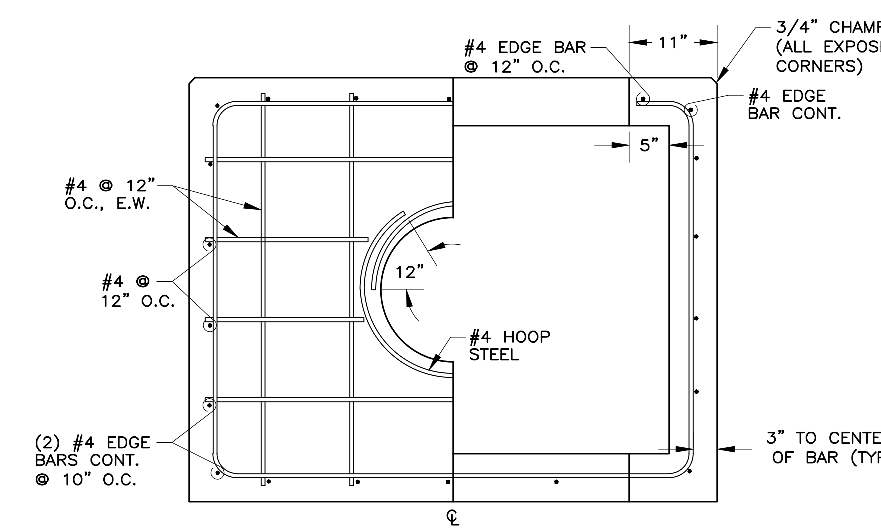


SECTION 1
N.T.S.



SECTION 2
N.T.S.



SECTION 3
N.T.S.

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FILE DATE: 8.6.2018 12:00:00 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 8/6/2018 STATE OF UTAH
PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE AUGUST 2018 REV 1	NO.	DATE	REVISIONS	BY	APVD.

SCALE

CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13
STORM DRAIN
BAFFLED OUTLET BOX

SHEET SD-3
064.85.100

10/07

APPENDIX B

Geotechnical Investigation
Cells 8 - 13
Grassy Mountain Facility
Tooele County, Utah

Prepared for:

Clean Harbors
2027 Independence Parkway
LaPorte, Texas 77571

Prepared by:

Applied Geotechnical Engineering Consultants, Inc.
Salt Lake City, Utah

AGEC
Applied GeoTech

GEOTECHNICAL INVESTIGATION

CELLS 8 - 13

GRASSY MOUNTAIN FACILITY

TOOELE COUNTY, UTAH

PREPARED FOR:

CLEAN HARBORS
2027 INDEPENDENCE PARKWAY
LAPORTE, TEXAS 77571

ATTENTION: FAIZUR KHAN

PROJECT NO. 1160276

NOVEMBER 16, 2017

TABLE OF CONTENTS

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FIGURES

APPENDIX

EXECUTIVE SUMMARY

1. In our professional opinion, the natural soils at the site are suitable for support of the proposed embankment and landfill disposal cells.

2. Exterior slopes of 2.5 horizontal to 1 vertical may be used for embankment construction. Interior slopes of 3 horizontal to 1 vertical may be used.

3. The natural on-site silty clay and silty sand to sandy silt materials are suitable for construction of the proposed embankment. The upper mud flat soils are suitable for the clay liner.

4. Stability analysis was performed for the proposed landfill configuration based on subsurface conditions encountered in explorations, laboratory testing and our understanding of the strengths of materials at the site. The results of the analysis indicate suitable safety factors for the proposed landfill cells.

5. Settlement analysis was performed for the proposed landfill cells considering the construction and closure of each sequential cell. Settlement at proposed embankments is established to be on the order of 105 inches and on the order of 140 inches in the central part of the cells after waste placement. Settlement profiles are presented in Appendix G.

6. Information obtained during the study and recommendations for geotechnical aspects of the proposed construction including subgrade preparation, materials and compaction are included in the report.

SCOPE

This report presents the results of a geotechnical study for the proposed Landfill Cells 8 through 13 at the Grassy Mountain Facility in Tooele County, Utah. The site is located in the east-central portion of Section 16, Township 1 North, Range 12 West, Salt Lake Base and Meridian in Tooele County, Utah. Our services are provided in general accordance with proposals dated June 4, 2016 and April 4, 2017.

Geotechnical investigations have been conducted at the Grassy Mountain Facility for Landfill Cells 1 through 7, A, X, Y and Z, along with Industrial Waste Cells 2 and 3. Geotechnical investigations have also been conducted for the other facilities at the Grassy Mountain Facility, which are included within Section 16. The previous geotechnical investigations conducted for Landfill Cells 1 through 5, X and Y were conducted by Chen and Associates, Inc. and Chen-Northern, Inc. The Cell 6, 7 and Z investigations were conducted by Applied Geotechnical Engineering Consultants, Inc. The Cell A investigation was conducted by Kleinfelder. Subsurface exploration and laboratory testing were previously conducted in the land treatment area, in which the proposed surface impoundment is located.

A report was provided previously by AGEC for Surface Impoundment B and is dated April 12, 2017 under Project No. 1160276A.

This report has been prepared to summarize the data obtained, to present our conclusions and recommendations based on the subsurface conditions encountered and the proposed construction for Cells 8 through 13. Construction considerations related to the geotechnical engineering aspects of the facility are included.

SITE CONDITIONS

The Grassy Mountain Facility consists of landfill cells and an office/laboratory complex.

The ground surface in the area of the proposed landfill cells is relatively flat and has a gentle downward slope to the east.

The site of the future landfill cells consists of an area that was previously a portion of the land treatment area used to spread and treat contaminated hydrocarbons. This process has since been abandoned and the contaminated soil removed.

Landfill Cell 7 is located along the west end of the north portion of the future landfill cell area. Landfill Cells 4, 5 and 6 are located along the north side. There is a storm water containment pond to the east at the north end of the area that extends to a depth of approximately 7 feet below the adjacent ground surface and has 3 horizontal to 1 vertical side slopes. The former land treatment area extends to the south and to the west of the south portion of the area. There is an office building and parking area for the facility on the east side of the south end of the proposed landfill cells.

Vegetation at the site consists of grass and weeds.

FIELD STUDY

The subsoil conditions in the area proposed for Landfill Cells 8 through 13 have been investigated during this and during previous studies. The locations of borings drilled and cone penetration tests performed in the area of the proposed Landfill Cells 8 through 13 and the proposed surface impoundment are shown on Figure 1. Listed below is a summary of the explorations in the area of proposed Landfill Cells 8 through 13 and the proposed surface impoundment including the dates of the explorations and project numbers.

Boring or CPT	Date of Exploration	Project Number
Borings L-2, L-6, L-8, L-10, L-12, L-14, L-15, L-17 and L-19	April 1992	AGEC #20591
CPTs L-3, L-5, L-7, L-9, L-11, L-13, L-14, L-16, L-18 and L-20	April 1992	AGEC #20591
CPTs L-32, L-33 and L-34	August 1995	AGEC #45995
Borings B-1A, B-2A, B-3A, B-1B, B-2B, B-3B and B-4B	August 2016	(this study)

Borings L-2, L-6, L-8, L-10, L-12, L-14, L-15, L-17 and L-19 were drilled using 8-inch diameter hollow stem auger. Locations of cone penetration test soundings designated by X's on Figure 1, were obtained using standard cone penetration test equipment. Borings B-1A, B-2A, B-3A, B-1B, B-2B, B-3B and B-4B were drilled using direct-push methods.

Borings were logged and samples obtained by engineers from AGEC. Logs for Borings B-1A, B-2A, B-3A, B-1B, B-2B, B-3B and B-4B are presented on Figures 2 through 7 with Legend and Notes on Figure 8. Logs of the other borings designated with "L" are included in Appendix A-1. The results of CPT soundings are included in Appendix A-2.

Water levels were measured several weeks after drilling Borings B-1A, B-2A and B-3A and B-1B through B-4B. Following the water level measurements, the borings were abandoned by introducing bentonite grout into the bottom of the boring and pumping grout to fill the boring. The following notes relate to the abandonment of these borings:

Boring Number	Boring Depth (feet)	Date Grouted	Theoretical Volume (ft^3)	Approximate Volume of Grout Placed (ft^3)	Notes
B-1A	40	9/7/2016	3.1	4½	Grout placed with tremie pipe
B-2A	40	9/7/2016	3.1	4½	Grout placed with tremie pipe
B-3A	100	10/11/2016	7.7	11½	Grout placed with tremie pipe
B-1B	100	10/11/2016	7.7	11½	Grout placed with tremie pipe
B-2B	100	10/11/2016	7.7	9½	Grout placed with tremie pipe
B-3B	100	10/13/2016	34.9	35	Boring re-drilled with 8-inch HSA. Grout placed through auger with tremie pipe
B-4B	100	10/11/2016	7.7	9½	Grout placed with tremie pipe

Notes:

1. Grout was pumped through a tremie pipe in each boring until grout was observed at the surface of the bore hole. Additional grout was pumped in stages as the tremie pipe was removed.

2. The initial portion of the bentonite grout was diluted by the groundwater in the bore hole as the grout displaced the water to the surface. Several additional cubic feet of grout were pumped in each boring, as needed, to ensure that undiluted grout extended to the ground surface. This resulted in a larger grout volume pumped than the theoretical volume.

Borings and CPT soundings from previous studies at the site were backfilled with bentonite at the time of the earlier studies.

LABORATORY TESTING

Laboratory testing was conducted (during this study and previous studies) for the land treatment area to identify the engineering characteristics of the soil obtained from the exploratory borings. Laboratory testing conducted during the study includes natural moisture content, natural dry density, Atterberg Limits, grain size distribution, strength and consolidation. The test results are shown on Figures 9 through 24 and summarized on Table I . Results of laboratory testing from previous studies in the area and adjacent areas are included in Appendix A-3.

Samples obtained from the exploratory borings were examined and classified in the laboratory by the project engineer.

A discussion of the laboratory testing procedures is presented below. The testing procedures are primarily those of the American Society for Testing and Materials (ASTM).

Index Properties - The Unified Soil Classification System (ASTM D-2487) was used to classify the soil. This system is based on index property tests including the determination of natural water content (ASTM D-2216), liquid and plastic limits (ASTM D-4318) and grain-size distribution (ASTM D-422). Results of the moisture content, dry density, Atterberg Limits and percentage of soil passing the No. 200 sieve are presented on Table I.

Consolidation - Consolidation tests (ASTM D 2435) were performed during this and earlier investigations. Consolidation test samples were prepared and placed in a consolidometer ring between porous disks. An initial seating load of 250 or 500 pounds per square foot (psf) was placed on the sample. The sample was then loaded to 1,000 psf, saturated with water and the percent of change in sample thickness was measured with a dial gauge. Additional load increments were applied to the sample as indicated on the consolidation test results. In some cases, the loads were reduced to measure the rebound portion of the consolidation curve. Results of consolidation tests are presented on Figures 9 through 21.

Uniaxial Compressive Strength - Unconfined compressive strength testing was conducted on samples of soil (ASTM D-2166). Each sample was prepared by cutting the ends of the specimen parallel to each other and at right angles to the longitudinal axis of the soil sample. The load was applied continuously and without shock to produce a constant range of deformation until failure occurred. The axial deformation during the tests is recorded. Results of the unconfined compressive strength testing are included on Table I and on the boring logs.

Triaxial Compression - Triaxial compression tests were conducted in general accordance with ASTM D-4767. Samples were prepared by trimming the ends perpendicular to the sample axis and placing it in a latex membrane. The prepared sample was placed in the triaxial cell and was saturated using back pressure saturation. Testing consisted of applying consolidation loads of 1, 2 and 4 ksf and loading the samples to near failure for each load (staged test) or beyond failure for each load (unique point test). Sample strains, loads and pore pressures were monitored throughout each test. Test results are shown on Figures 22, 23 and 24.

SUBSURFACE CONDITIONS

Subsurface conditions at the site were determined by drilling exploratory borings and performing cone penetration tests. Since the subsurface soils consist of multiple layers of silt, sand and clay, the cone penetration tests provided a more detailed subsurface profile.

Based on the explorations, the subsoil profile generally consists of approximately 19 feet of clay to sandy clay overlying interlayered sand, silt and clay. The interlayered sand, silt and clay extends to the maximum depth investigated, which was approximately 250 feet.

Deeper exploration near the proposed cell indicates layers and lenses of clay and sand to a depth of at least 300 feet. A seismic reflection study conducted at the facility indicates a reflective layer at a depth of approximately 520 feet. This reflective layer could be materials that are more consolidated than the upper soils.

Using the reflection study results and more recent shear wave velocities, we have estimated that dense gravels would be encountered at a depth of approximately 380 feet below the ground surface in the area of Cells 8 to 13. We have estimated that bedrock would be encountered at a depth of approximately 600 feet.

The natural clay was found to be interlayered with thin sand and silt layers. Consistency of the clay ranged from very soft to hard. Moisture content of the clay ranged from slightly moist near the ground surface to wet at the water level and deeper. Color ranged from light to olive brown and gray.

The interlayered clay and silty sand had a consistency and density ranging from soft to medium stiff and very loose to medium dense. The soil contains occasional cemented layers. The soil is very moist to wet and olive brown to gray color.

The engineering characteristics of the soils were tested during this and earlier investigations. These parameters have been reviewed and are incorporated into our analysis to estimate the behavior of the soil for the proposed landfill cells.

SUBSURFACE WATER

Water was encountered in all of the borings and cone penetration test holes at the time of the investigations. Water levels measured within the borings are shown on the logs. From the borings, the water level is estimated to be between approximate elevation 4231 and 4232 feet.

PROPOSED CONSTRUCTION

Plans provided show Landfill Cells 8 through 13 each having dimensions similar to Landfill Cell 7 and sharing common embankments (see Figure 1). Each cell will have plan dimensions on the order of 800 feet by 800 feet. Profiles provided show exterior embankment slopes of 2½ horizontal to 1 vertical and interior slopes of 3 horizontal to 1 vertical. The top of the embankments are shown at elevation 4267 feet, which is the same as the design elevation of Landfill Cell 7 and approximately 29 feet above the original ground surface. Embankment crest widths are shown at 20 feet. The lowest points in the interior of the cell will be at the floor sumps which will have elevations of approximately 4242 at the top of the clay liner. Ramps will provide access to the cells at slopes of 10 percent.

The waste mounding is shown with a 3 horizontal to 1 vertical slope from the top of the embankment to approximately elevation 4293 feet. Above the 3 horizontal to 1 vertical slope, the cell cap slopes up at 5 percent to a maximum elevation of 4306 feet. A copy of the profiles provided and considered in the geotechnical analysis including details of the planned liner systems and entry ramps are included in Appendix B.

SEISMICITY AND LIQUEFACTION

A. Seismicity

A bedrock peak horizontal ground acceleration (PGA) of 0.15g was used for our seismic analysis considering a seismic event with a 90 percent probability of not being exceeded in a 250 year period (Petersen et al., 2008). Soil response to the bedrock acceleration was evaluated using the computer program "SHAKE". The results of this analysis are included in Appendix H. Based on the results of the soil response analysis, a horizontal seismic load coefficient equal to the PGA of 0.18g was used for our analysis.

B. Liquefaction

The liquefaction hazard at the site was evaluated based on cone penetration (CPT) soundings conducted at the site in 1992 and 1995. The results of the analysis indicate that some soil layers at the site are susceptible to liquefaction during the design seismic event.

Settlement resulting from liquefaction was analyzed based on available CPT data from the locations indicated on Figure 1. The printouts of the analysis and supporting documents are included in Appendix I.

The liquefaction assessment indicates the following settlement due to liquefaction from a seismic event having a 90 percent probability of not being exceeded in 250 years.

CPT	Liquefaction-Induced Settlement (inches)
L-1	3½
L-3	1½
L-5	1
L-7	1½
L-9	1½
L-11	4½
L-13	1½
L-14	1½
L-16	3
L-18	2
L-20	3½
L31	½
L32	½
L33	½
L34	½

Based on our analysis, we estimate that settlement from liquefaction will be on the order of ½ to 4½ inches for the design seismic event. It is our opinion that the settlement resulting from liquefaction is small compared to the expected settlement from consolidation and would be within acceptable tolerances for a landfill.

STABILITY

Static and dynamic (pseudostatic) analysis of the landfill cells, closure caps and critical interfaces were conducted using the configurations presented in Appendix B.

A. Soil Profile

The soil profile used in the stability analysis was defined from the information obtained from cone penetration tests, exploratory borings and laboratory test results. Material types consist of lean clay to sandy lean clay from the ground surface down to a depth of 19 feet and interlayered silty sand and sandy lean clay below 19 feet.

B. Moisture Conditions

Free water was measured during the field exploratory program at an elevation of approximately 4231 to 4232 feet. The free water level was assumed to be at an elevation of approximately 4234 for the stability analyses. This level is not necessarily the high water level, but was used as a conservative level in the analysis.

The potential of water entering the embankment would be limited to surface infiltration from the exterior portion of the embankment. The interior portion of the embankment will be covered with clay and impervious synthetic liners. With this condition, the embankment was evaluated assuming drained conditions. The natural soils were evaluated for both an undrained and drained condition.

C. Tension Cracking

The potential of tension cracking within the embankment was evaluated assuming that fine-grained soil will be used to construct embankments. Calculations indicate with the stiff, upper, natural soils, the critical height of embankment above which tension cracking would begin is 36 feet. Based on this information and the settlement behavior of embankments on soft foundation soils, tension cracking is not expected to occur and will therefore not influence the stability of the proposed embankment. Calculations for tension crack estimates are presented in Appendix D.

D. Seismic Considerations

Based on the results of a soil response analysis, a PGA of 0.18g was used at the ground surface for stability analysis. This PGA value was used for the seismic coefficient in the pseudostatic stability analysis. This is a conservative approach, since a seismic coefficient on the order of one-half of PGA for pseudostatic stability analysis provides a more representative result. Simplified deformation analysis was performed where the safety factor obtained from the pseudostatic analysis was near or below 1.3. The simplified deformation analysis was performed using methods presented by Bray and Travasarou (2007).

E. Strength Parameters

1. <u>Soil Strength</u>

Strength parameters for use in the stability analysis were determined from the field and laboratory test results conducted for this and previous studies. The testing consisted of unconfined compressive strength tests, triaxial compression tests, direct shear tests, pocket penetrometer tests and Torvane tests. Based on these results, a profile of strength parameters versus depth was developed. The strength parameters are presented in Appendix C.

Strength parameters for the embankment fill and clay liner materials were reviewed from previous investigations. The strength parameters used in this investigation are consistent with those used during earlier investigations. Verification testing of embankment material placed in Landfill Cell No. 2 has been conducted and indicates that the strength parameters used for the stability analysis are conservative.

2. Waste Strength

We have assumed the waste to have a cohesive strength of 100 psf and a friction angle of 25 degrees, which is consistent with the values previously used for evaluation of the existing landfill cells at the site.

Based on a discussion with the landfill operator we understand that the waste placed in Landfill Cells 6 and 7 has consisted of the following:

Waste Material	Fraction
Soil Type Waste	60 to 70 percent
Steel (Pipe, Drums etc.)	15 to 20 percent
Wood, Paper, Plastics etc.	15 to 20 percent

We understand that waste has been placed with a Caterpillar D7 dozer and compacted with a Caterpillar 825 sheepsfoot compactor.

The waste characteristics for hazardous waste landfills are difficult to establish. However, information related to municipal solid waste landfills has indicated a cohesive strength of 300 psf and friction angle of 36 degrees may be typical for waste landfills of similar composition (Bray et al., 2009). In our professional opinion, it is likely that the hazardous waste materials described as having been placed in Landfill Cells 6 and 7 have strength properties similar to or greater than municipal solid waste. Therefore, the strength parameters used in stability analysis should be conservative.

F. End of Construction

With the silty sand to sandy silt used for embankment construction, the strength parameters for both end-of-construction and long term conditions for the embankment were assumed to be in a drained condition, thus, both friction and cohesive strength parameters of the material were used to resist sliding.

During construction of Landfill Cell 2, pore pressures were measured in the foundation soils at shallow depths to determine excess pore pressure build-up and rate of dissipation. During placement of the embankment, it was observed that the pore pressure increase in the foundation soils was small with respect to fill load placed. The excess pore pressures dissipated fairly rapidly. Based on this, the stability of the embankment and cell during construction and filling is adequate.

G. Stability Calculations and Results

A slope stability analysis computer program, Slide 7.0, developed by Rocscience, was used for the analysis except for the interface stability analysis, which was performed using hand calculations. The Spencer method was selected for the analysis. Factors of safety were calculated for the overall landfill cell profile where the failure was allowed to extend through the cell and into the subsurface soil. A typical profile was evaluated as well as a profile for Cell 13 adjacent to the runoff pond.

Overall Stability - Long Term Static - Stability calculations provide a safety factor under long-term static conditions of 2.1 for the typical section and 2.0 for the section adjacent to the runoff control pond. The stability calculation printouts are presented in Appendices E-1 and E-2.

Overall Stability - Long Term Seismic - For the seismic long term condition, the safety factor is calculated to be 1.3 for the typical section and 1.1 for the section adjacent to the runoff control pond (east side of Cell 13). Stability calculation printouts are presented in Appendices E-3 and E-4.

Simplified deformation analysis based on Bray and Travasarou (2007) indicates deformation of 2½ and 3½ inches under seismic conditions for the typical landfill profile and the profile adjacent to the runoff pond, respectively. Small amounts of deformation are predicted based on this analysis, even though the design PGA does not exceed the yield acceleration due to the method being based on spectraL accelerations. Calculations for the simplified deformation analysis are presented in Appendix E-5.

Stability End of Embankment Construction - Based on past experience at the site, it is our professional opinion that the safety factor during placement of the embankment and storage of waste materials will not drop below 2.0 under static conditions.

Closure Cap - Long Term Static - Stability calculations indicate a safety factor of 2.1 for the closure cap under the static condition. Stability calculation printouts are presented in Appendix E-6.

Closure Cap - Long Term Seismic - Stability calculations indicate a safety factor of 1.3 for the closure cap under the seismic condition. Stability calculation printouts are presented in Appendix E-7.

Recommended minimum factors of safety are dependent on the uncertainty of soil strength parameters and the cost of consequences of slope failure. The Environmental Protection Agency recommends use of a minimum safety factor under static conditions of 1.5 for a slope, where the cost of repair is comparable to the cost of construction and if there is no danger to human life or other valuable property if the slope fails with large uncertainty of strength parameters. The corresponding recommended minimum factor of safety under seismic conditions is 1.3.

Based on the subsoils encountered, laboratory test results, stability analysis and given loading conditions, the embankment and landfill cell meet the minimum safety factors under static conditions. Under seismic conditions, analysis indicates that the anticipated deformation of the landfill cells would be relatively small, on the order of 2½ to 3½ inches, which should be within acceptable limits.

H. Interface Stability

1. Soil Protective Cover

Interface stability for the soil protective cover over the landfill liner system was considered. With the use of a welded geocomposite drainage layer, the critical interface in the liner system is between the soil cover and the textured HDPE liner. Based on our experience at the site, a friction angle of 23.8 degrees was used for this interface. To maintain a safety factor of 1.5 against sliding, the height of the soil cover should not extend higher than 10 feet vertically up the slope until materials are placed in the cell sufficient to resist the sliding. Calculations for the soil protective cover interface are presented in Appendix E-8.

2. Entry Ramp

The entrance ramp will be constructed along the interior slope, beginning in a corner of each cell. The ramps will slope at a 10 horizontal to 1 vertical. Soil protective cover material will be placed above the liner materials with a thickness of 3 feet to support traffic into the landfill cell. The soil protective cover will slope down at a 3 horizontal to 1 vertical at the edge of the ramp. The ramp will be 31.5 feet wide. See the ramp details provided in Appendix B. Included within the materials on the ramp from the top down, will be the soil protective cover, textured HDPE, double-sided geocomposite, textured HDPE, and compacted clay liner. With the use of a welded geocomposite drainage layer, the critical interface in the liner system for the ramp is between the soil cover and the textured HDPE liner. Based on our experience at the site, a friction angle of 23.8 degrees was used for this interface. The stability analysis for the ramp indicates static and seismic safety factors of greater than 1.5 and 1.3, respectively. Interface stability calculations for the ramp are presented in Appendix E-9.

3. Closure Cap

The 3 horizontal to 1 vertical slope around the perimeter of the closure cap was considered. The critical interface for this slope is between the compacted clay and textured HDPE. The strength of the clay is assumed to be the controlling strength at the interface between compacted clay and textured HDPE. Safety factors of greater than 1.5 and 1.3 for static and seismic conditions, respectively, were obtained.

The slope of the closure cap above the 3 horizontal to 1 vertical slope is 5 percent. A double-sided geocomposite is planned for use in the closure cap above the 3 horizontal to 1 vertical slope. The critical interface is between the textured HDPE and double-sided geocomposite. Safety factors greater than 1.5 and 1.3 for static and seismic conditions, respectively, are obtained. Calculations are presented in Appendix E-10.

BEARING CAPACITY

Soil bearing capacity with respect to the proposed landfill cell was evaluated. The stability calculations, summarized in the previous section, also models a bearing capacity type failure. A bearing capacity type failure is defined as the lack of strength within the foundation soils for support of the proposed construction. Typically, the bearing capacity of an embankment is evaluated by conducting stability analyses.

Classical bearing capacity calculations have been conducted to determined the bearing capacity of the natural soils with respect to the proposed embankment construction and under the loading conditions resulting from the completed disposal cell. A safety factor of greater than 3 with regards to classical bearing capacity is calculated for the embankment alone, at the level of the softest clay material. In these calculations, it was assumed that the soft clay extends to great depth.

Based on the calculations for bearing capacity and the information obtained during the slope stability evaluation, it is our professional opinion that the natural soils will support the proposed construction and will result in suitable safety factors against bearing capacity type failures. Attached in Appendix F are the classic bearing capacity calculations performed with regards to the proposed embankment and cell.

Bearing capacity of the clay liner was evaluated to determine the loads that can safely be supported by the clay. The analysis indicates that the clay can support an allowable load of 1,500 pounds per square foot under static conditions. Under impact loading conditions, a bearing capacity of 2,000 pounds per square foot may be used.

Bearing capacity of the soil protective cover material was evaluated to determine the loads that can safely be supported by the cover material. Calculations indicate a static allowable bearing capacity to be:

$$q_{all} = 250\ (B) + 600\ (d)$$

Where q_{all} = allowable bearing pressure (psf)

B = load width (feet)

d = depth of embedment (feet)

Under temporary loading conditions the q_{all} values may be increased to:

$$q_{all} = 375\ (B) + 900\ (d)$$

Bearing capacity calculations are included in Appendix F.

SETTLEMENT

Prior to construction of Landfill Cell X, Cell Z and the stabilization facility, settlement platforms were installed on the original ground surface. Measurements were taken for up to 3 years during and after construction. From these measurements, the time rate of settlement has been estimated along with settlement magnitudes.

In addition to the monitoring described above, elevations of the tops of embankments for Landfill Cells 4, 5, 6B, 7 and Z have been measured over many years. Prior to estimating the settlement for the proposed landfill cells, we obtained these measurements from Hansen, Allen and Luce and used this information to calibrate our model used to predict settlement at the site. Based on the difference between embankment design elevations and the most recent survey information provided, the tops of the embankments of Landfill Cells 5, 6B, 7 and Z have settled on the order of 65 to 75 inches and additional settlement is anticipated to result in settlement being on the order of 65 to 90 inches for the tops of these existing embankments. The magnitude of this settlement is influenced by the load of the embankment fill at the point that was surveyed as well as adjacent loads such as adjacent embankments and landfill waste.

A settlement model was used to estimate settlement for the landfill cells. The model is based on the evaluation of measured settlement at the site as discussed above. Subsurface conditions obtained from explorations and laboratory test results and previous settlement monitoring were also considered in development of this model.

Settlement profiles are presented in Appendix G. Seven cross sections were analyzed and estimated settlement profiles are presented to provide information for planning of the proposed landfill cells. Cross sections are cut through the high portion of the landfill cells, along the shared embankment and through sumps.

Calculations indicate that settlement below the proposed embankments could be up to approximately 105 inches near the center of the cells where there are waste cells adjacent to both sides of the embankments. The embankment settlement is estimated to be on the order of 72 inches at the center of cells where there is a landfill cell on only one side of the embankment. The past survey data would suggest that the embankment settlement may be on the order of 20 percent less near the corners of the cells versus the central part of the embankment. Settlement in the central part of the cells below the mounded waste is estimated to be on the order of 140 inches.

Time rate of settlement, as measured indicate the following percentage of settlement with respect to the time period required for settlement to occur. This time rate is based on the past settlement measured at the top of embankments over time with projected future settlement.

Time (years)	Percentage of Settlement
7	50 percent
15	70 percent
22	90 percent

CONSTRUCTION CONSIDERATIONS

Based on the subsurface investigation, the proposed embankment materials, and our experience in the area, the following considerations are presented for design and construction of the proposed landfill disposal cells.

A. Foundation Preparation

Foundation preparation should consist of removing disturbed soils in the proposed landfill cell foundation. Any vegetation or debris that is within the areas to receive fill should be removed. Positive measures should be taken to remove any backfill material in the foundation area that does not meet the compaction criteria.

B. Embankment Construction

1. Materials

   The embankment may be constructed with a mixture of clay, silt or sand soils.

Materials for construction of the embankment are likely available from the surrounding area. If material from areas other than the dunes is used in the embankments, we should be notified to evaluate the potential effect on the stability of the embankments.

2. Compaction

Fill within the embankment should be placed and compacted to at least 95 percent of the maximum dry density as determined by ASTM D-698. The moisture content of the fill should be close to optimum to facilitate the compaction process. Ideally, the moisture content would be within 2 percent of the optimum moisture content.

Fill should be placed in uniform lifts not more than 8 inches thick for compaction. Compaction should be accomplished with heavy compaction equipment. Lifts compacted by hand operated equipment should be no more than 4 inches in thickness.

Based on previous experience at the Grassy Mountain Facility, the first few lifts of embankment material are difficult to compact within specification. Typically, it has been found that the material is moisture sensitive in respect to compaction. Once the moisture of the fill is near optimum and relatively uniform, compaction is more easily obtained. This difficulty has also been encountered as embankments are constructed of fill materials obtained from near the ground surface in the borrow areas. These materials have typically been very dry and very difficult to moisture condition prior to placement and compaction.

3. Erosion Protection

The exterior portions of the embankment should be protected to reduce erosion. Erosion on existing embankments at the site has been reduced by placement and compaction of a graded gravel material. Consideration should be given to using similar material for the exterior portion of the proposed embankments.

4. Construction Quality Control

Construction should be observed and fill tested by a representative of the soils engineer to verify that the material type, densities and moisture contents meet project specifications.

C. Compacted Clay Liner

We understand that the proposed landfill cell will be provided with a low permeable soil liner at least 3 feet thick. Synthetic liners will be placed above the soil liner. A 2-foot thick soil cover will be placed above the synthetic liners.

1. Materials

Clay may be obtained from near the site. Laboratory and field tests conducted during previous investigations indicate that the permeability of the remolded clay ranges from $2x10^{-8}$ to $1x10^{-6}$ cm/sec. The slower permeabilities were obtained on samples remolded at moisture contents above the optimum moisture content. The faster permeabilities were obtained on samples remolded below the optimum moisture content.

The soil used for liner on previous projects is classified as CL, CL-ML and ML based on the Unified Soil Classification System. The percent passing the No. 200 sieve has ranged from 85 to 99. The liquid limits have ranged from 22 to 49 with plasticity indexes from 5 to 25. The soil used for the soil liner have been tested. They had permeabilities of less than $1x10^{-7}$ cm/sec, which is the permeability required by regulation.

Previous liner construction at the site has been accomplished by mining clay from the mud flats and allowing the clay to dry to within a few percentage points of optimum. To consistently achieve the required low permeability, a deflocculent should be added to the clay and the clay should be disced and kneaded with a sheepsfoot compactor while it is drying.

2. Placement and Compaction

Placement and compaction procedures need to be defined to obtain the desired permeability. Many test fills have been constructed and tested. We recommend that a test fill be constructed in the field to determine the construction technique, density and moisture contents required to consistently obtain the permeability required by regulation if other equipment or contractors are considered for the project. Commercial additives have been used in the past to achieve the permeability using on-site clay soils. Previous liners have been constructed using the on-site clay soils mixed with 3 pounds of sodium hexametaphosphate for every 50 cubic feet of loose clay, or 3-1/2 pounds of sodium tripolyphosphate per 50 cubic feet of loose clay. Permeability tests conducted on the compacted clay have found permeabilities to be less than 1×10^{-7} cm/sec.

To prevent surface cracking, positive measures should be taken to keep the surface of the clay liner moist.

LIMITATIONS

This report has been prepared in accordance with generally accepted soil and foundation engineering practices in this area for the use of the client for design purposes. The conclusions and recommendations submitted in this report are based on the data obtained from the exploratory borings drilled and cone penetration tests conducted at the locations indicated on Figure 1. Subsurface information obtained for other areas of the site have been added to this information. The nature and extent of variations between exploratory locations may not become evident until excavation is performed. If during construction, soil and groundwater conditions appear to be different from those described herein, this office should be advised at once so that re-evaluation of the recommendations may be made.

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

PROFESSIONAL ENGINEER
11/16/17
JAY R. MCQUIVEY
No. 177892-2202
STATE OF UTAH

Jay R. McQuivey, P.E.

Reviewed by Douglas R. Hawkes, P.E., P.G.

James E. Nordquist by bw

Reviewed by James E. Nordquist, P.E., G.E.

JRM/bw

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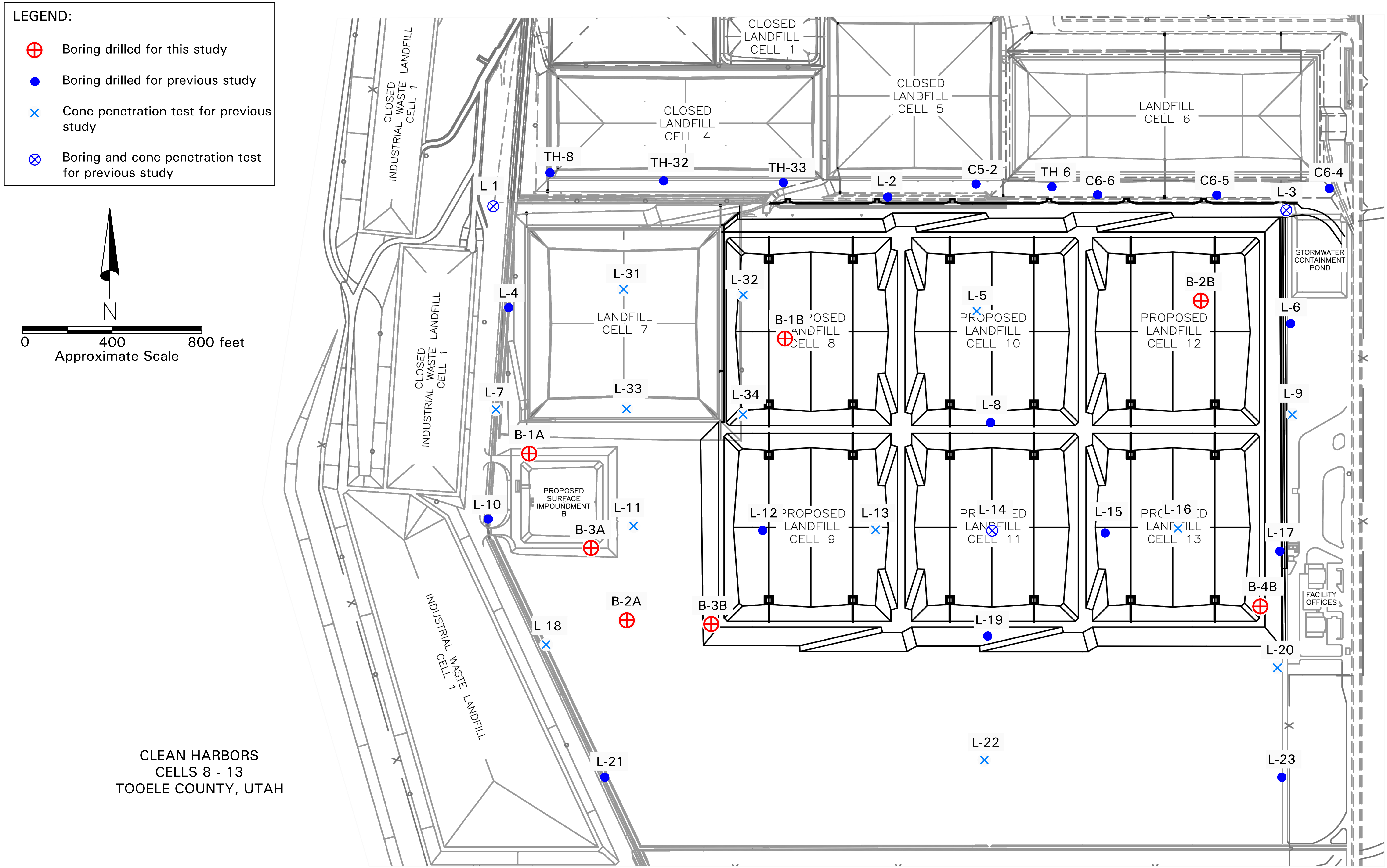
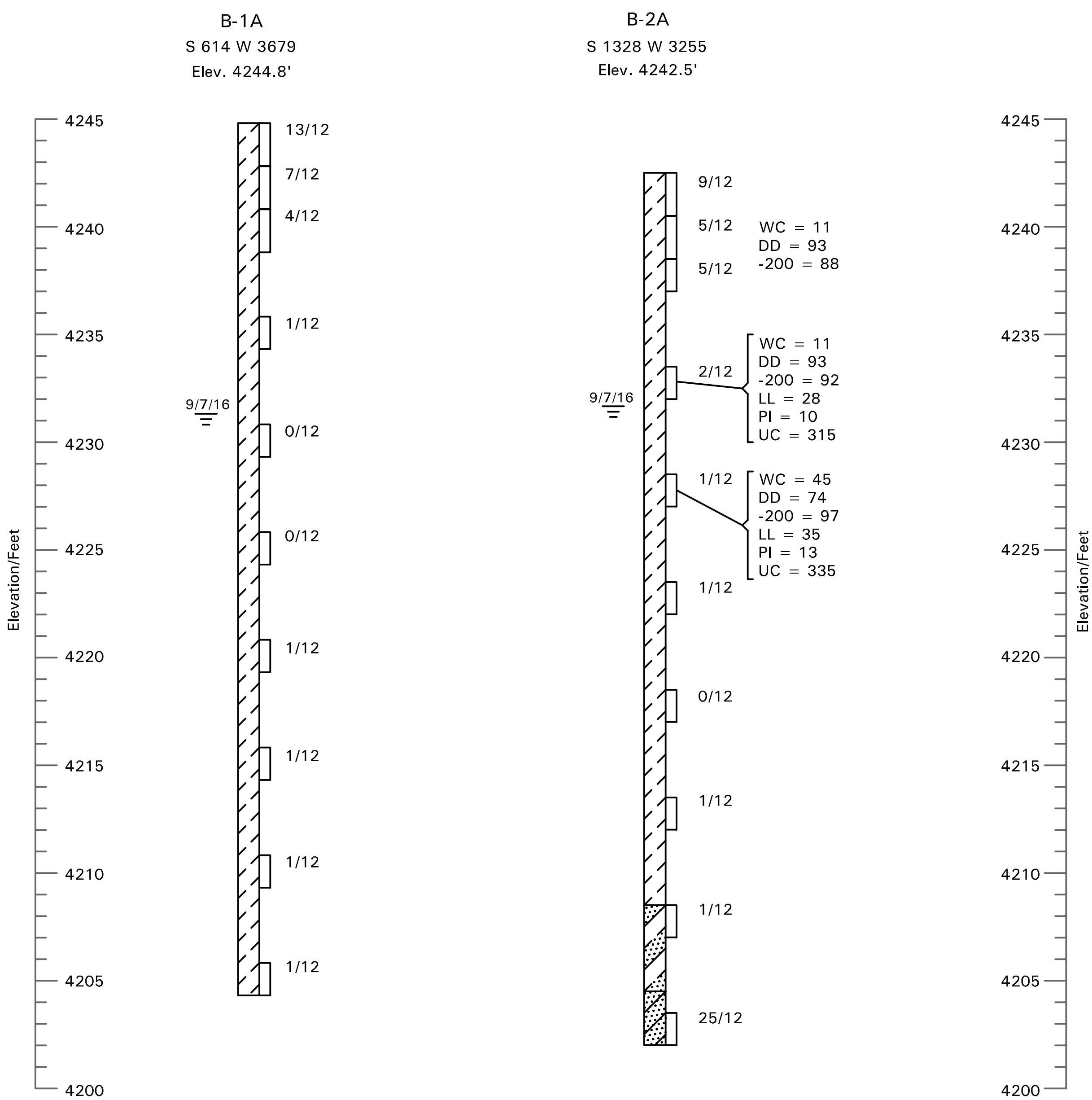


CLEAN HARBORS
CELLS 8 - 13
TOOELE COUNTY, UTAH

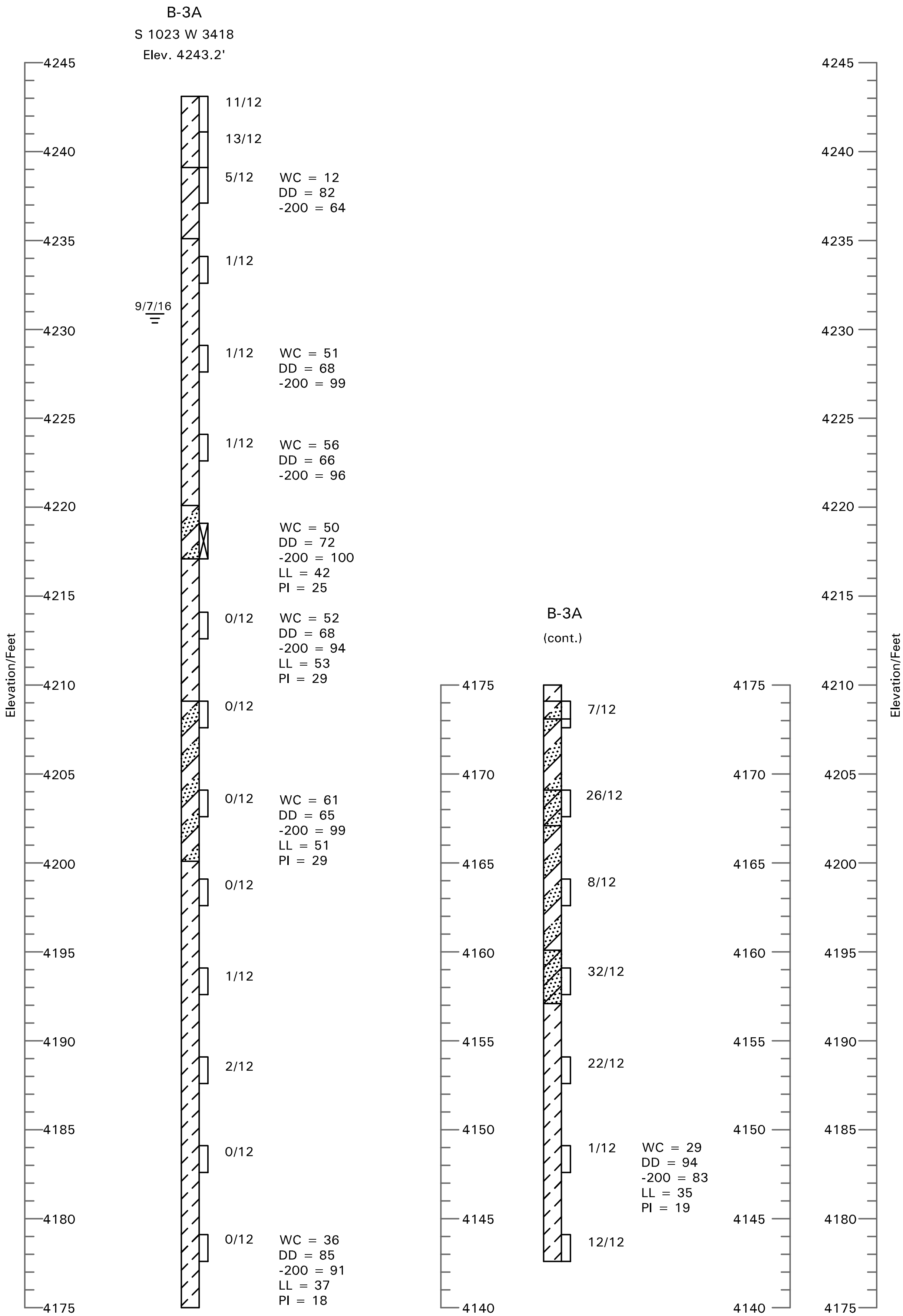
1160276	AGEC	Exploratory Boring Locations	Figure 1



Approximate Vertical Scale 1" = 8'

See Figure 8 for legend and notes.

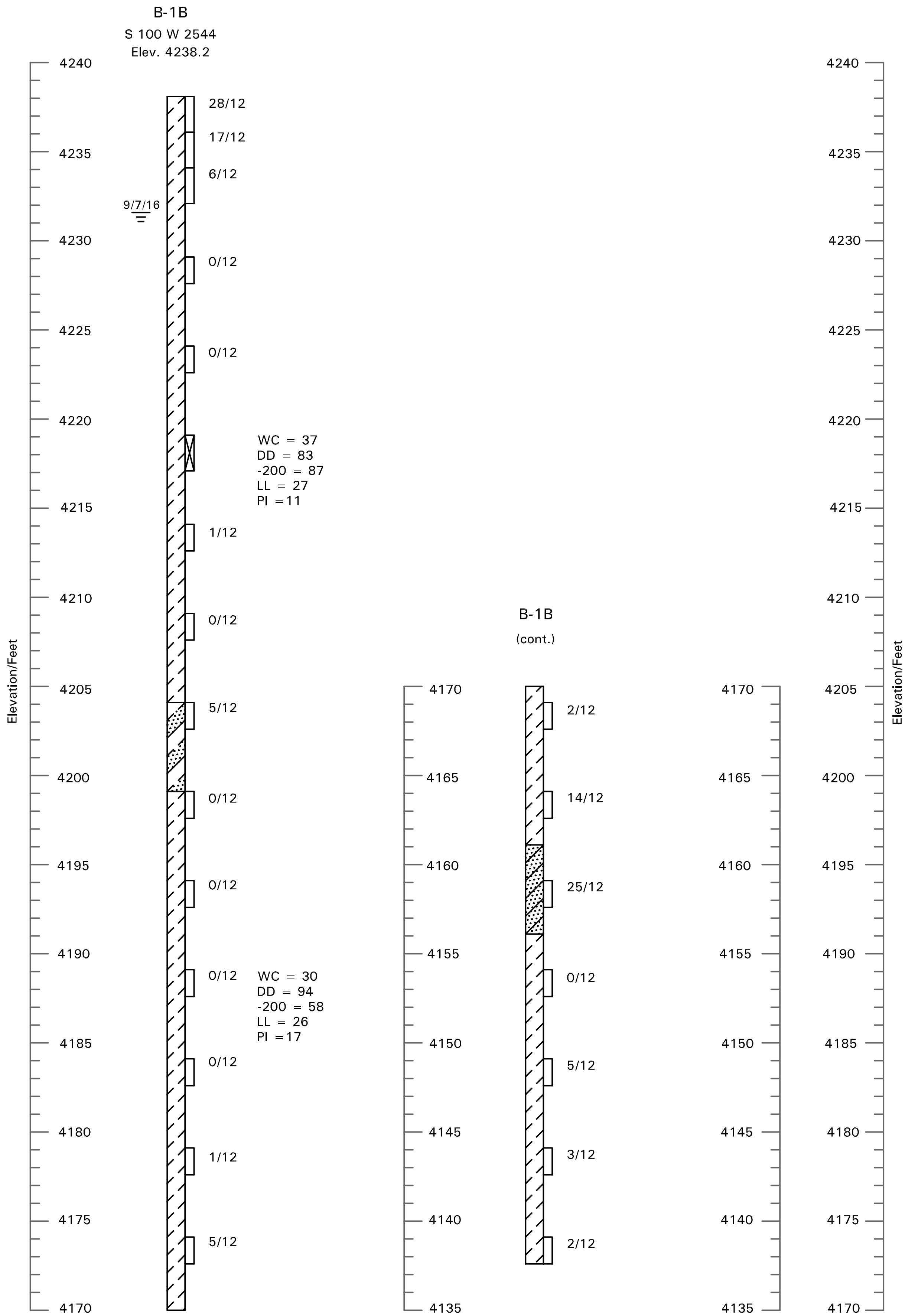
1160276	AGEC	Exploratory Boring B-1A and B-2A Logs	Figure 2



Approximate Vertical Scale 1" = 8'

See Figure 8 for legend and notes.

1160276	AGEC	Exploratory Boring B-3A Log	Figure 3



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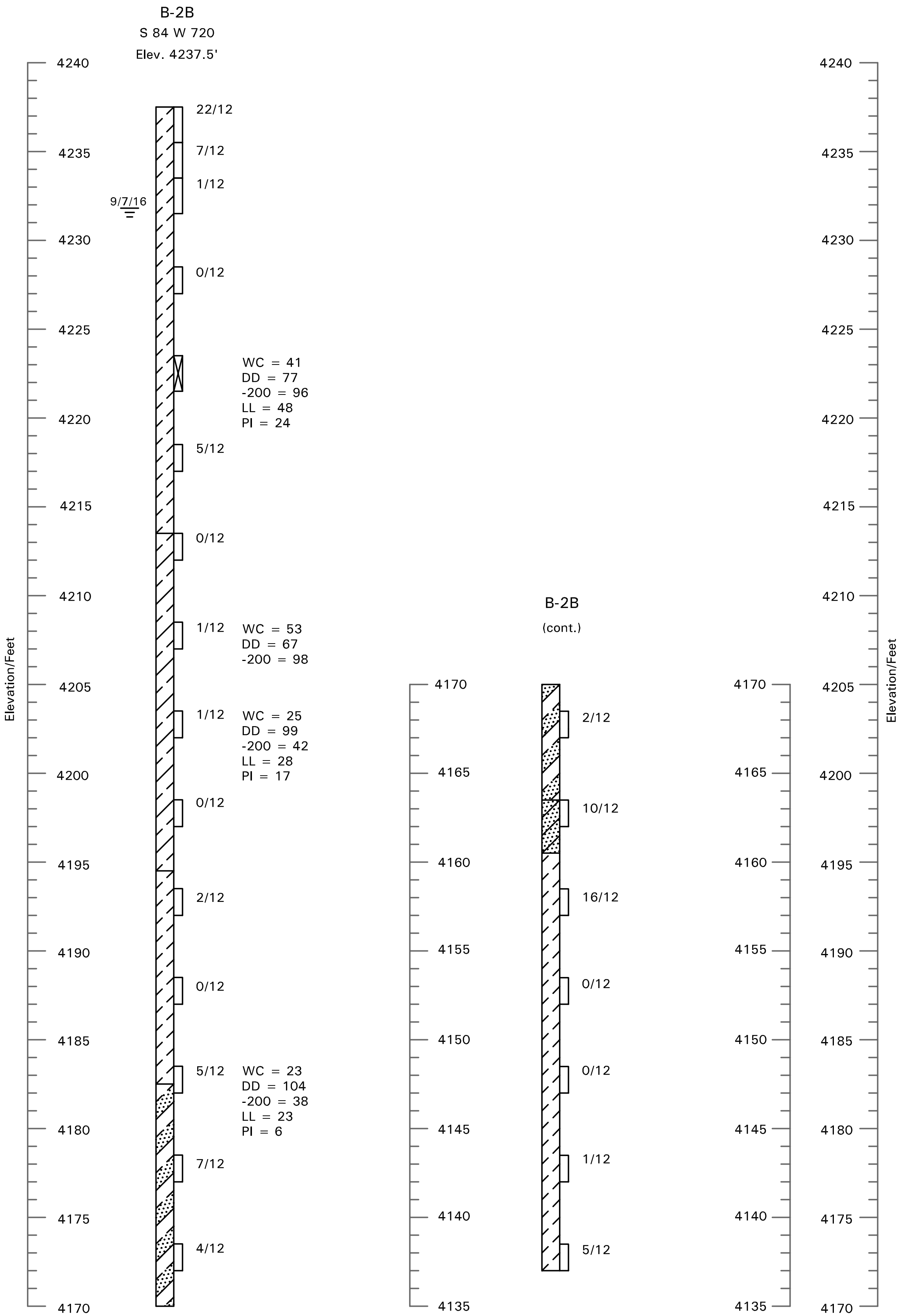
See Figure 8 for legend and notes.

1160276	AGEC	Exploratory Boring B-1B Log	Figure 4



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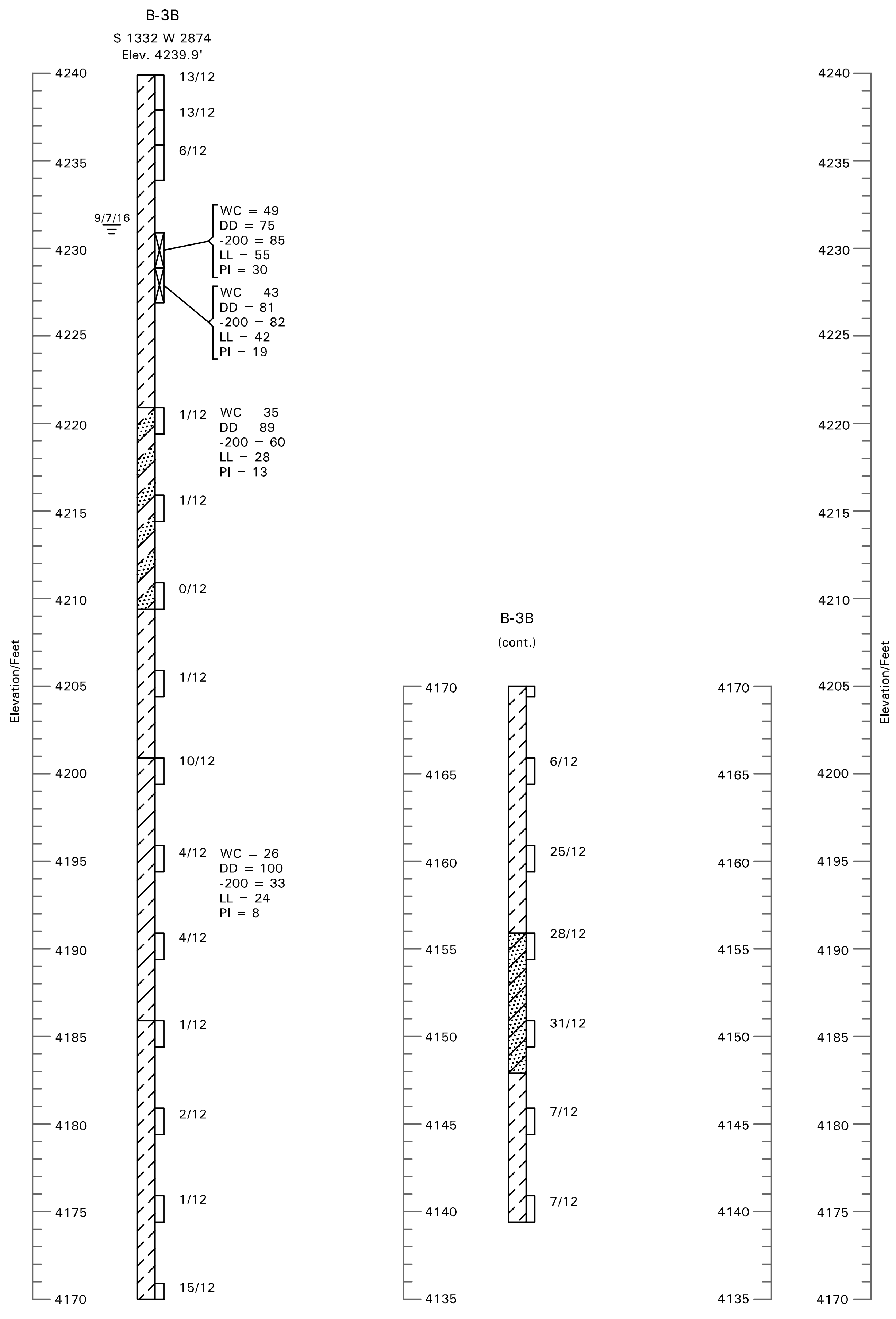
See Figure 8 for legend and notes.

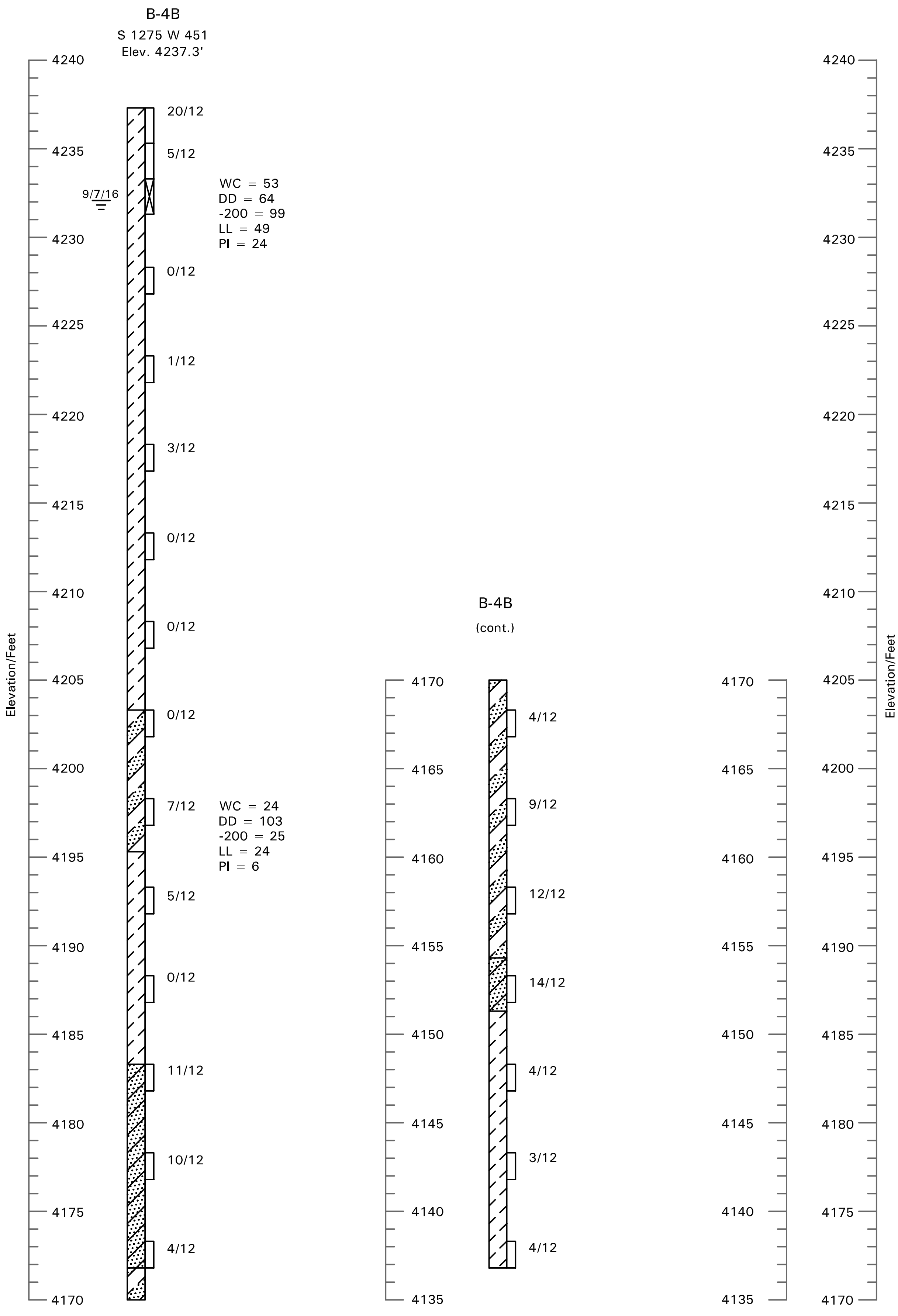
1160276	AGEC	Exploratory Boring B-2B Log	Figure 5



Approximate Vertical Scale 1" = 8'

See Figure 8 for legend and notes.

1160276	AGEC	Exploratory Boring B-3B Log	Figure 6



Approximate Vertical Scale 1" = 8'

See Figure 8 for legend and notes.

1160276	AGEC	Exploratory Boring B-4B Log	Figure 7

LEGEND:

Lean Clay (CL); thin silt and sand layers, occasional cemented layers, small to moderate amount of sand, slightly moist to wet, very hard in the upper 3 to 5 feet, very soft to medium stiff at depth, slightly moist to wet, light brown to gray, sulfurous odor.

Lean Clay and Silt (CL/ML); interlayered, small to moderate amount of sand, silty sand and clayey sand layers, stiff, wet, gray.

Lean Clay and Silty Sand (CL/SM); interlayered, sandy silt layers, soft to medium stiff, medium dense, wet, gray, sulfurous odor.

Silty Sand (SM); clay and sandy silt layers, medium dense, wet, gray to dark gray, sulfurous odor.

10/12 California Drive sample taken. The symbol 10/12 indicates that 10 blows from a 140 pound automatic hammer falling 30 inches were required to drive the sampler 12 inches.

Indicates a Shelby tube sample was taken.

9/7/16 Indicates the depth to free water and the date the measurement was taken.

NOTES:

1. The borings were drilled on August 2 through 10, 2016 using direct push methods.
2. Locations of the borings were measured approximately by pacing from features shown on the site plan provided.
3. Elevations of the borings were surveyed by Hansen Allen and Luce.
4. The boring locations and elevations should be considered accurate only to the degree implied by the method used.
5. The lines between materials shown on the boring logs represent the approximate boundaries between material types and the transitions may be gradual.
6. Water level readings shown on the logs were made at the time and under the conditions indicated. Fluctuations in the water level will occur with time.
7. WC = Water Content (%);
   DD = Dry Density (pcf);
   +4 = Percent Retained on the No. 4 Sieve;
   -200 = Percent Passing the No. 200 Sieve;
   LL = Liquid Limit (%);
   PI = Plasticity Index (%);
   UC = Unconfined Compressive Strength (psf).

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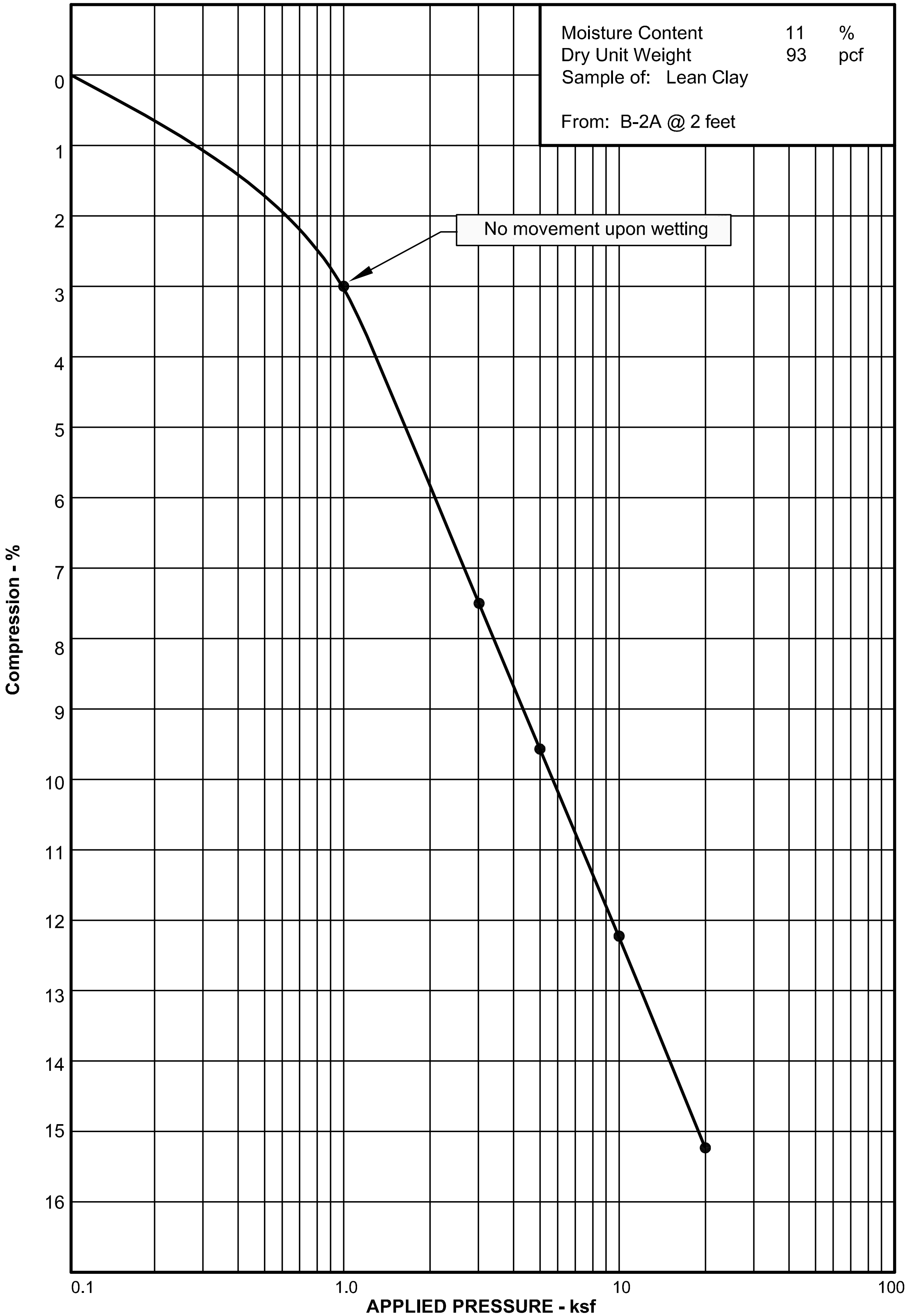
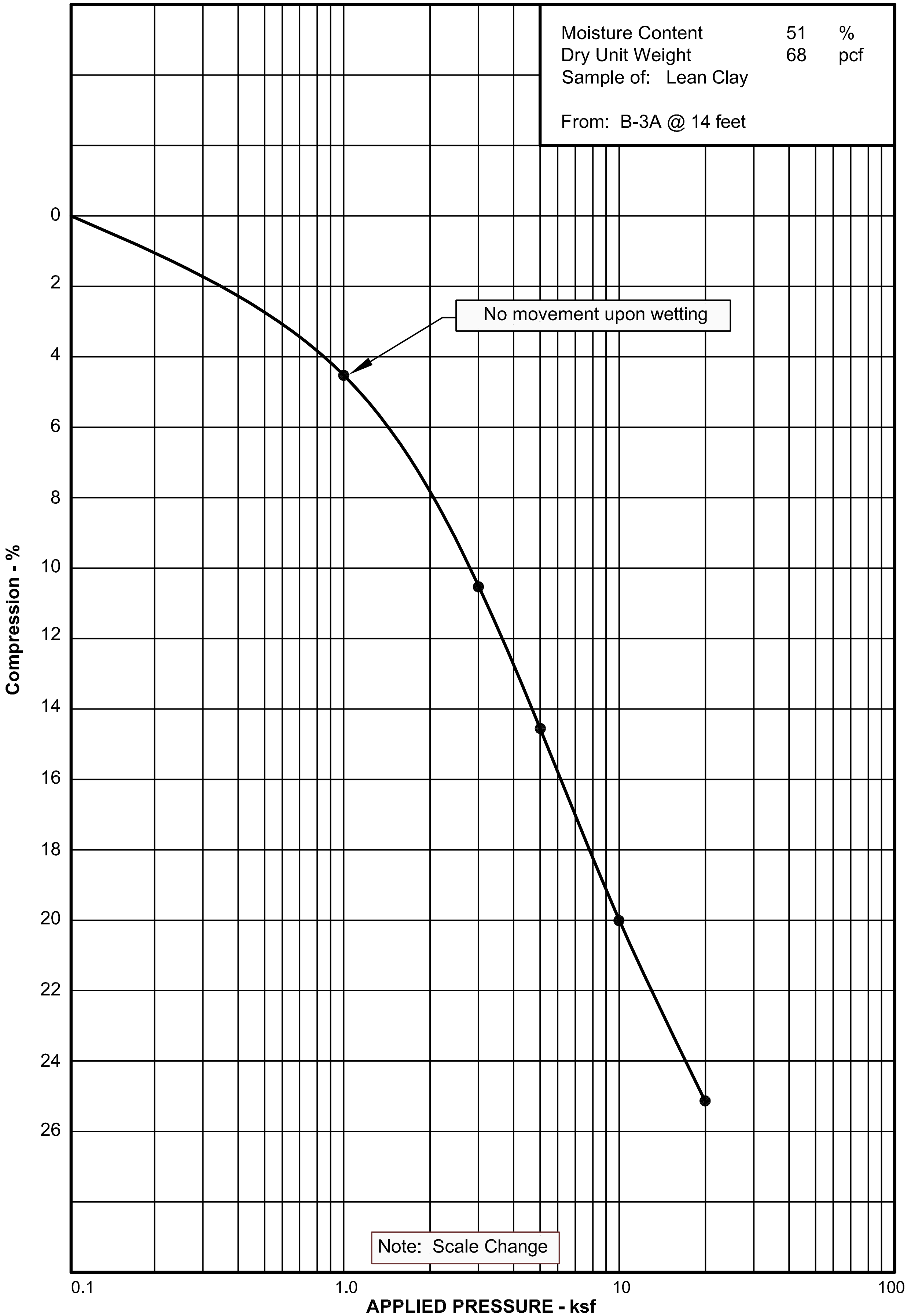


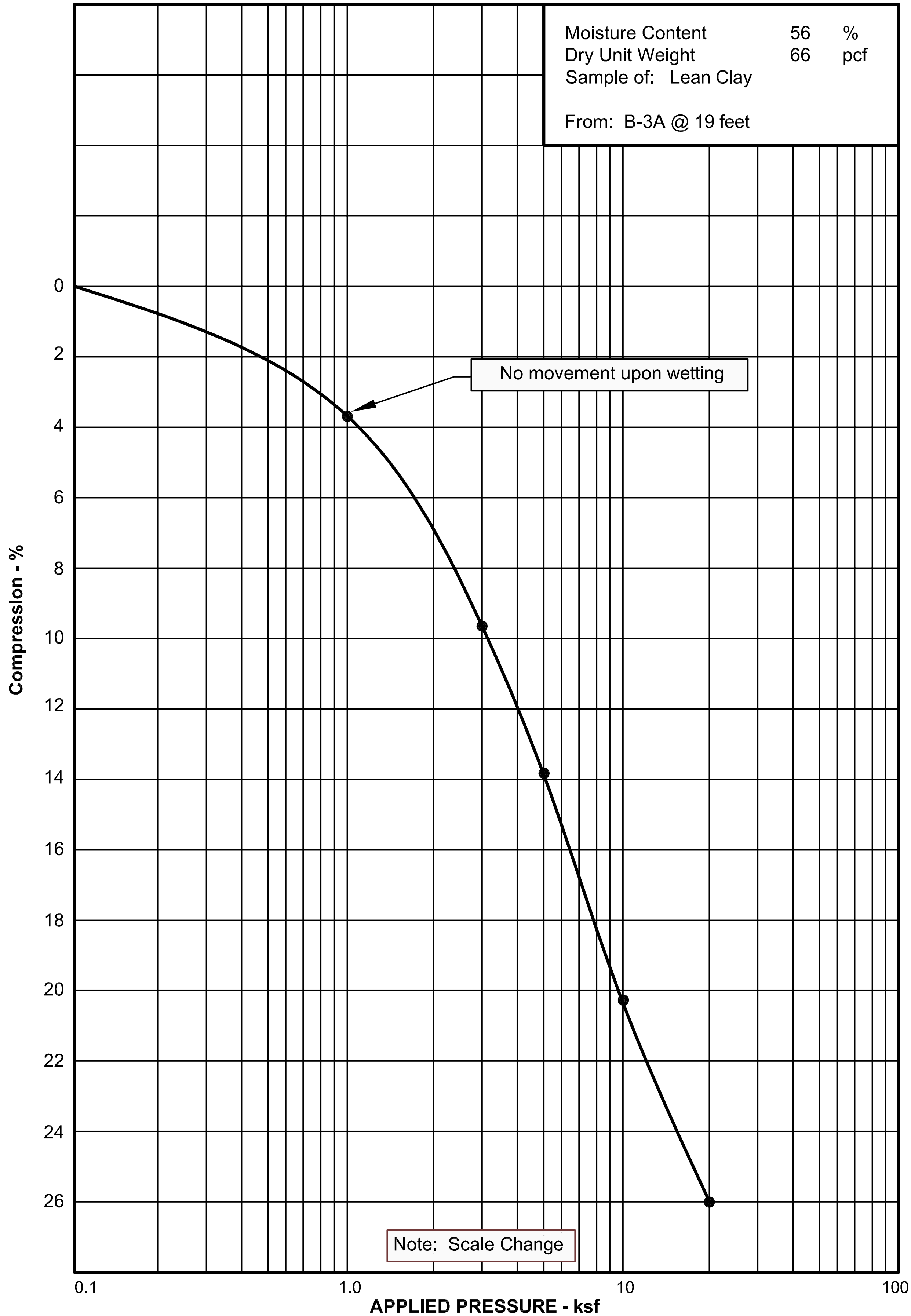
Project No. 1160276 **CONSOLIDATION TEST RESULTS** **Figure 9**

Applied Geotechnical Engineering Consultants, Inc.



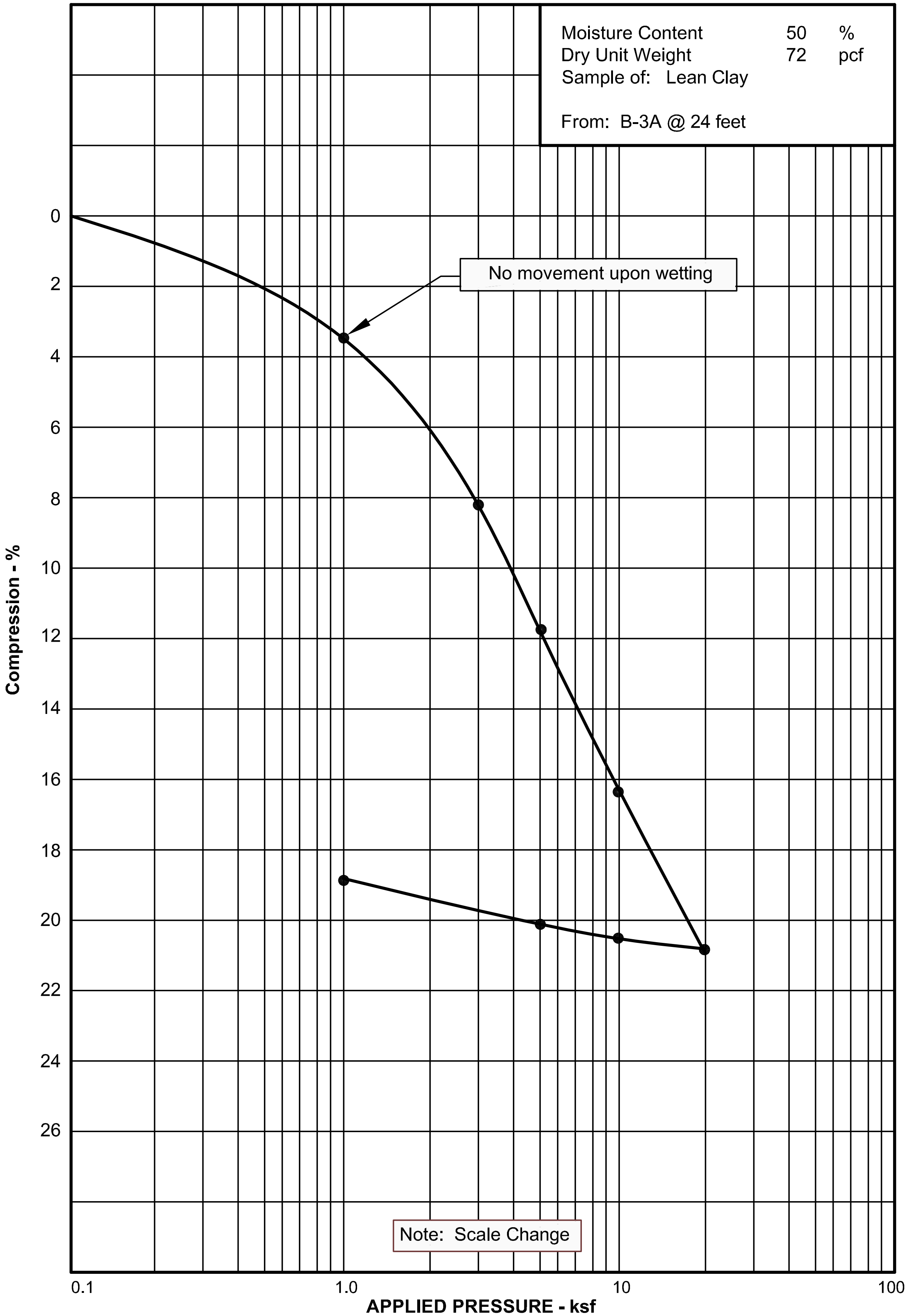
Project No. 1160276 **CONSOLIDATION TEST RESULTS** **Figure 10**

Applied Geotechnical Engineering Consultants, Inc.



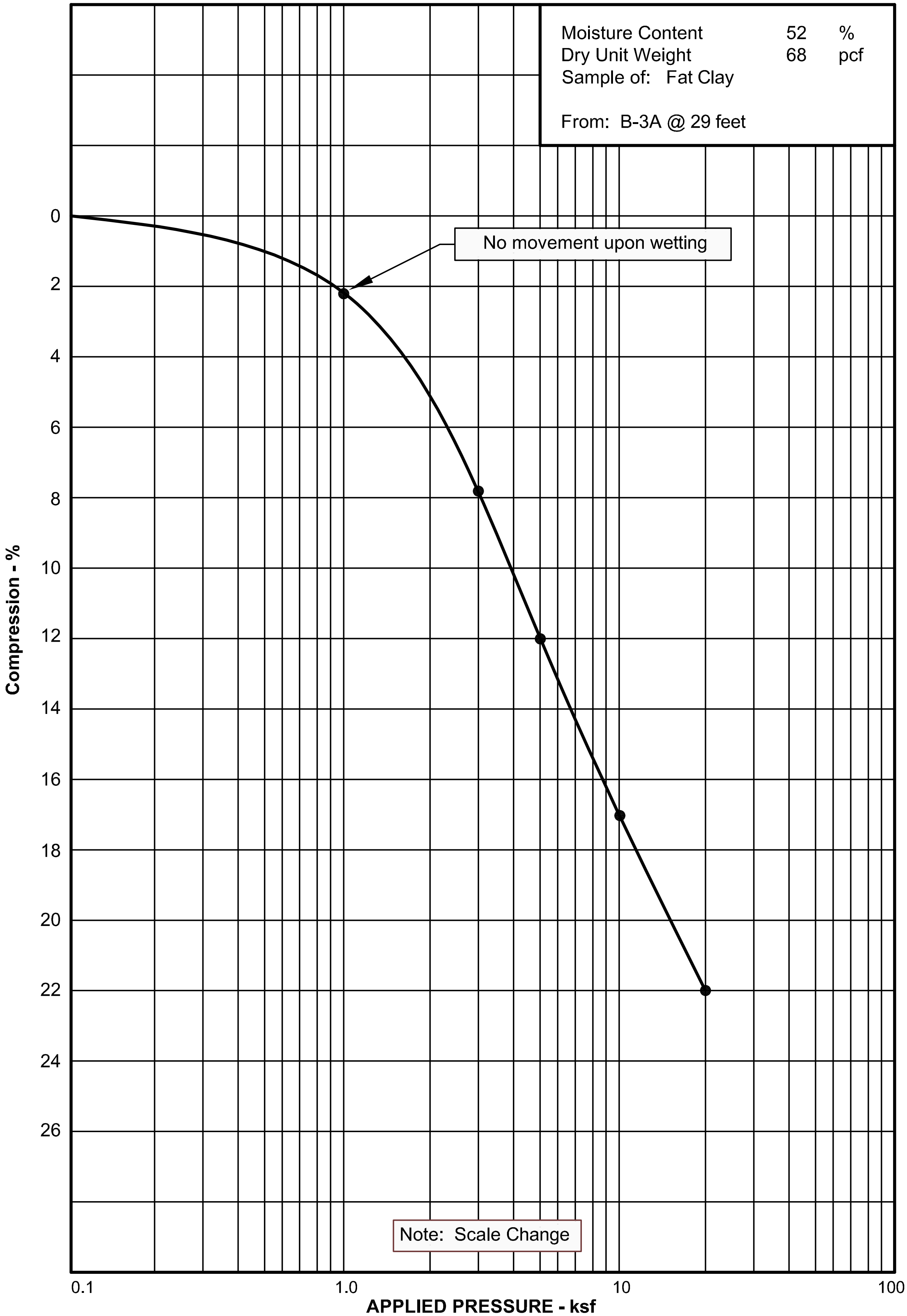
Project No. 1160276 CONSOLIDATION TEST RESULTS Figure 11

Applied Geotechnical Engineering Consultants, Inc.



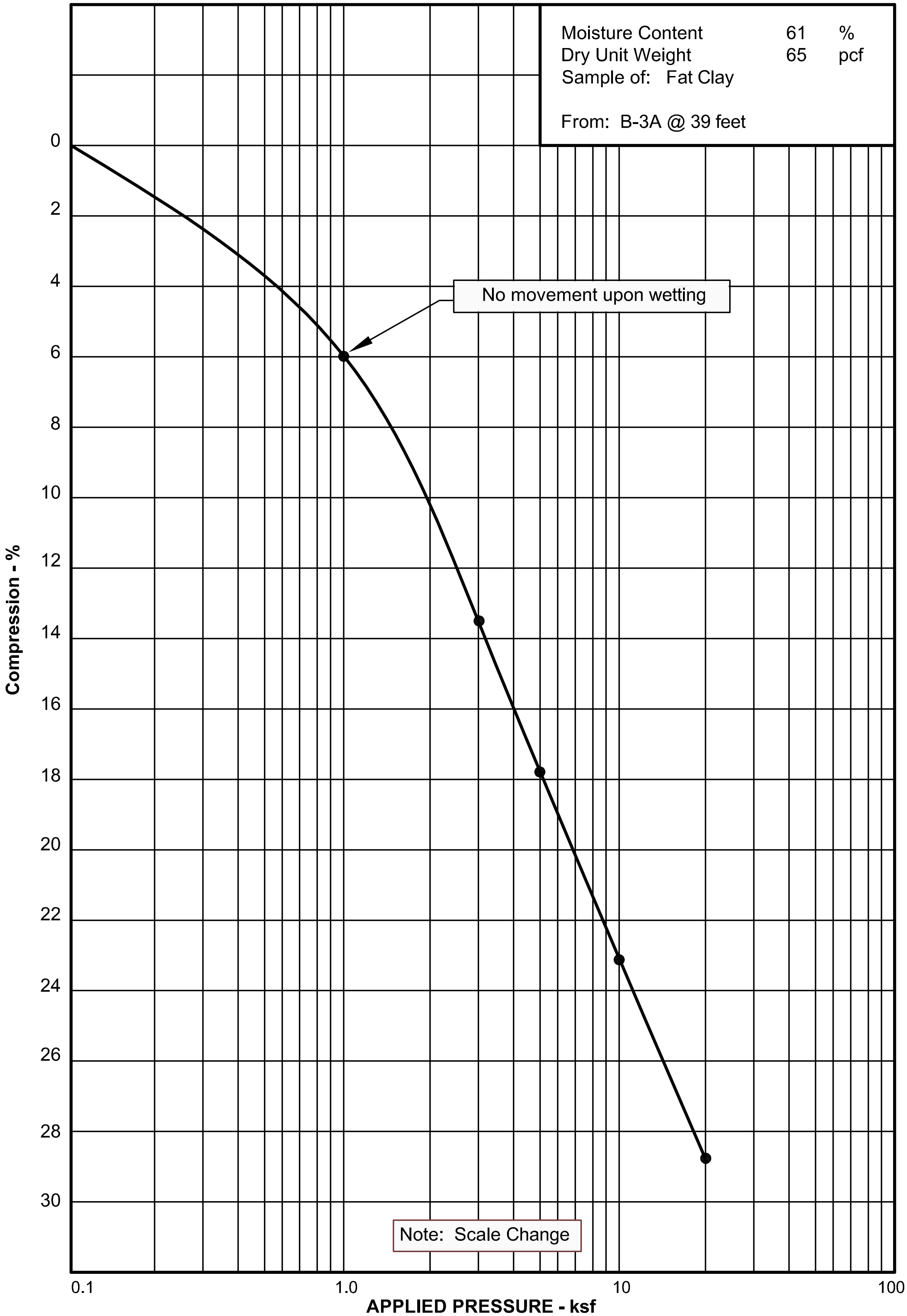
Project No. 1160276 CONSOLIDATION TEST RESULTS Figure 12

Applied Geotechnical Engineering Consultants, Inc.



Project No. 1160276 **CONSOLIDATION TEST RESULTS** Figure 13

Applied Geotechnical Engineering Consultants, Inc.



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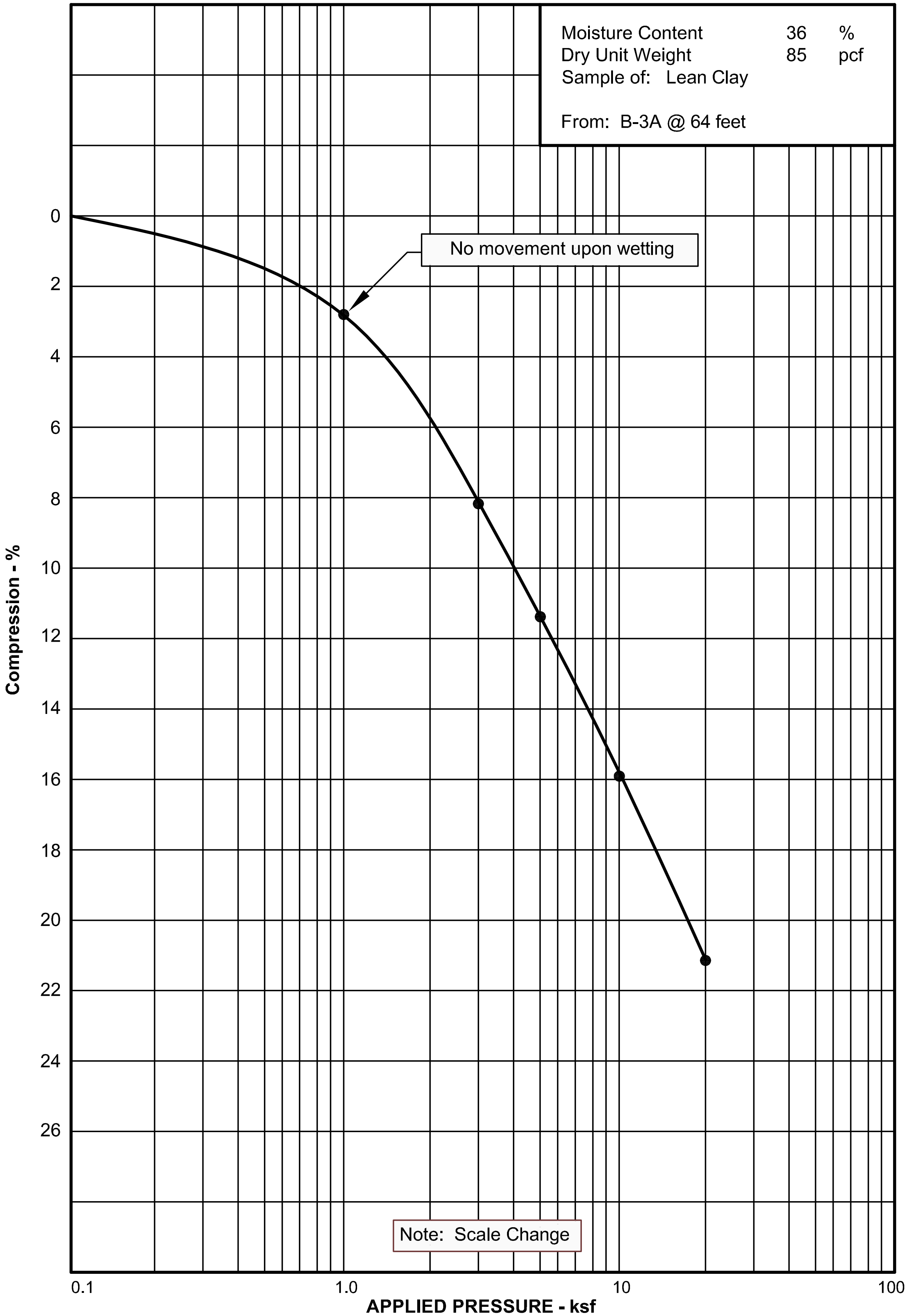
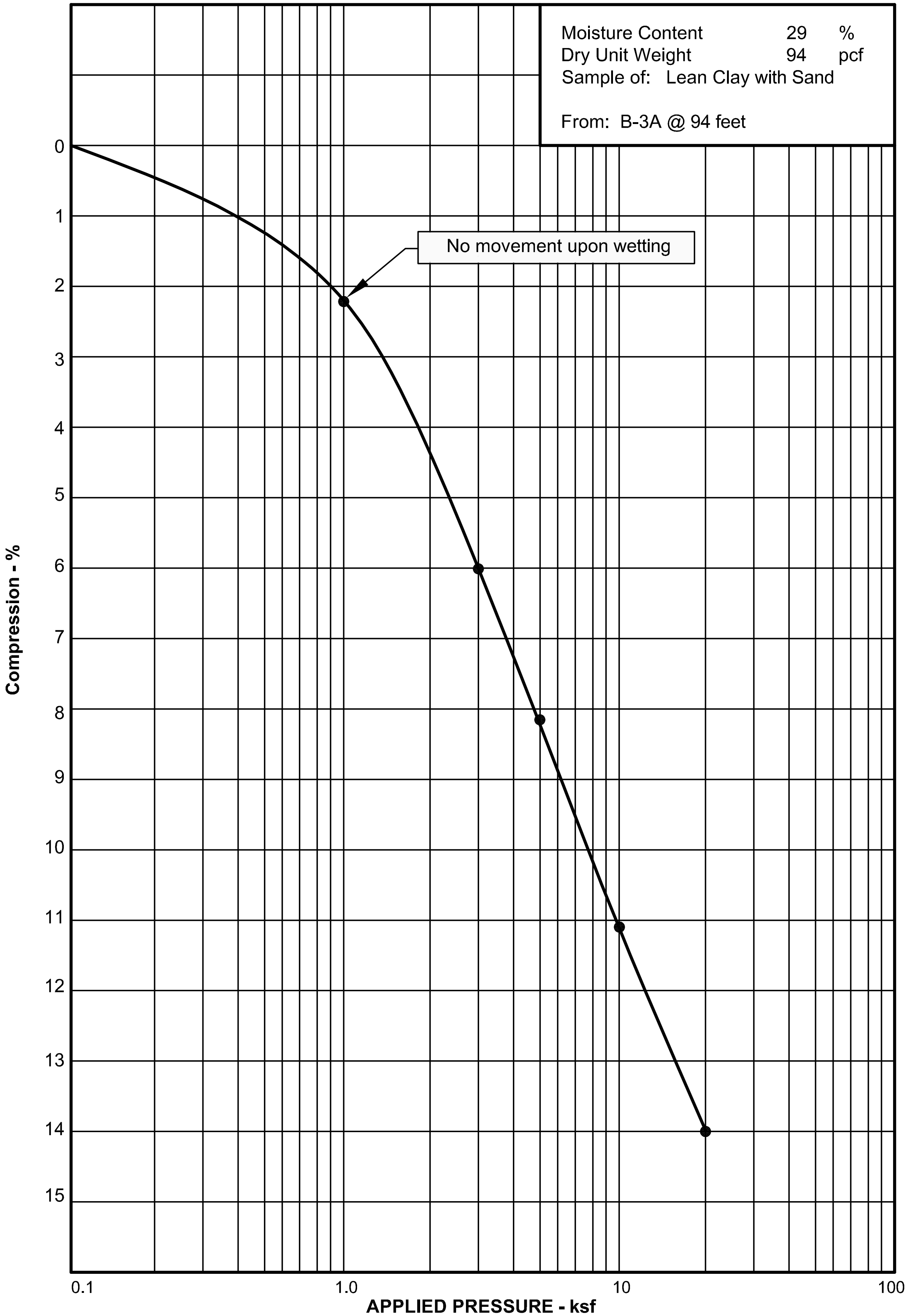


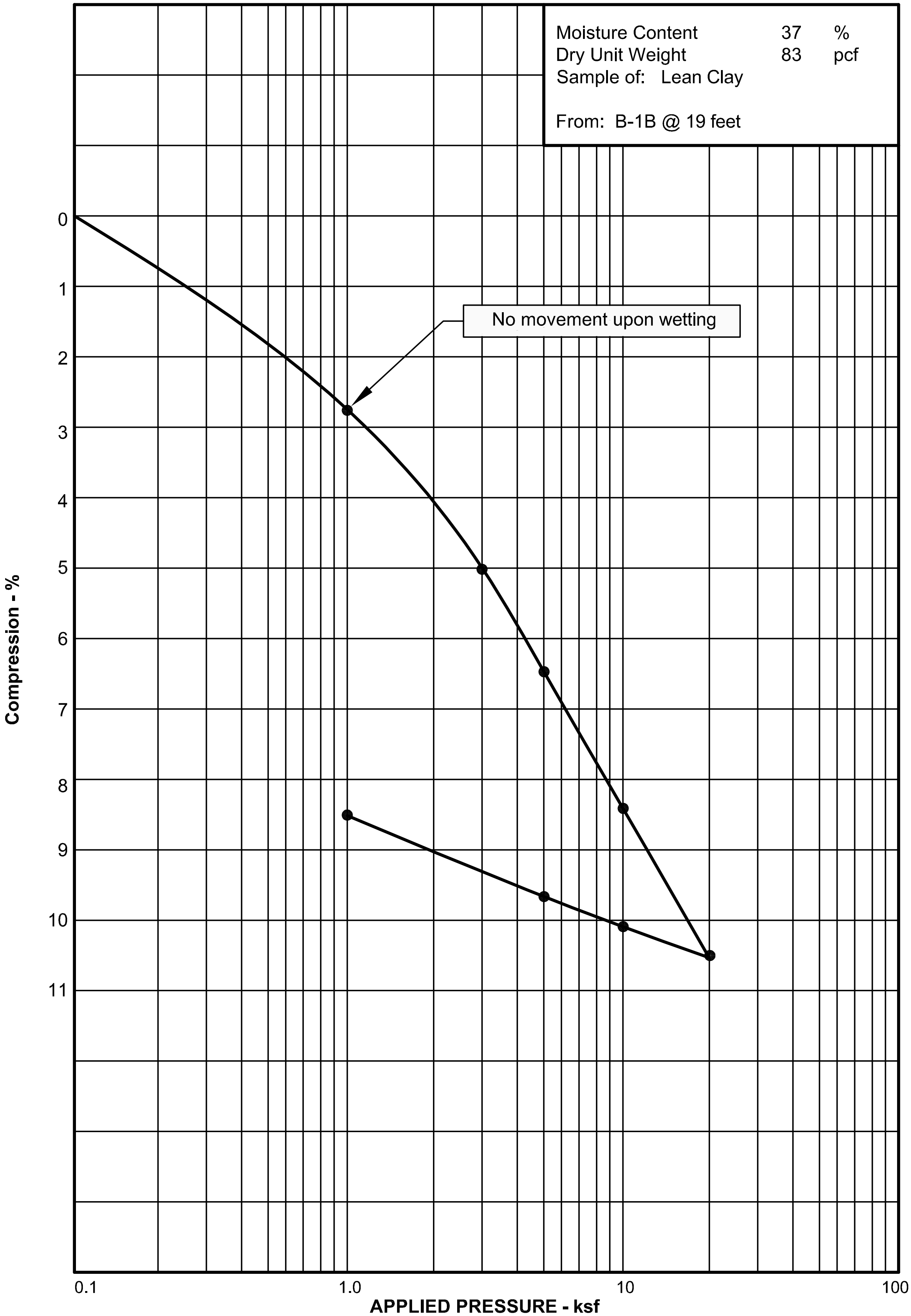
Project No. 1160276 CONSOLIDATION TEST RESULTS Figure 15

Applied Geotechnical Engineering Consultants, Inc.



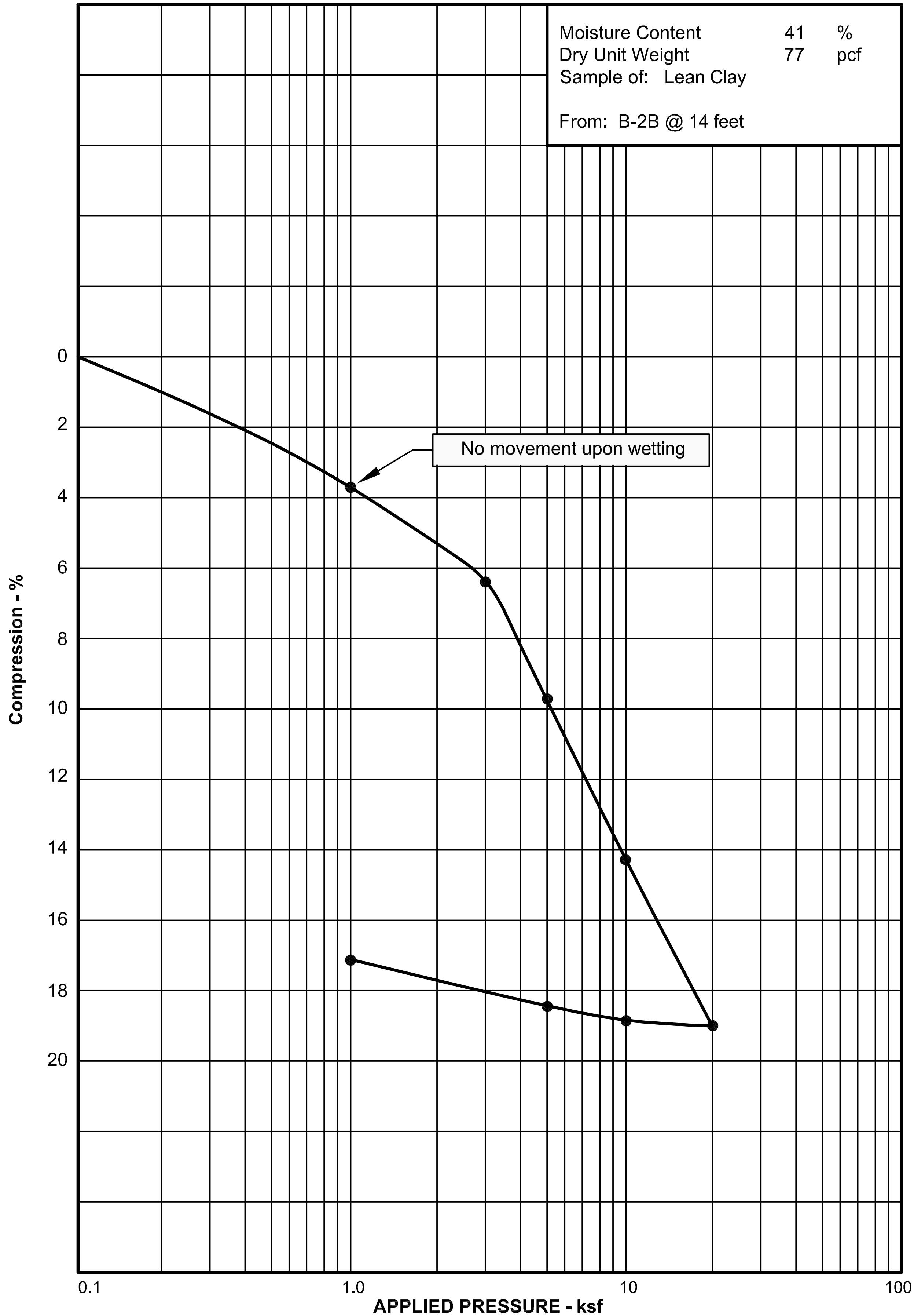
Project No. 1160276 **CONSOLIDATION TEST RESULTS** **Figure 16**

Applied Geotechnical Engineering Consultants, Inc.



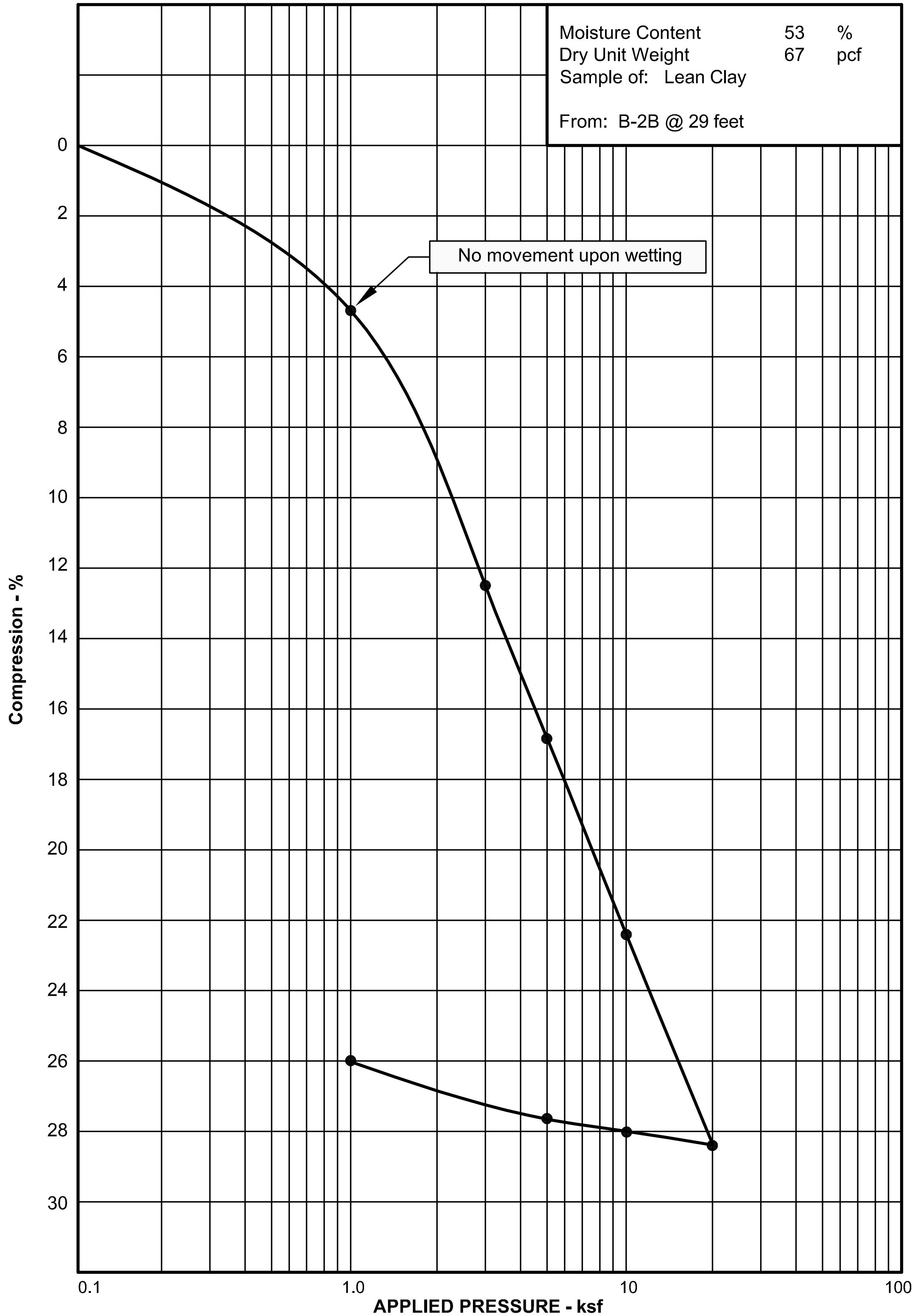
Project No. 1160276 **CONSOLIDATION TEST RESULTS** Figure 17

Applied Geotechnical Engineering Consultants, Inc.



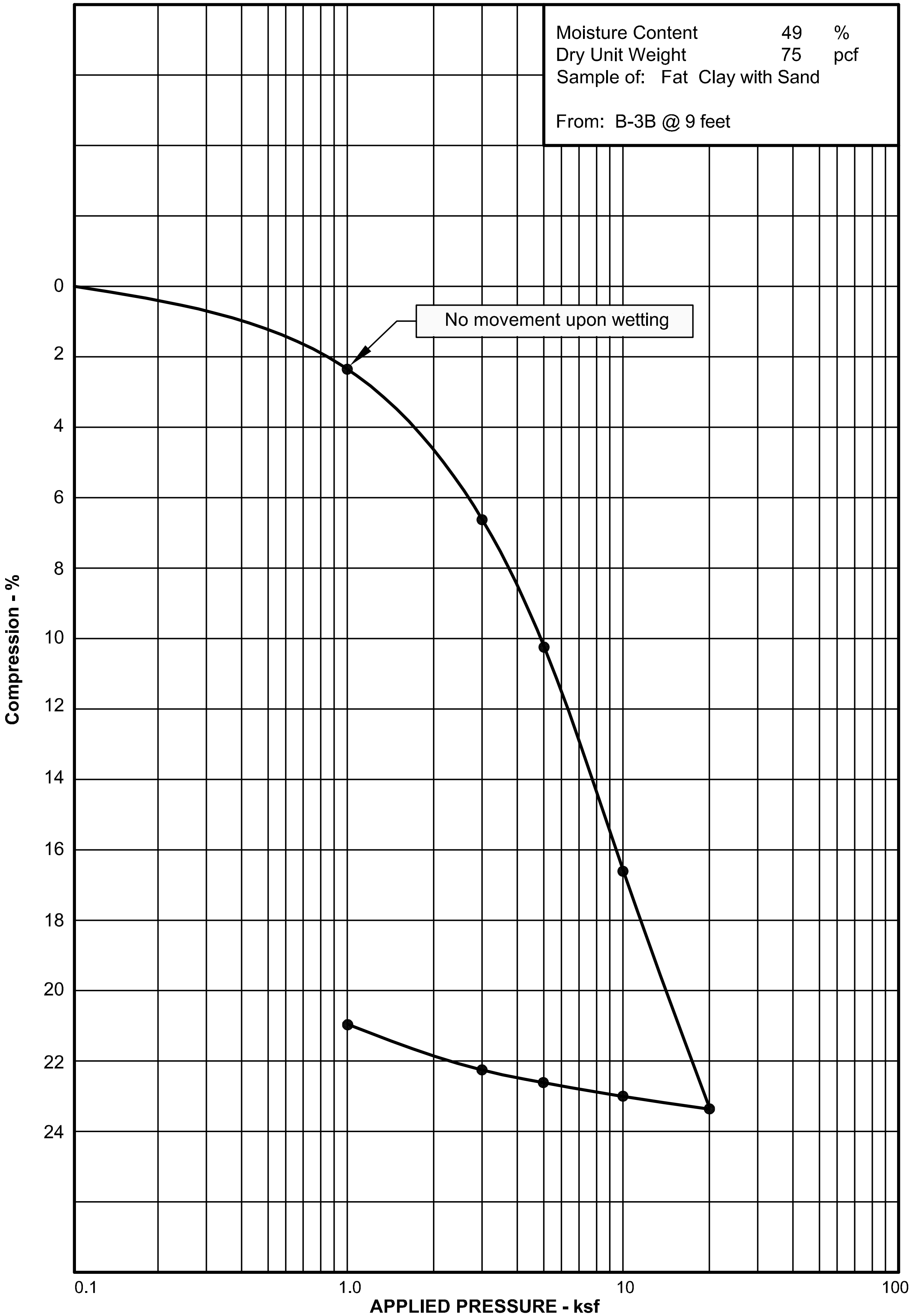
Project No. 1160276 **CONSOLIDATION TEST RESULTS** **Figure 18**

Applied Geotechnical Engineering Consultants, Inc.



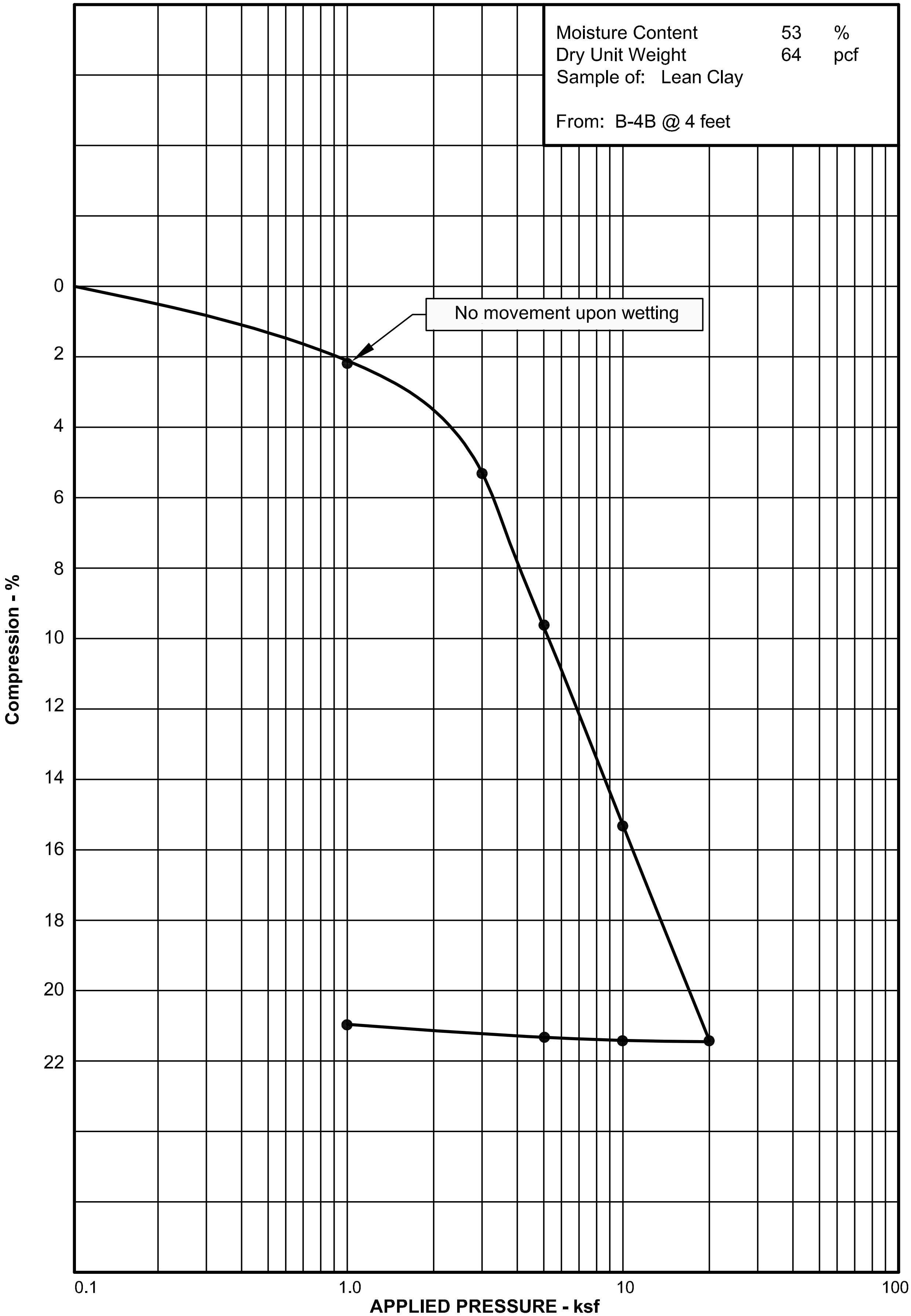
Project No. 1160276 **CONSOLIDATION TEST RESULTS** Figure 19

Applied Geotechnical Engineering Consultants, Inc.



Project No. 1160276 **CONSOLIDATION TEST RESULTS** Figure 20

Applied Geotechnical Engineering Consultants, Inc.



Project No. 1160276 CONSOLIDATION TEST RESULTS Figure 21

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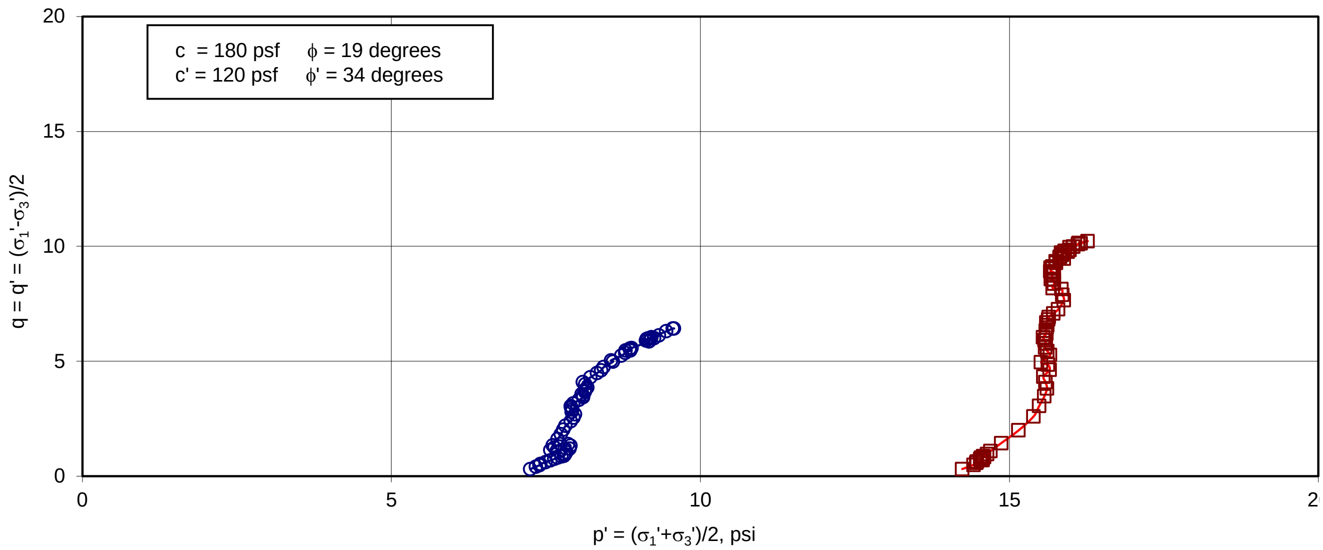

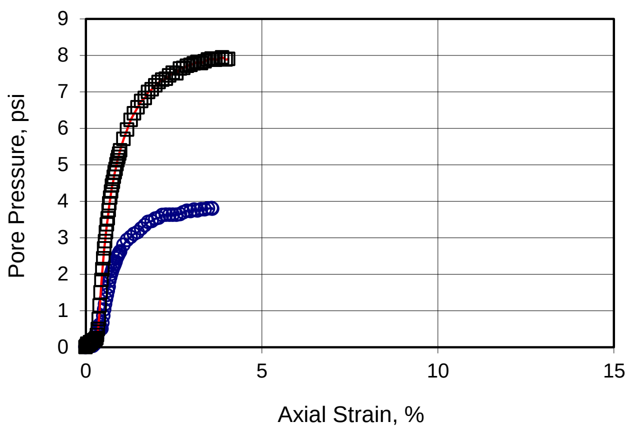

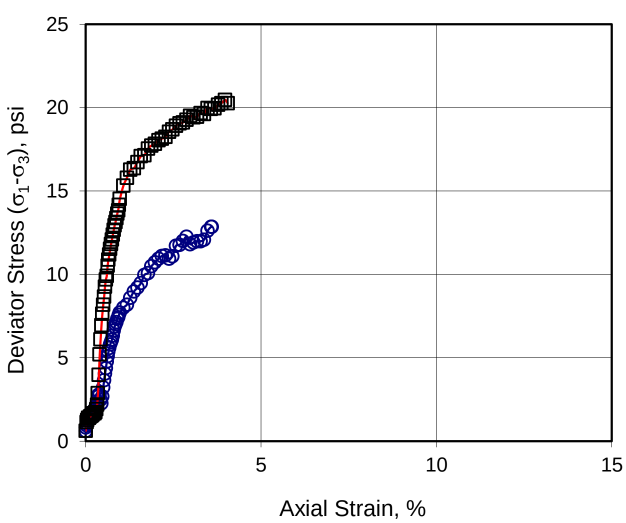

Test No. (Symbol)	○	□	△
Sample Type	Undisturbed		
Length, in.	5.14	4.97	
Diameter, in.	2.33	NM	
Dry Density, pcf	73.3	NM	
Moisture Content, %	48.8	NM	
Consolidation Pressure, psi	6.9	13.93	
"B" Parameter	97	NA	
Total Confining Stress (σ_3), psi	6.9	13.9	
Total Axial Stress (σ_1), psi	18.8	33.4	
Deviator Stress (σ_1-σ_3), psi	11.8	19.5	
Effective Lateral Stress (σ_3'), psi	3.2	6.2	
Effective Axial Stress (σ_1'), psi	15.0	25.7	
Pore Pressure (μ), psi	3.7	7.7	
Strain, %	3.0	3.0	

Remarks: Multistage Triaxial Shear Test
Consolidated Undrained (CU) Test
with pore pressure measurements.
Sample saturated with back pressure saturation.
Strength values based on conditions at approximately
3% strain.

Sample Index Properties	
Ave. Natural Dry Density, pcf	73
Ave. Natural Moisture Content, %	49
Liquid Limit, %	48
Plasticity Index, %	24
Percent Gravel	0
Percent Sand	0
Percent Passing No. 200 Sieve	96

USCS Classification
Lean Clay

Test Description: Multi-Stage Triaxial Compression Test
Test Sample Location: B-2B at 14' to 16'
Project Name: Grass Mountain

Project No. 1160276

Triaxial Compression Test

Figure 22

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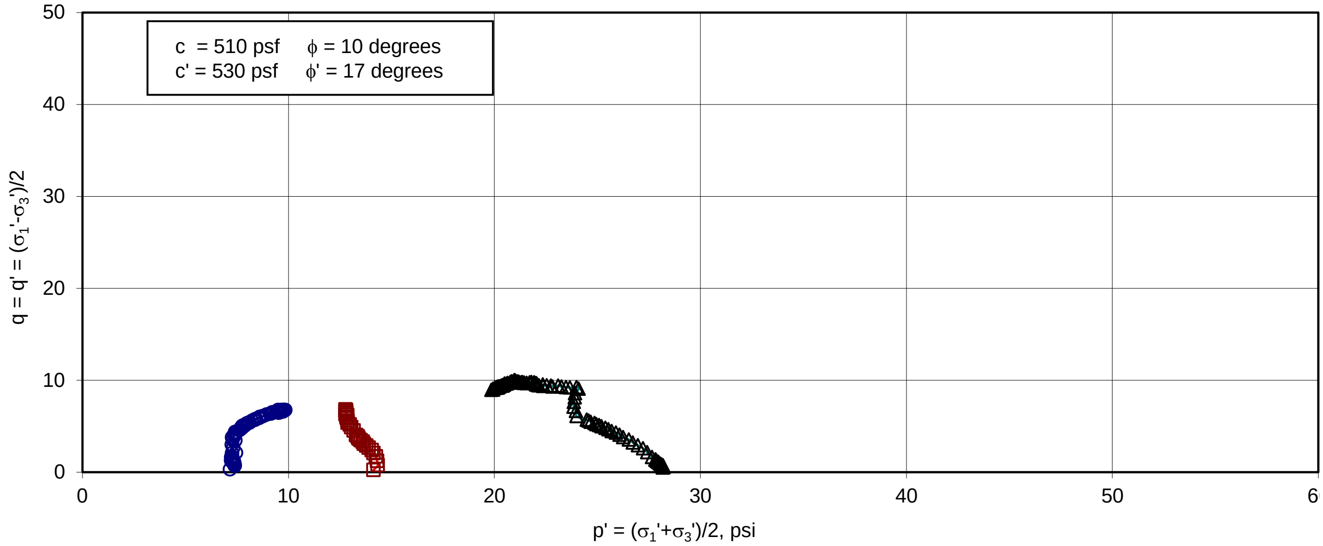
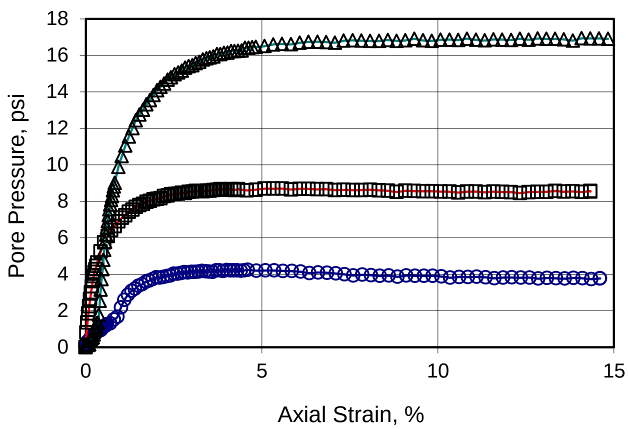
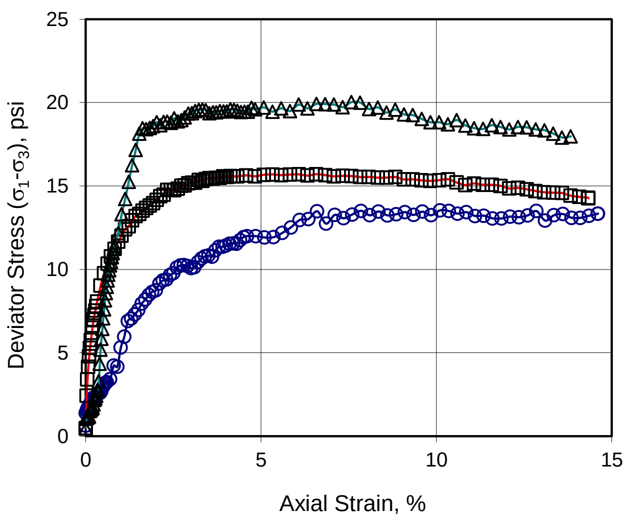






Test No. (Symbol)	○	□	△
Sample Type	Undisturbed		
Length, in.	4.89	4.95	4.57
Diameter, in.	2.50	2.49	2.50
Dry Density, pcf	78.6	80.0	78.0
Moisture Content, %	41.9	43.1	42.0
Consolidation Pressure, psi	6.94	13.9	27.8
"B" Parameter	96	97	98
Total Confining Stress (σ_3), psi	6.9	13.9	27.8
Total Axial Stress (σ_1), psi	18.8	29.6	47.5
Deviator Stress (σ_1-σ_3), psi	11.9	15.7	19.7
Effective Lateral Stress (σ_3'), psi	2.7	5.2	11.3
Effective Axial Stress (σ_1'), psi	14.6	20.9	31.0
Pore Pressure (μ), psi	4.2	8.7	16.5
Strain, %	5.1	5.1	5.1

Remarks	Multi-Point Test
Consolidated Undrained (CU) Triaxial Shear Test	
With Pore Pressure Measurements.	
Sample saturated with back pressure saturation.	
Strength envelopes given for conditions at 5.1% strain.	

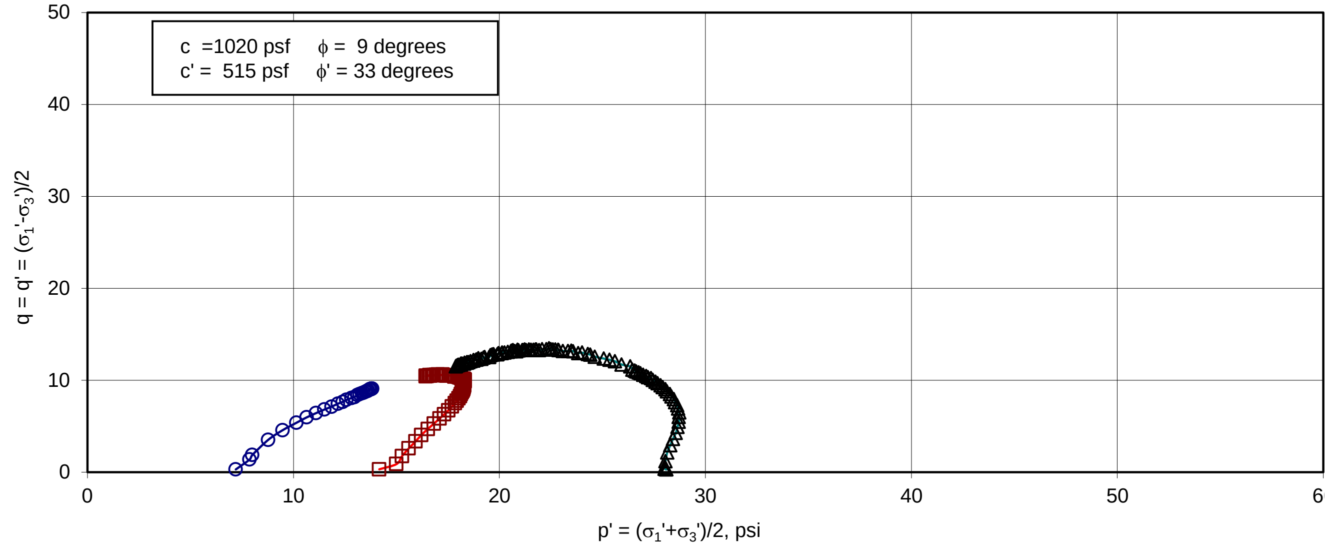
Sample Index Properties	
Ave. Natural Dry Density, pcf	79
Ave. Natural Moisture Content, %	42
Liquid Limit, %	42
Plasticity Index, %	19
Percent Gravel	0
Percent Sand	8
Percent Passing No. 200 Sieve	82

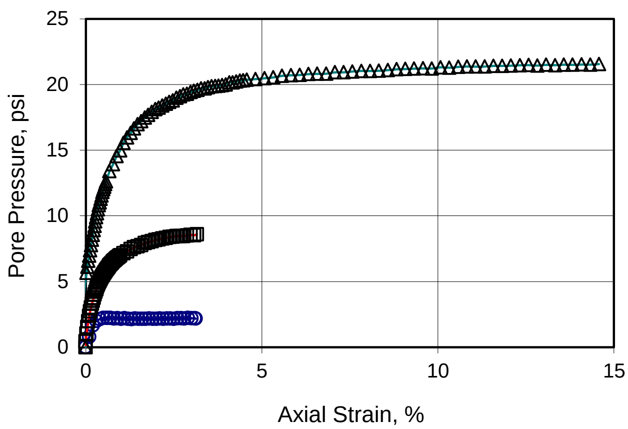
USCS Classification
Lean Clay with Sand

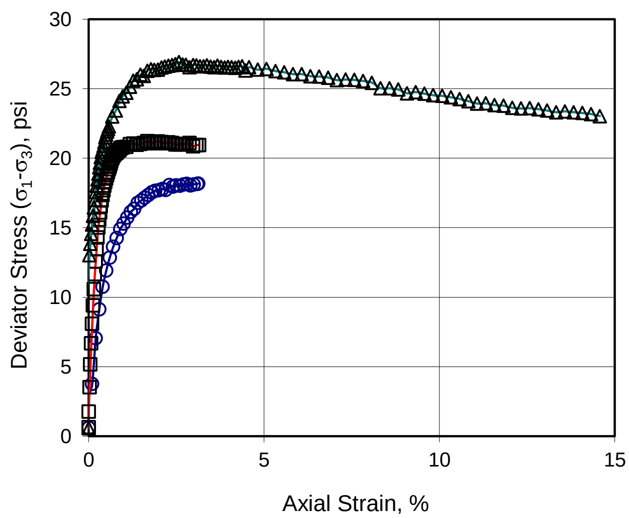
Test Description: Multi-Point Triaxial Compression Test
Test Sample Location: B-3B at 11' to 13'
Project Name: Grassy Mountain

Project No. 1160276 **Triaxial Compression Test** Figure 23

Applied Geotechnical Engineering Consultants, Inc.







Test No. (Symbol)	○	□	△
Sample Type	Undisturbed		
Length, in.	5.75		
Diameter, in.	2.38	NM	NM
Dry Density, pcf	58.7	NM	NM
Moisture Content, %	64.2	NM	NM
Consolidation Pressure, psi	6.9	14.6	27.8
"B" Parameter	96	NA	NA
Total Confining Stress (σ_3), psi	6.9	14.6	27.8
Total Axial Stress (σ_1), psi	25.0	25.4	54.5
Deviator Stress (σ_1-σ_3), psi	18.1	20.9	26.7
Effective Lateral Stress (σ_3'), psi	4.7	6.0	8.4
Effective Axial Stress (σ_1'), psi	22.8	26.9	35.1
Pore Pressure (μ), psi	2.2	8.6	19.4
Strain, %	3.0	3.0	3.0

Remarks: Multistage Triaxial Shear Test
Consolidated Undrained (CU) Test
with pore pressure measurements.
Sample saturated with back pressure saturation.
Strength values based on conditions at approximately
3% strain.

Sample Index Properties	
Ave. Natural Dry Density, pcf	59
Ave. Natural Moisture Content, %	64
Liquid Limit, %	49
Plasticity Index, %	24
Percent Gravel	0
Percent Sand	1
Percent Passing No. 200 Sieve	99
USCS Classification	
Lean Clay	

Test Description: Multi-Stage Triaxial Compression Test
Test Sample Location: B-4B at 4' to 6'
Project Name: Grass Mountain

Project No. 1160276 **Triaxial Compression Test** Figure 24

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1160276

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	WATER SOLUBLE SULFATE (%)	SAMPLE CLASSIFICATION
BORING	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)			
B-2A	2	11	93			88					Lean Clay
	9	24	93			92	28	10	315		Lean Clay
	14	45	74			97	35	13	335		Lean Clay
B-3A	4	12	82			64					Sandy Lean Clay/Silt
	14	51	68			99					Lean Clay
	19	56	66			96					Lean Clay
	24	50	72			100	42	25			Lean Clay
	29	52	68			94	53	29			Fat Clay
	39	61	65			99	51	29			Fat Clay
	64	36	85			91	37	18			Lean Clay
	94	29	94			83	35	19			Lean Clay with Sand
B-1B	19	37	83			87	27	11			Lean Clay
	49	30	94			58	26	17			Sandy Lean Clay
B-2B	14	41	77			96	48	24			Lean Clay
	29	53	67			98					Lean Clay
	34	25	99			42	27	16			Lean Clay/Silty Sand
	54	23	104			38	23	6			Lean Clay/Silty Sand

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

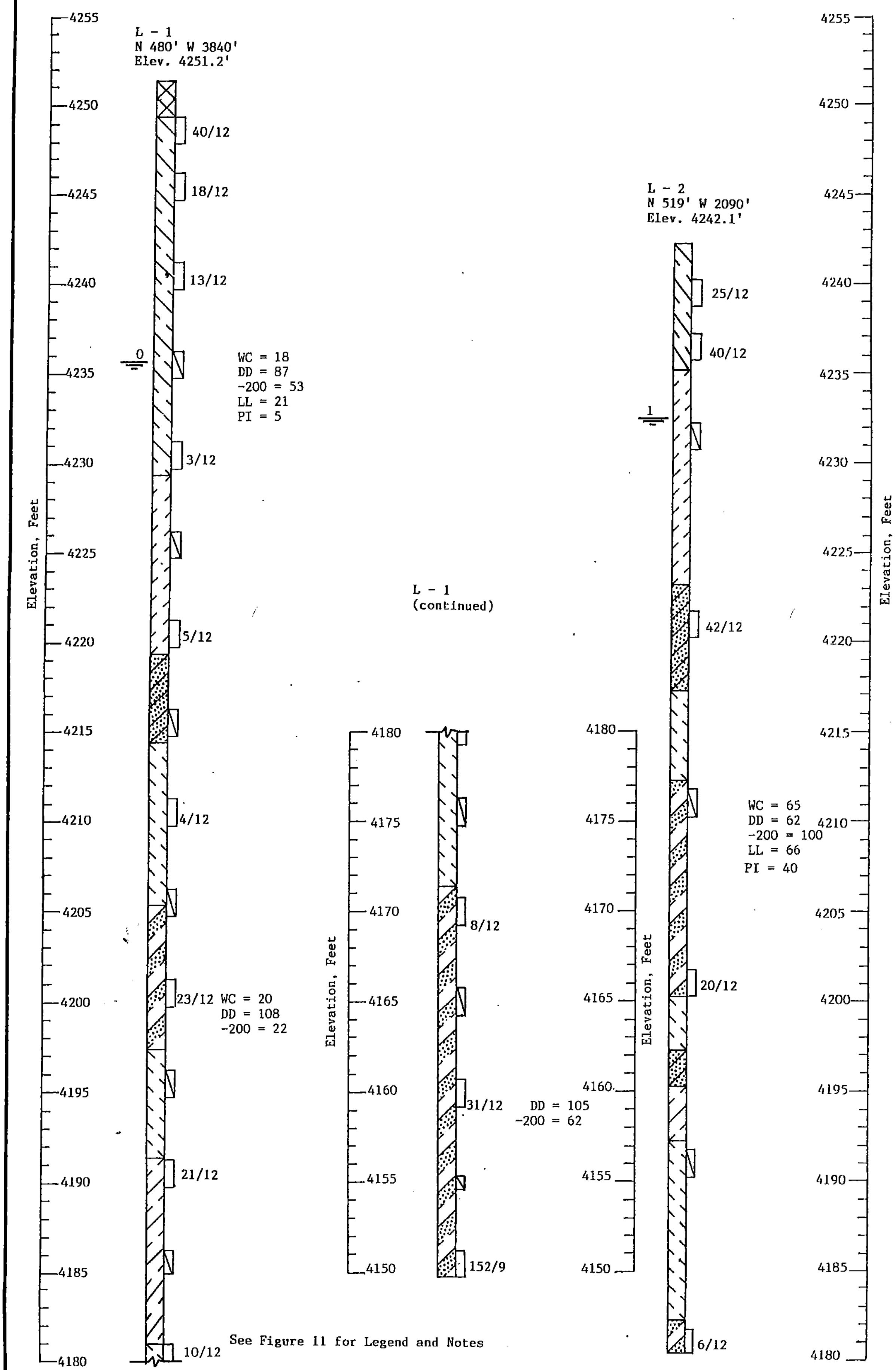
PROJECT NUMBER 1160276

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	WATER SOLUBLE SULFATE (%)	SAMPLE CLASSIFICATION
BORING	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)			
B-3B	9	49	75			85	55	30			Fat Clay with Sand
	11	43	81			82	42	19			Lean Clay with Sand
	19	35	89			60	28	13			Lean Clay/Silty Sand
	44	26	100			33	24	8			Lean Clay/Silty Sand
B-4B	4	53	64			99	49	24			Lean Clay
	39	24	103			25	24	6			Lean Clay/Silty Sand

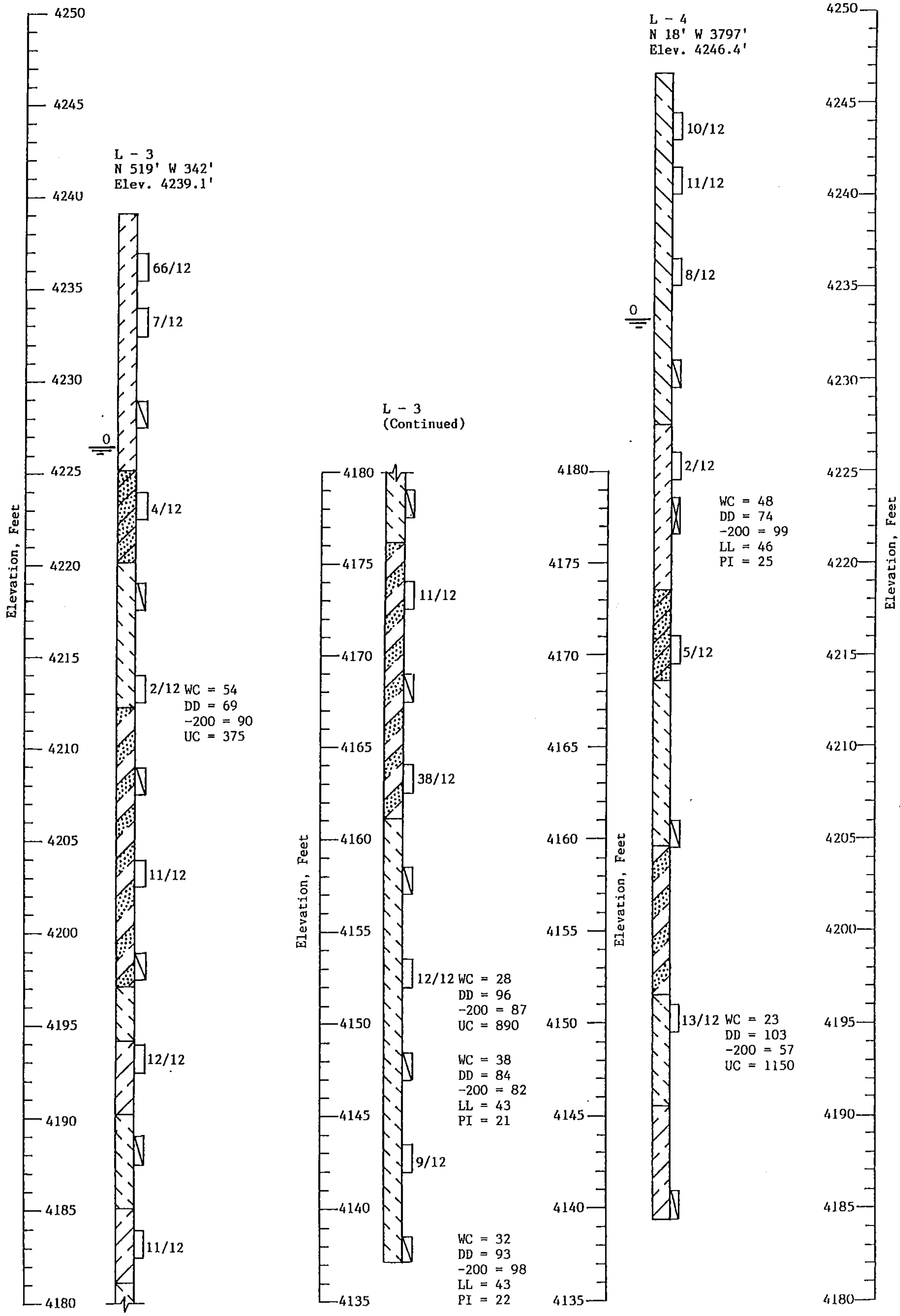
APPENDIX A-1

BORING LOGS

PREVIOUS STUDIES

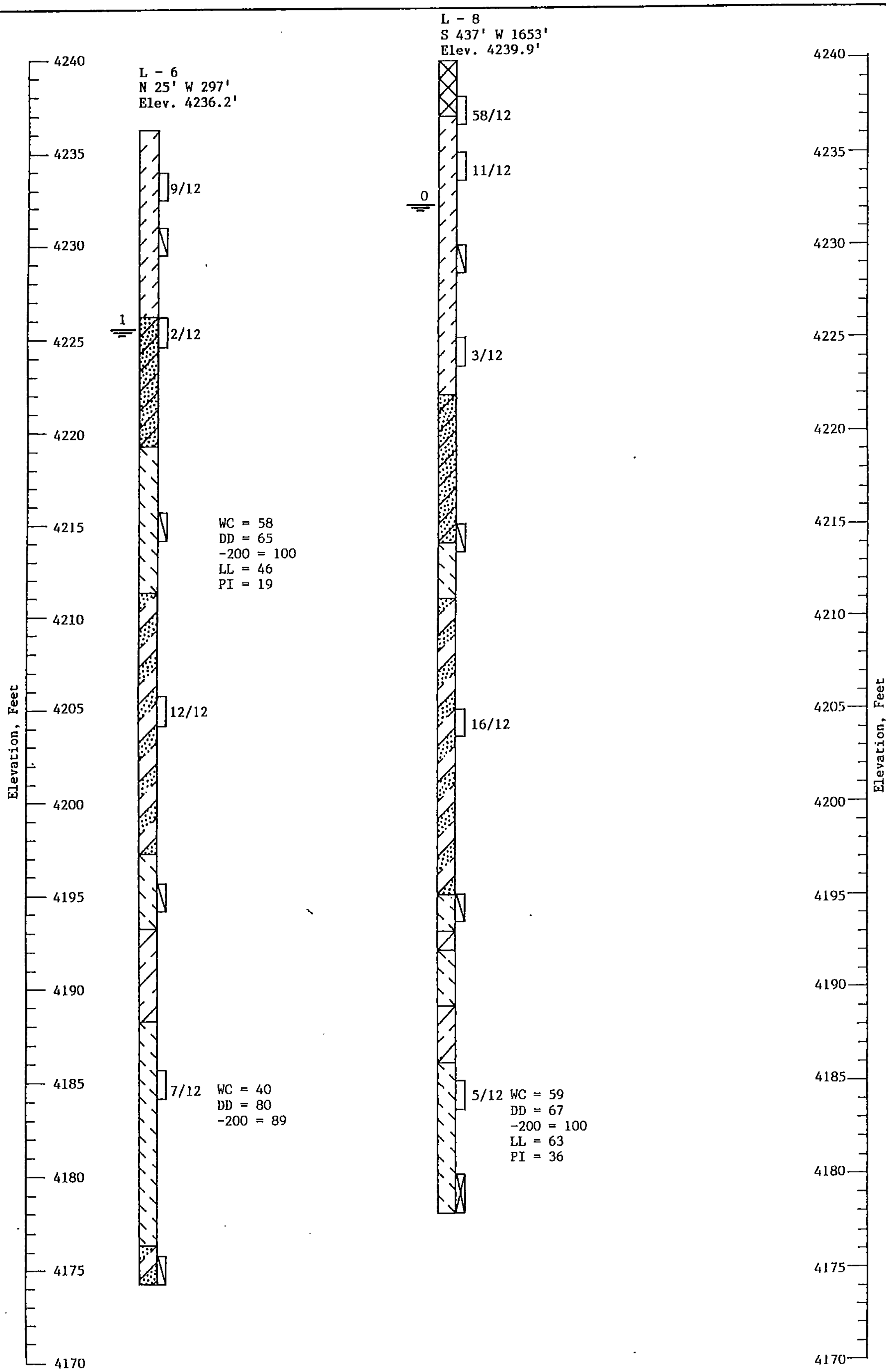


20591	A G E C	LOGS OF EXPLORATORY BORINGS	FIGURE 2



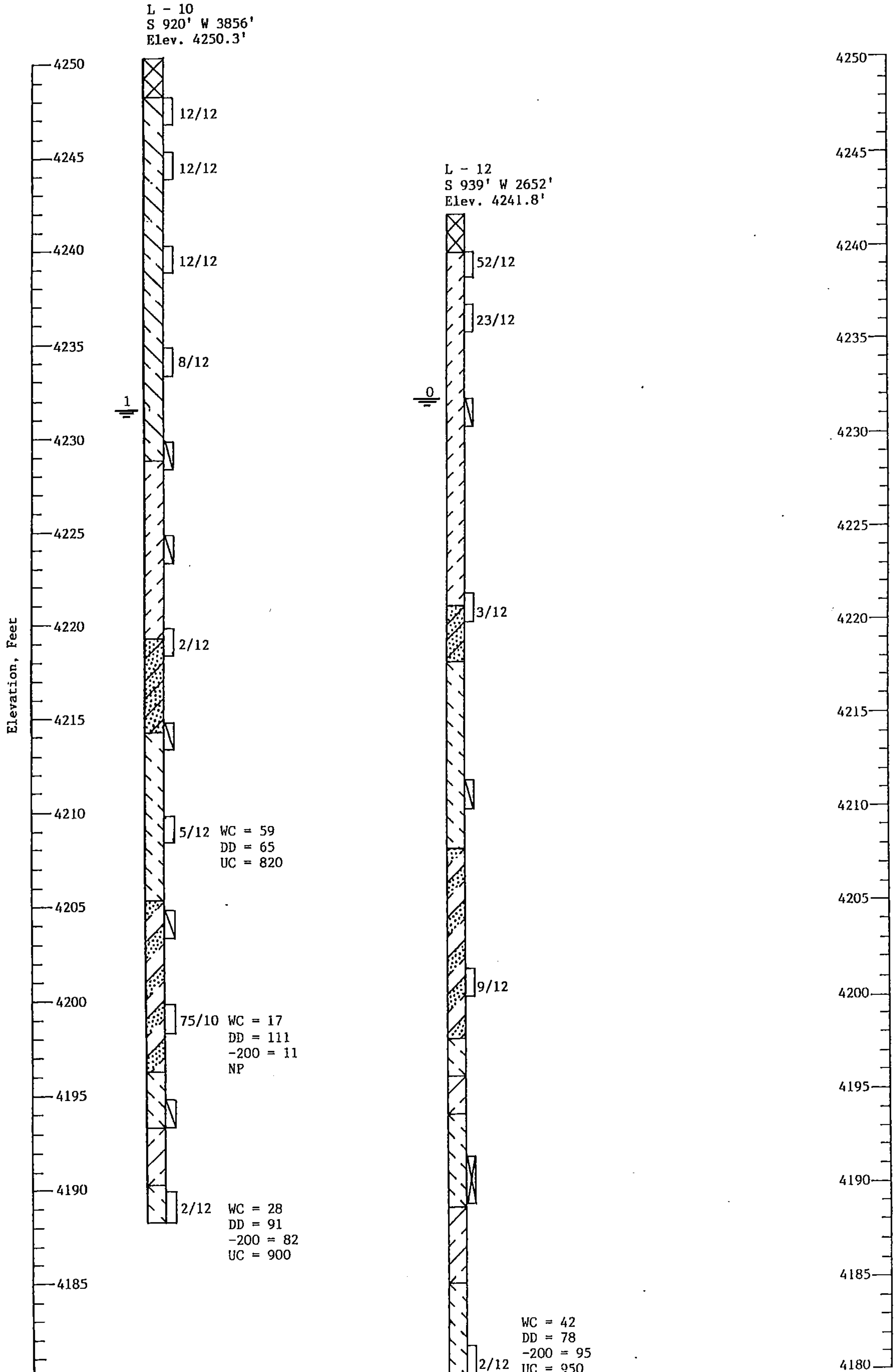
See Figure 11 for Legend and Notes.

20491	A G E C	LOGS OF EXPLORATORY BORINGS	FIGURE 3



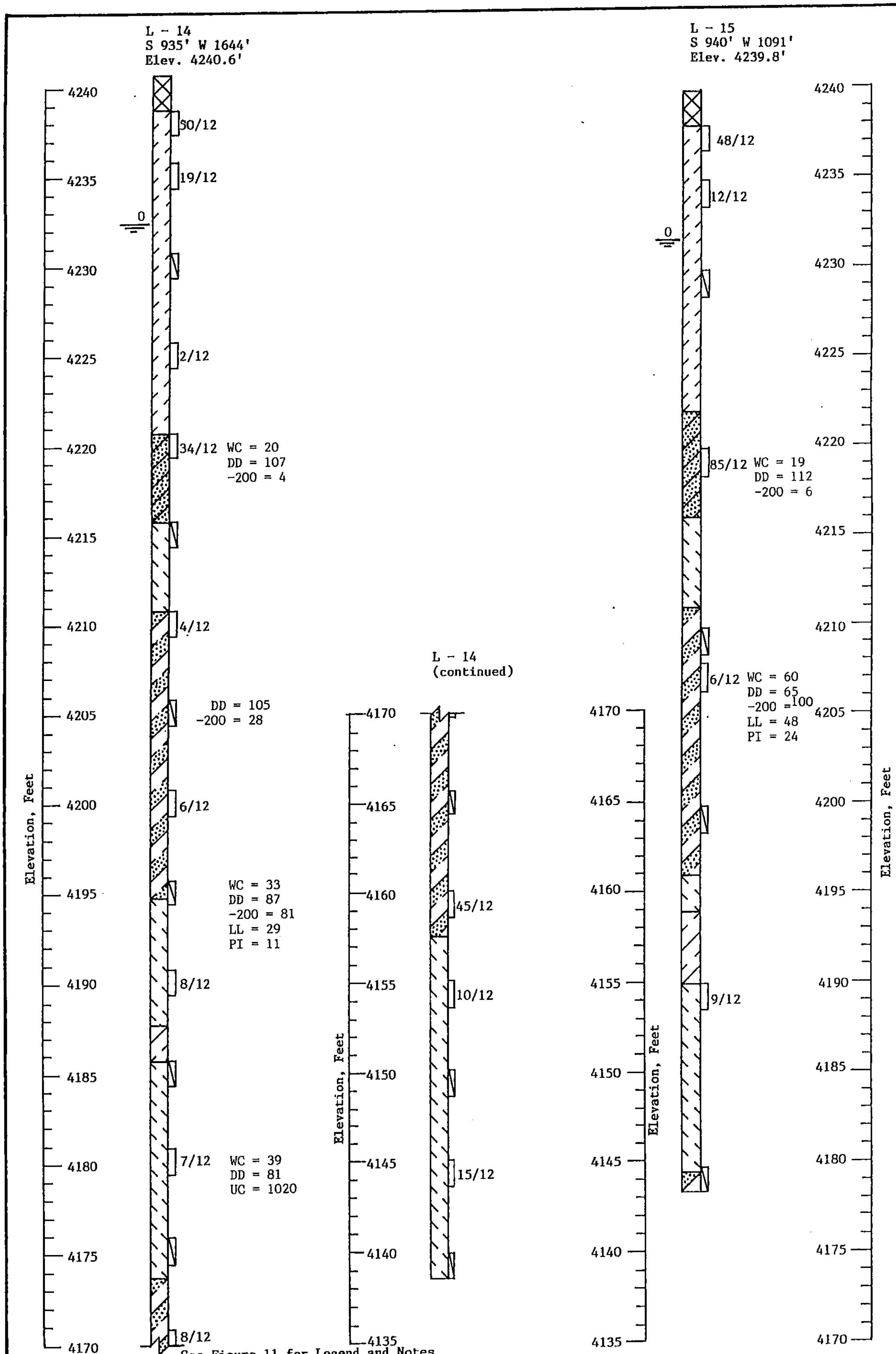
See Figure 11 for Legend and Notes

20501	A G E C	LOGS OF EXPLORATORY BORINGS	FIGURE 4

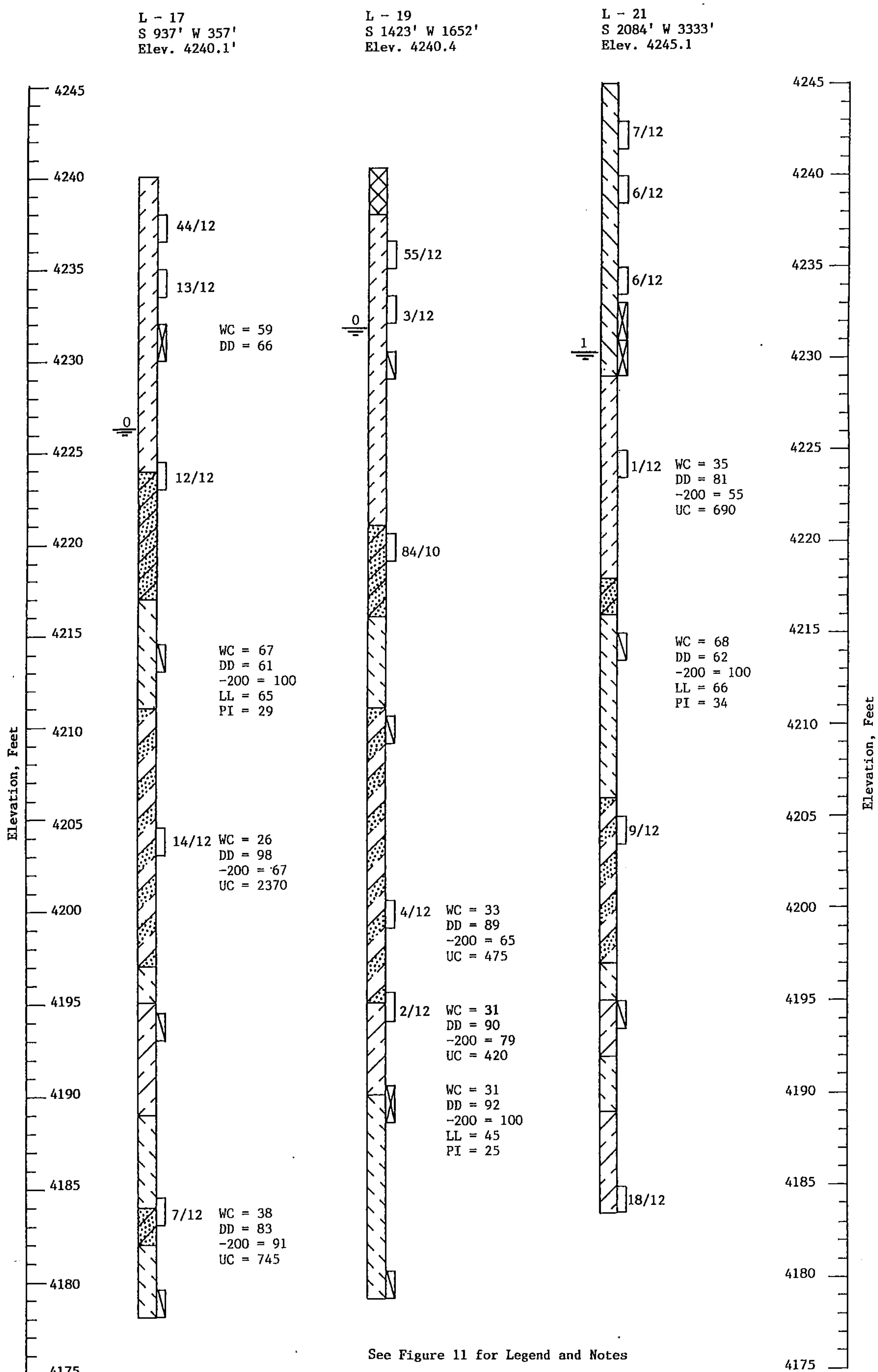


See Figure 11 for Legend and Notes

20491	A G E C	LOGS OF EXPLORATORY BORINGS	FIGURE 5

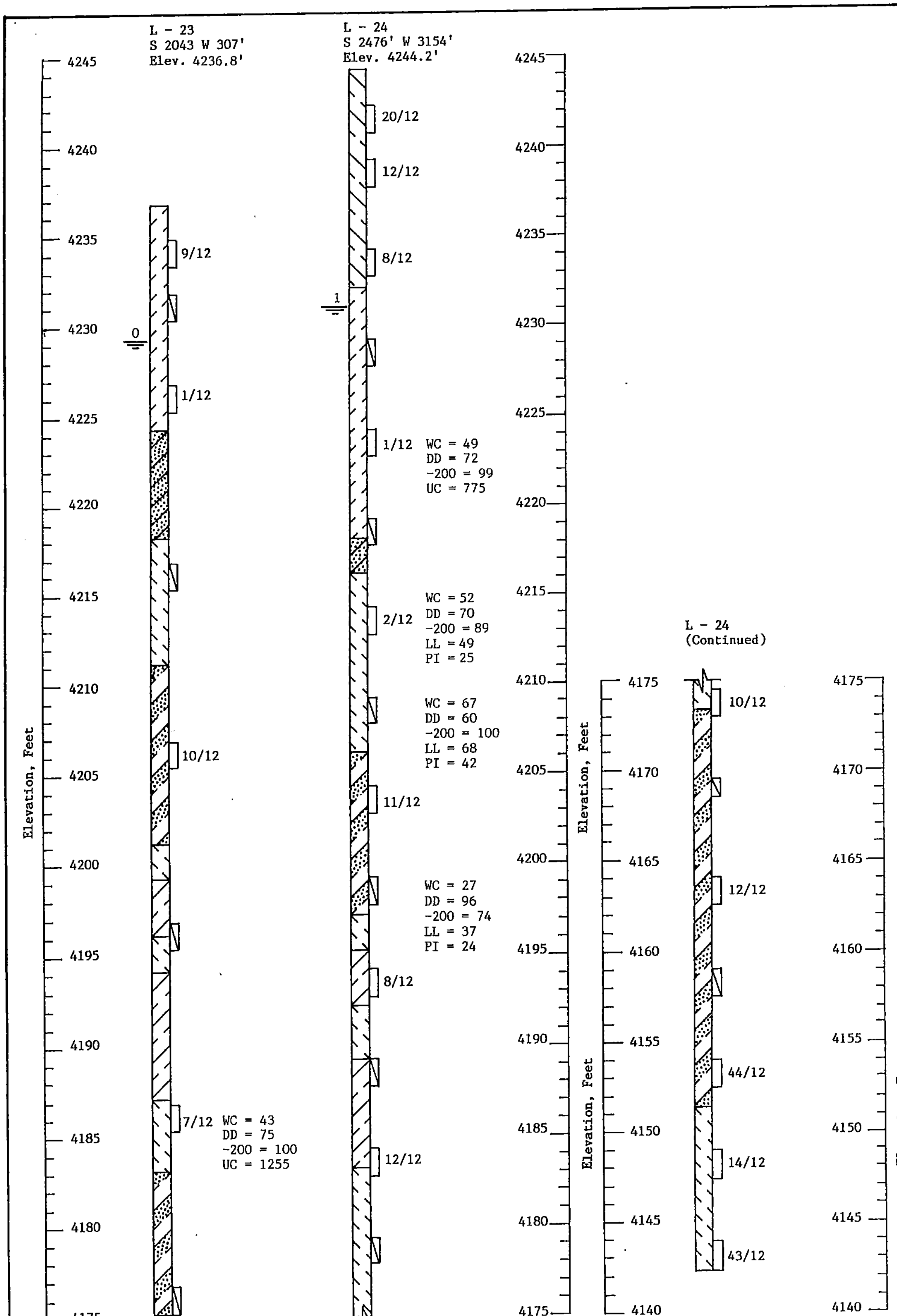


20591	A G E C	LOGS OF EXPLORATORY BORINGS	FIGURE 6



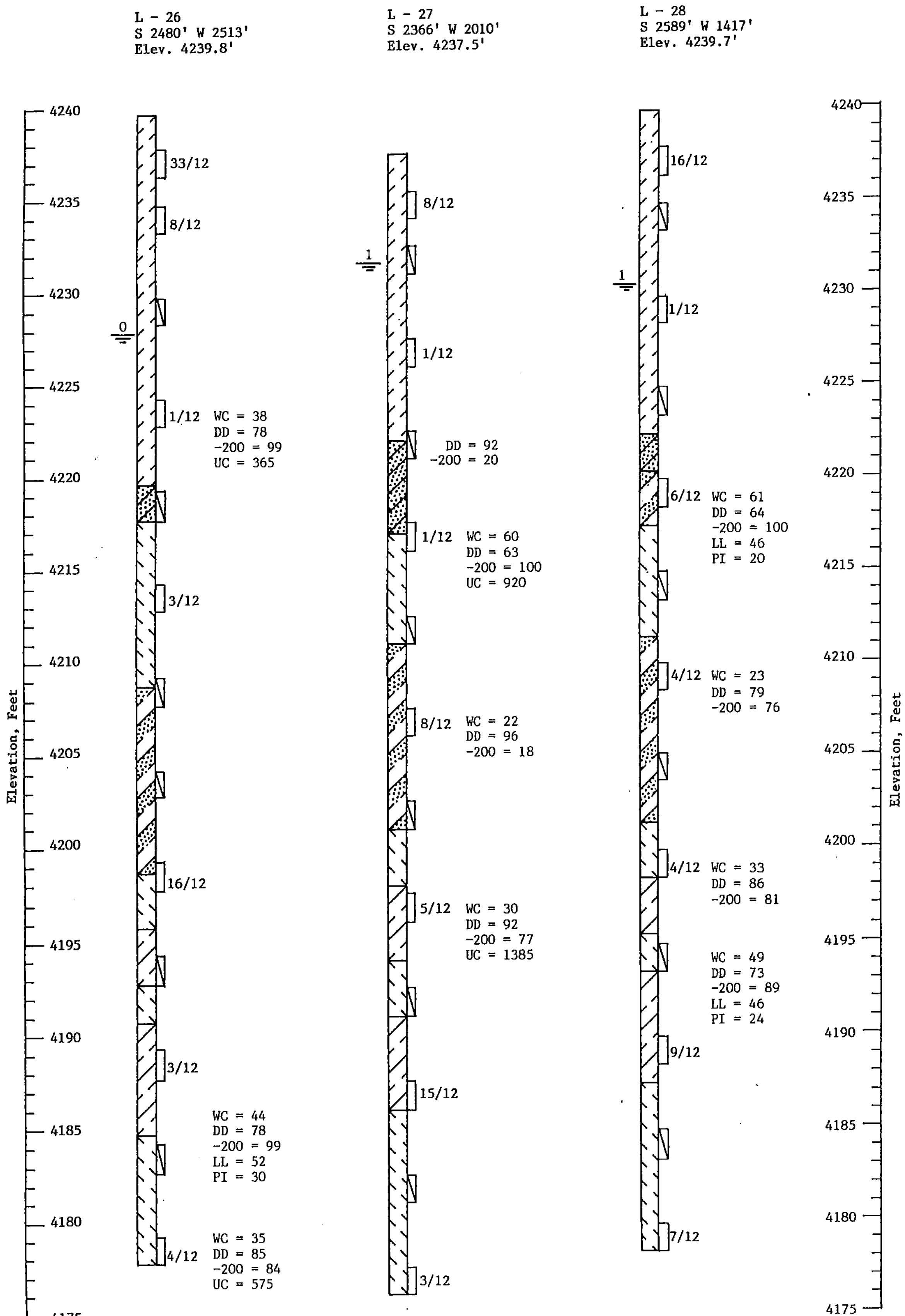
See Figure 11 for Legend and Notes

20591	A G E C	LOGS OF EXPLORATORY BORINGS	FIGURE 7



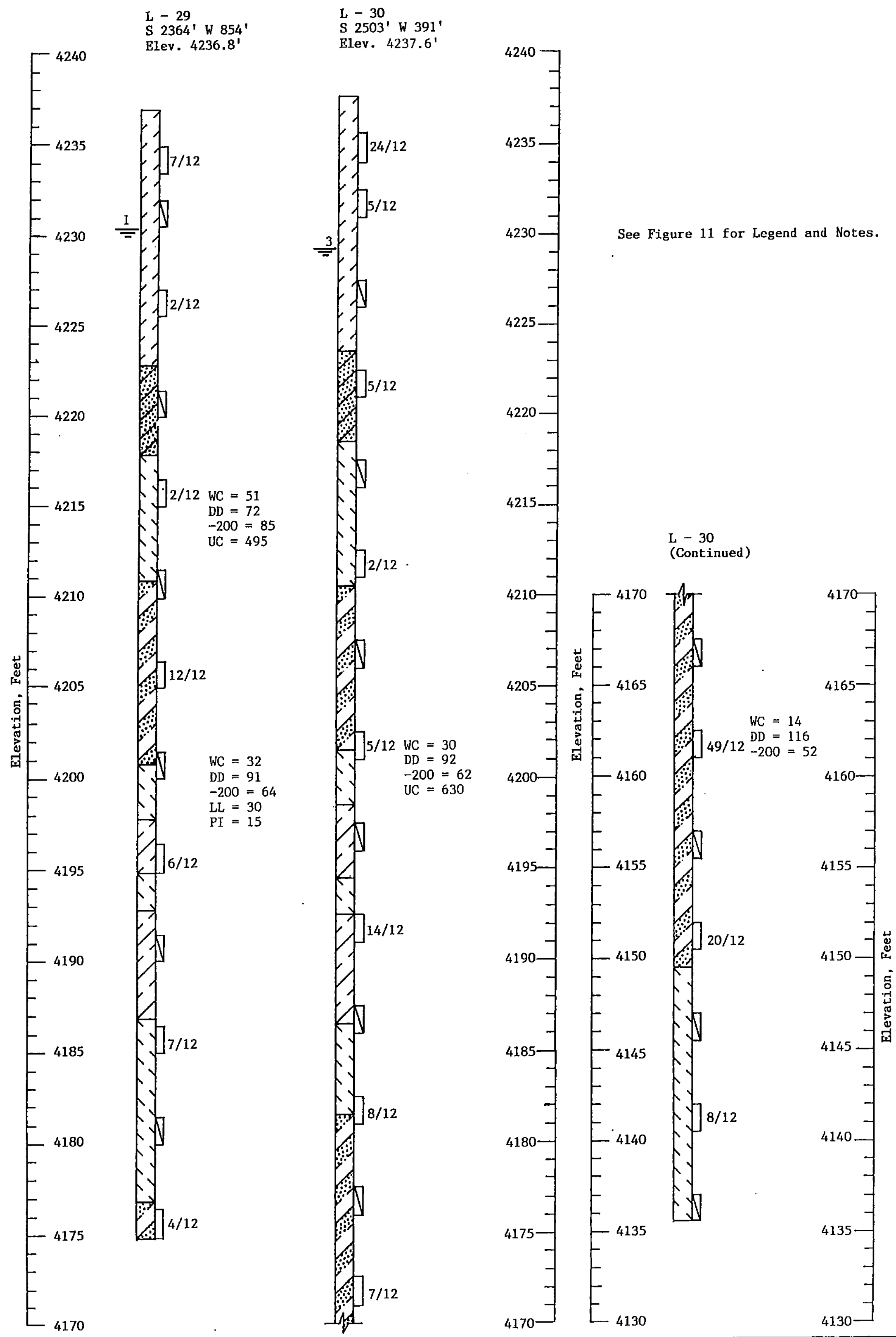
See Figure 11 for Legend and Notes

20591	A G E C	LOGS OF EXPLORATORY BORINGS	FIGURE 8



See Figure 11 for Legend and Notes

20591	A G E C	LOGS OF EXPLORATORY BORINGS	FIGURE 9



20591	A G E C	LOGS OF EXPLORATORY BORINGS	FIGURE 10

NOTES:

1. Exploratory borings were drilled on March 30, 1992 through May 12, 1992 with 8-inch diamter hollowstem auger.

2. Locations and elevations of exploratory borings were surveyed by Sorenson once drilling was completed.

3. The exploratory boring locations and elevations should be considered accurate only to the degree implied by the method used.

4. The lines between the materials shown on the boring logs represent the approximate boundaries between material types and the transitions may be gradual.

5. Water level readings shown on the logs were made at the time and under the conditions indicated. Fluctuations in the water level may occur with time.

6. WC = Water Content (%);
   DD = Dry Density (pcf);
   -200 = Percent Passing No. 200 Sieve;
   LL = Liquid Limit (%);
   PI = Plasticity Index (%);
   NP = Nonplastic;
   UC = Unconfined Compressive Strength (psf).

7. All borings were backfilled with bentonite.

LEGEND:

Fill; sandy lean clay, slightly moist to moist, light gray brown.

Lean Clay (CL); slightly moist to wet, very hard in upper 3 - 5 feet grading to very stiff to medium stiff with depth, slightly moist to wet with depth, light brown to light gray brown.

Lean Clay (CL); thin silt and sand layers, occasional cemented layers, very soft to stiff, very moist to wet, light brown to gray, sulfurous odor.

Interlayered Sandy Silt and Sandy Lean Clay (ML-CL); silty sand and clayey sand layers, very hard to very soft with depth, moist to wet, light brown, sulfates.

Interlayered Sandy Silt and Lean Clay (ML-CL); occasional thin silty sand layers, medium to very stiff, very moist to wet, light brown to gray, sulfurous odor.

Interlayered Silty Sand and Lean clay (SM-CL); sandy silt layers, medium to very dense, medium to very stiff, very moist to wet, light brown to gray, sulfurous odor.

Silty Sand (SM); clay and sandy silt layers, medium to very dense, wet, gray to dark gray, sulfurous odor.

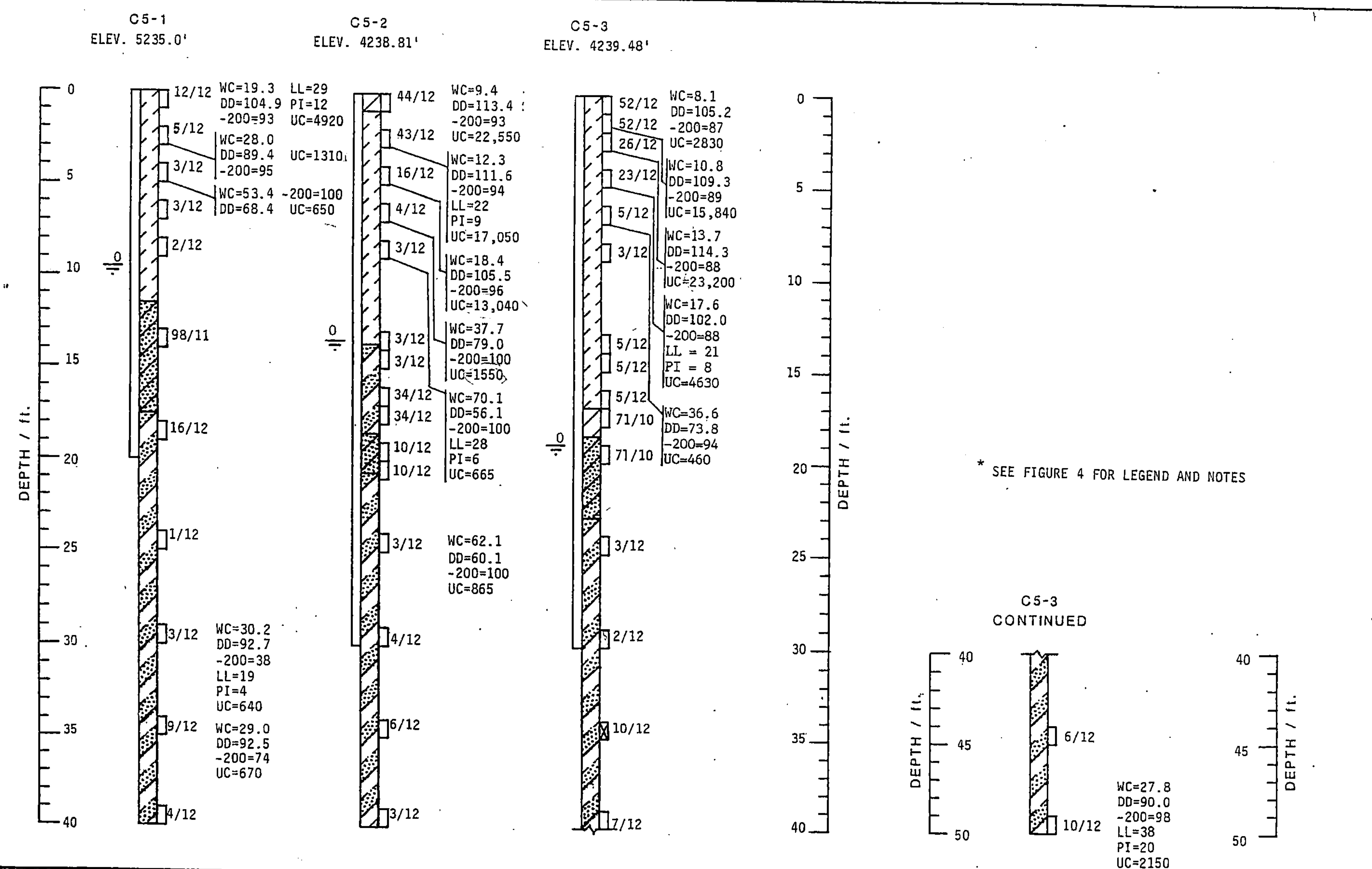
10/12 California Drive Sample. The symbol 10/12 indicates that 10 blows from a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches.

Indicates 2½ inch inside diameter sampler used. The sampler was pushed not driven with a hammer.

Indicates a Shelby tube sample was taken.

1 Indicates depth to free water and the number of days after drilling the measurement was taken.

20591	AGEC	Legend and Notes of Exploratory Borings	Figure 11



#546089	Chen-Northern, Inc.	LOGS OF BORINGS	Figure 2

NOTES

1. Exploratory borings for this investigation were drilled on August 15 & 16, 1989 with with a 7-inch diameter continuous flight hollow stem power auger.

2. Locations of exploratory borings were measured approximately by pacing from features shown on the site plan provided.

3. Elevations of exploratory borings were provided by others.

4. The exploratory boring locations should be considered accurate only to the degree implied by the method used.

5. The lines between the materials shown on the boring logs represent the approximate boundaries between material types and the transitions may be gradual.

6. Water level readings shown on the logs were made at the time and under the conditions indicated. Fluctuations in the water level may occur with time.

7. WC = Water Content (%);
DD = Dry Density (pcf);
-200 = Percent Passing No. 200 Sieve;
LL = Liquid Limit (%);
PI = Plasticity Index (%);
UC = Unconfined Compressive Strength (psf);

8. Borings drilled for earlier investigations were drilled on the following dates and previously reported under the listed project numbers.

Borings	Dates Drilled	Project Number
B-1, B-3, B-4, B-6	April, 1984	520484
TH-7	June, 1984	527584
TH-33	June, 1986	522486

LEGEND

EMBANKMENT FILL, sandy clay to silty sand, very stiff or medium to very dense, slightly moist to moist, light brown.

CLAY (CL), interlayered with sand and silt, soft to very stiff, occasional cemented layers, dry to wet, buff to light brown changing to olive-blueish brown w/depth, black streaks.

SILT (ML), interlayered with clay and sand, medium to very stiff, occasional cemented layers, dry to very moist, light brown.

CLAY, sandy to sand, silty (CL-SM), interlayered, soft to very stiff, on loose to very dense, occasional cemented layers, very moist to wet, olive brown to grey to blueish green.

SAND (SM), silty, loose to very dense, wet, olive-blueish brown.

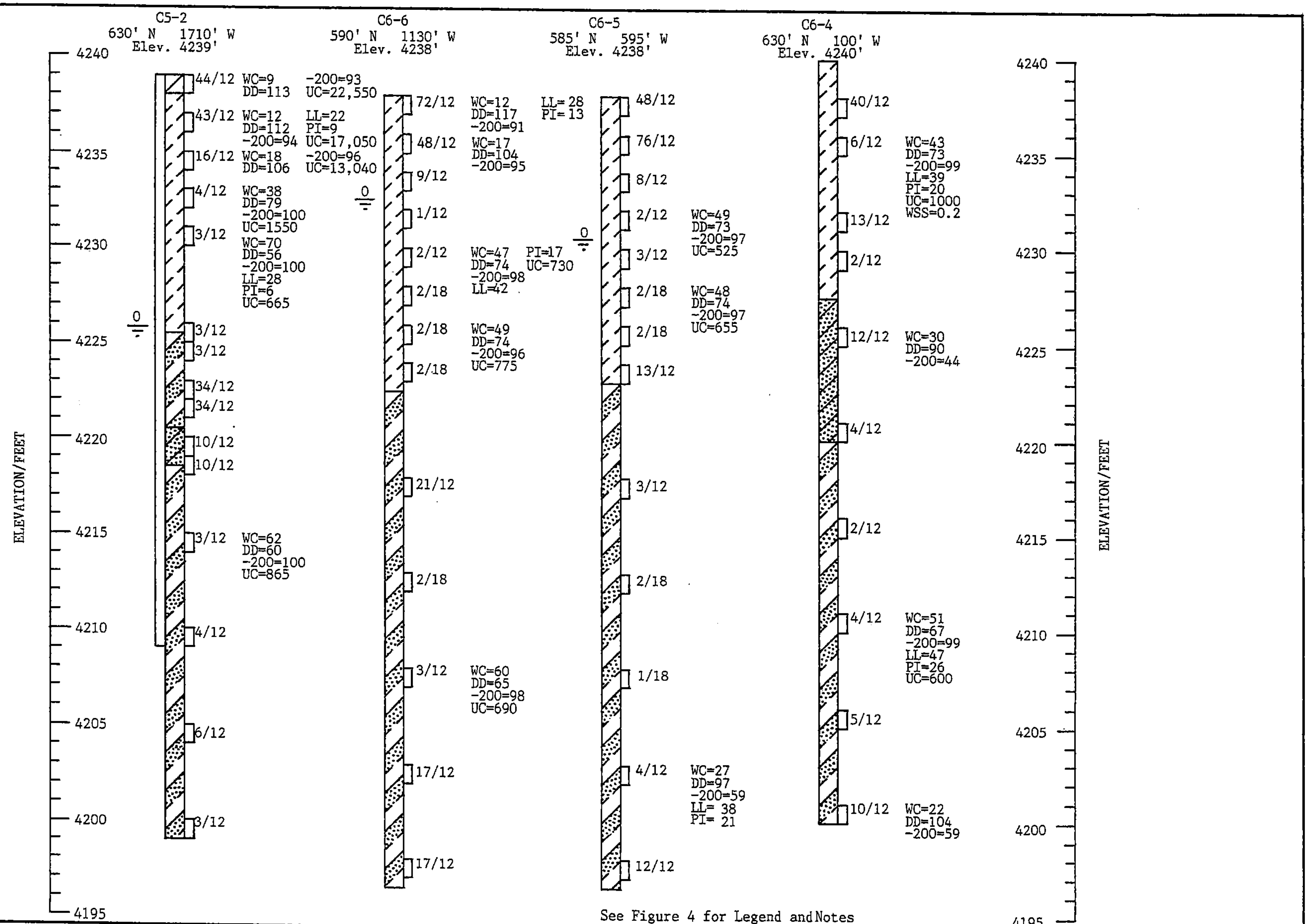
10/12 CALIFORNIA DRIVE SAMPLE. The symbol 10/12 indicates that 10 blows of a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches.

SHELBY TUBE SAMPLE.

Indicates slotted 1½ inch P.V.C. pipe installed in boring to the depth shown.

0 Indicated depth to free water and number of days after drilling that measurement was taken.

#546089 Chen Northern, Inc. | LEGEND AND NOTES OF BORINGS | Figure 4



See Figure 4 for Legend and Notes

11791	A G E C	LOGS OF BORINGS, INCLUDING SELECTED BORINGS FROM PREVIOUS INVESTIGATIONS	FIGURE 3

NOTES:

1. Exploratory borings for this project (C6-5, 6 & 7) were drilled on March 5, 1991 with 7-inch diameter continuous flight hollow stem power augers.

2. Locations of borings were measured approximately by taping from features shown on the site plan provided.

3. Elevations of borings were determined by interpolating between contours shown on the site plan provided. The boring locations and elevations should be considered accurate only to the degree implied by the method used.

4. The lines between the materials shown on the boring logs represent the approximate boundaries between material types, and the transitions may be gradual.

5. Water level readings shown on the logs were made at the time and under the conditions indicated. Fluctuations in the water level may occur with time.

6. WC = Water Content (%);
   DD = Dry Density (pcf);
   -200 = Percent Passing the No. 200 Sieve;
   LL = Liquid Limit (%);
   PI = Plasticity Index (%);
   UC = Unconfined Compressive Strength (psf);
   WSS = Water Soluble Sulfate (%).

7. All borings were backfilled with bentonite.

8. Borings drilled for earlier investigations were drilled on the following dates and previously reported under the listed project numbers.

Boring	Date Drilled	Project Number
C5-1, 2	August 1989	CNI #546089
C6-1, 2, 3 & 4	September 1989	CNI #560589
TH-1	June 1984	CAI #542184

NOTE: CAI indicates Chen & Associates, Inc.
CNI indicates Chen-Northern, Inc.

LEGEND:

Clay (CL); interlayered with fine sand and silt layers, upper 3-5 feet of upper clays are very hard, changing to very soft to medium stiff with depth, occasional cemented layers, slightly moist to wet, buff to light brown, olive brown, black streaks.

Clay and Silty Sand (CL-SM); interlayered with silt, primarily soft to medium stiff with occasional cemented layers (very loose to loose, occasionally medium dense in sandy deposits), very moist to wet, olive brown to gray to bluish green, to buff.

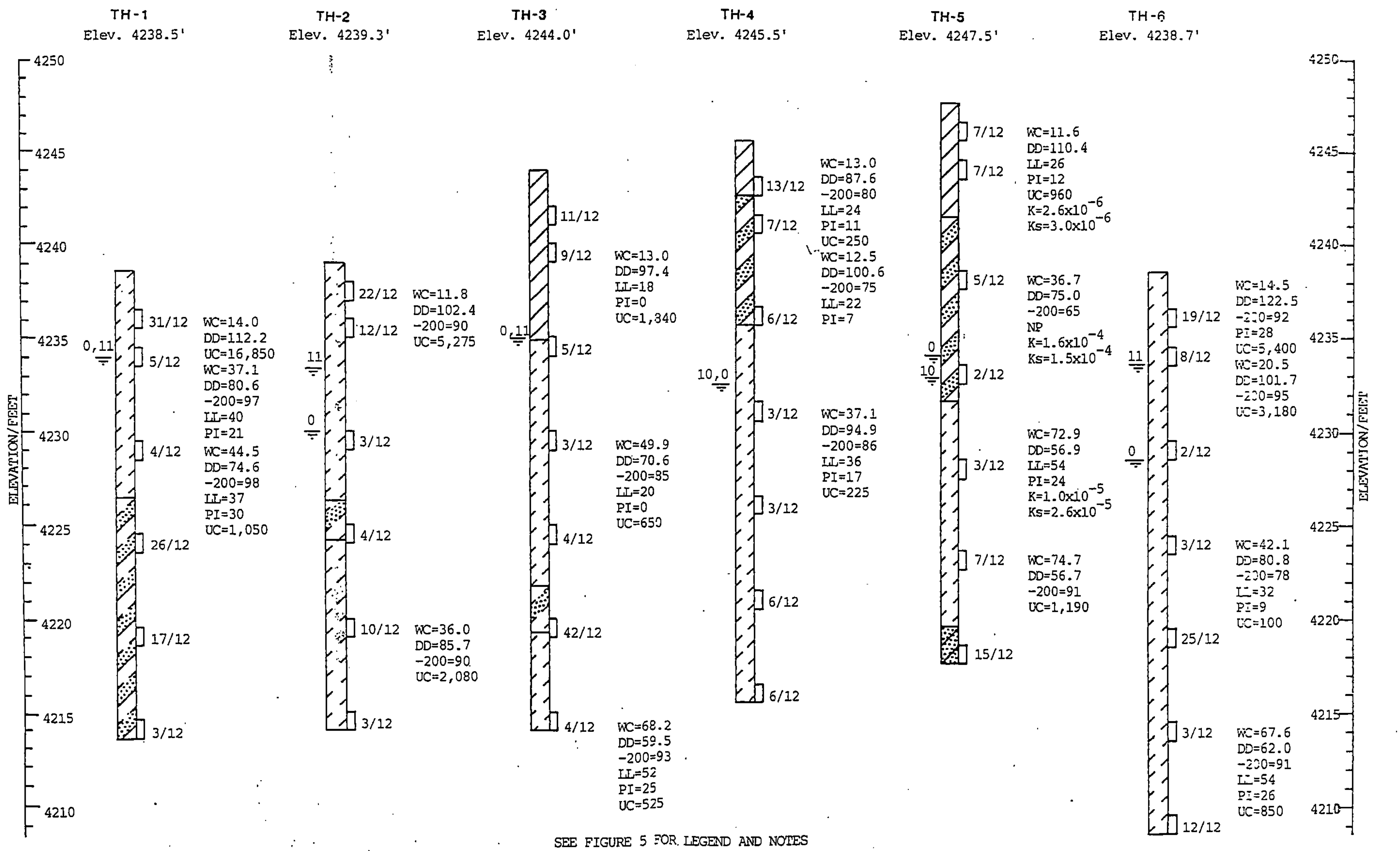
Silty Sand (SM); loose to medium dense, wet, olive-bluish brown, cemented layers.

10/12 California Drive Sample. The symbol 10/12 indicates that 10 blows of a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches.

Indicates PVC pipe placed in boring to depth shown.

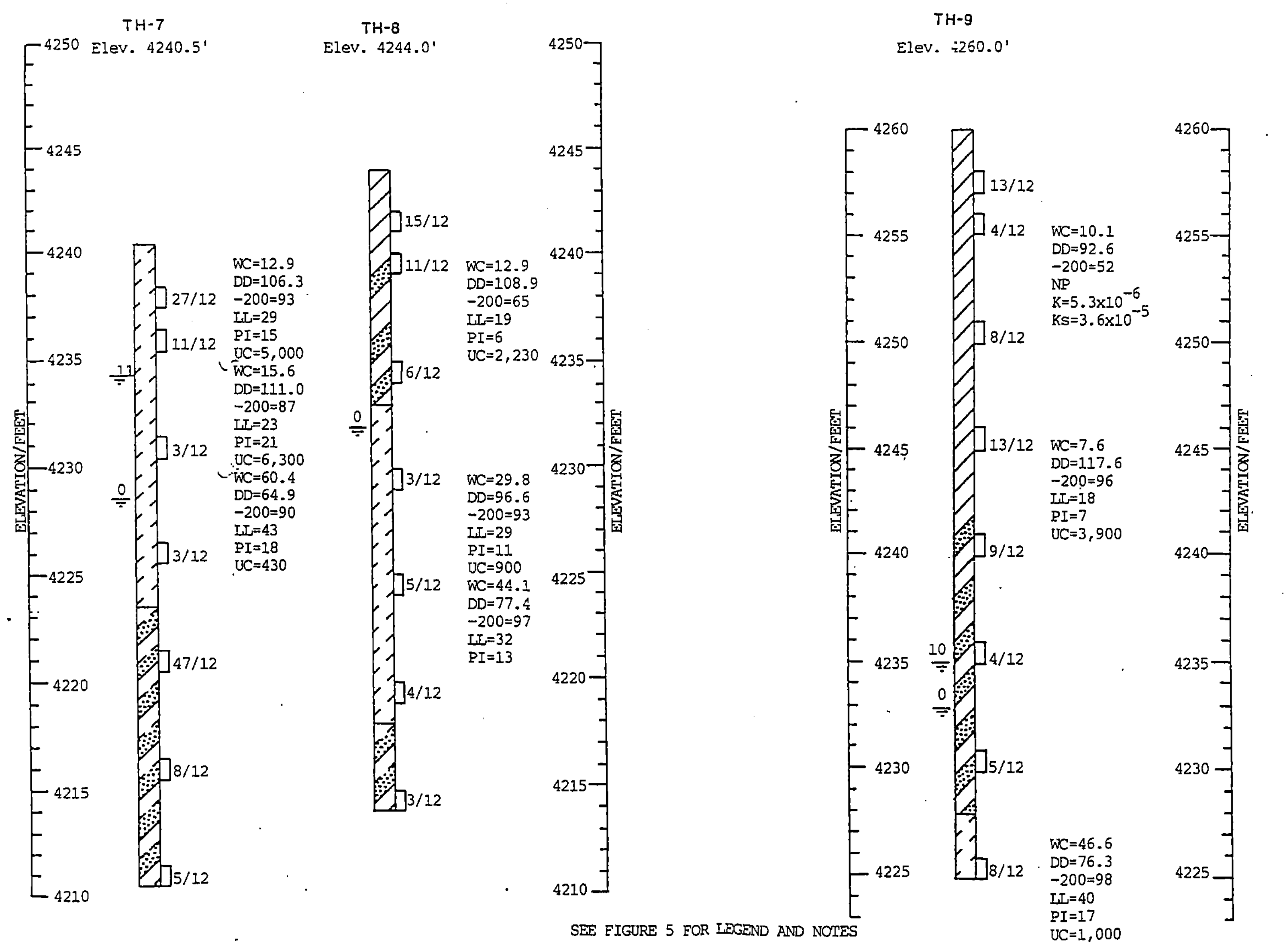
0 Indicates depth to free water and number of days after drilling that measurement was taken.

11791	A G E C	LEGEND AND NOTES OF BORINGS	FIGURE 4



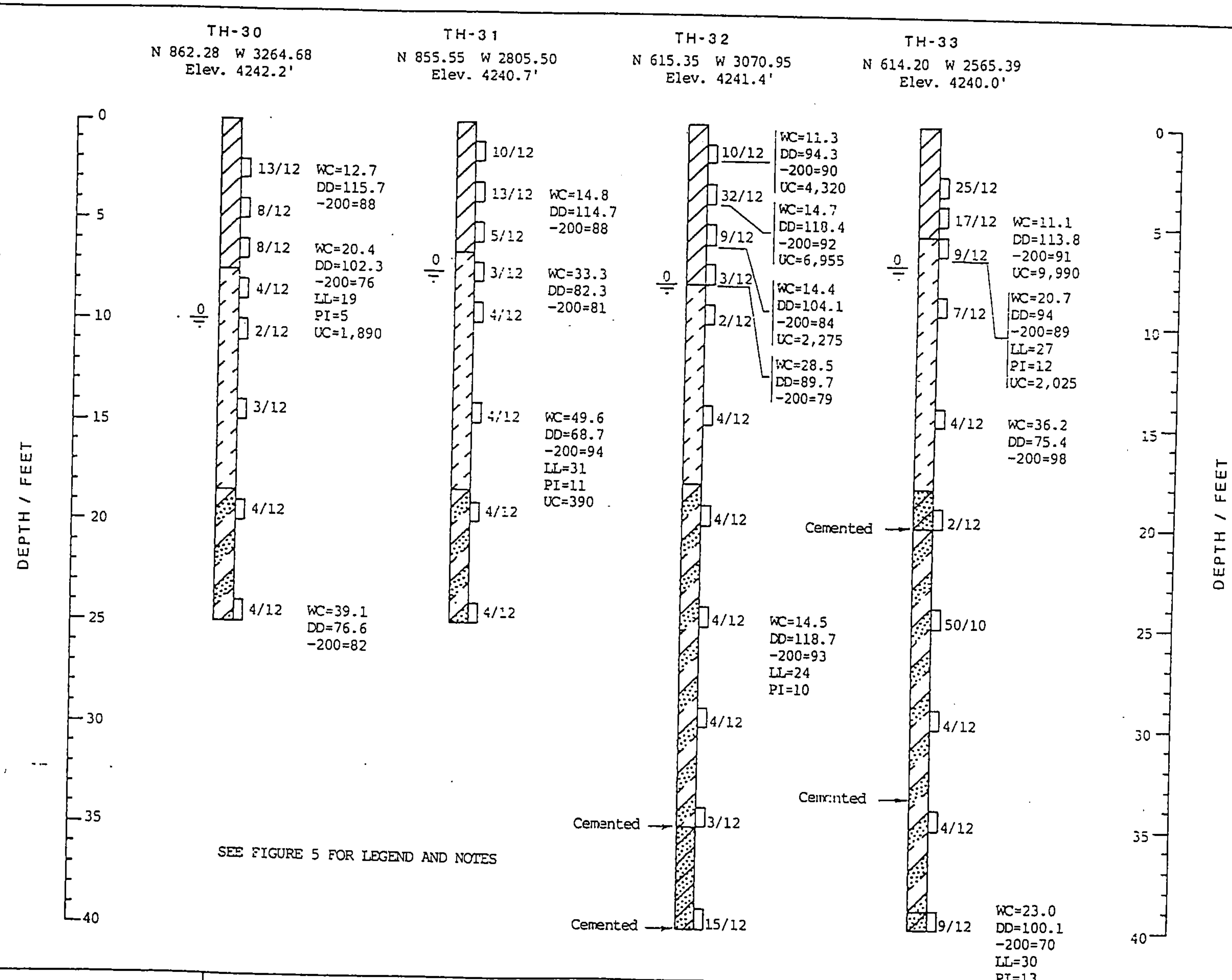
SEE FIGURE 5 FOR LEGEND AND NOTES

527584	chen and associates, inc.	LOGS OF EXPLORATORY TEST HOLES	Figure 3



SEE FIGURE 5 FOR LEGEND AND NOTES

527584	chen and associates, inc.	LOGS OF EXPLORATORY TEST HOLES	Figure 4



522486 | Chen & Associates | LOGS OF EXPLORATORY BORINGS | Figure 3

APPENDIX A-2

CONE PENETRATION

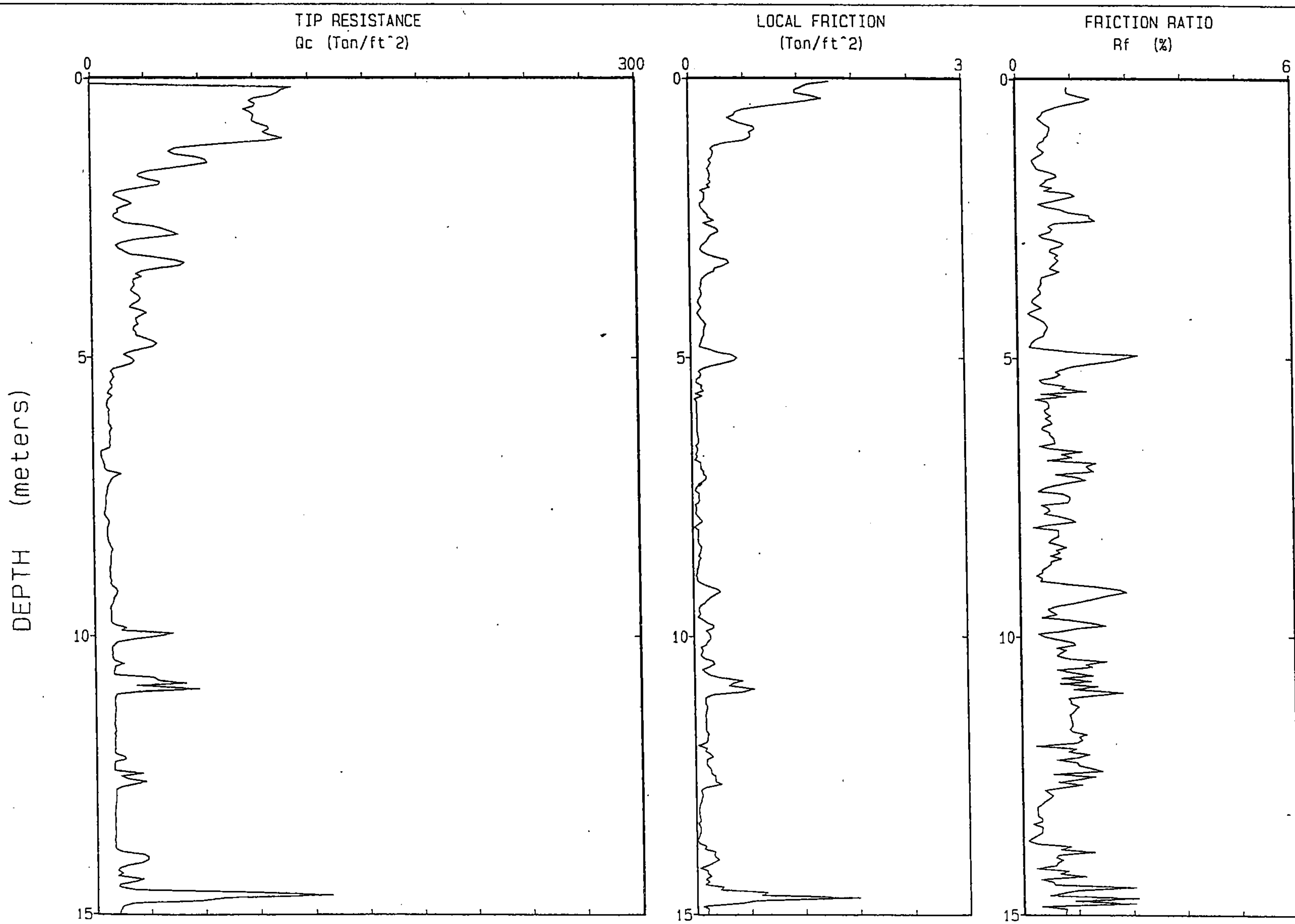
TEST RESULTS

AGEC

Engineer : JM
Location : CL-1

CPT Date : 02/01/92 14:05
Cone Used : H215

Page No: 1 / 2
Job No. : 20591



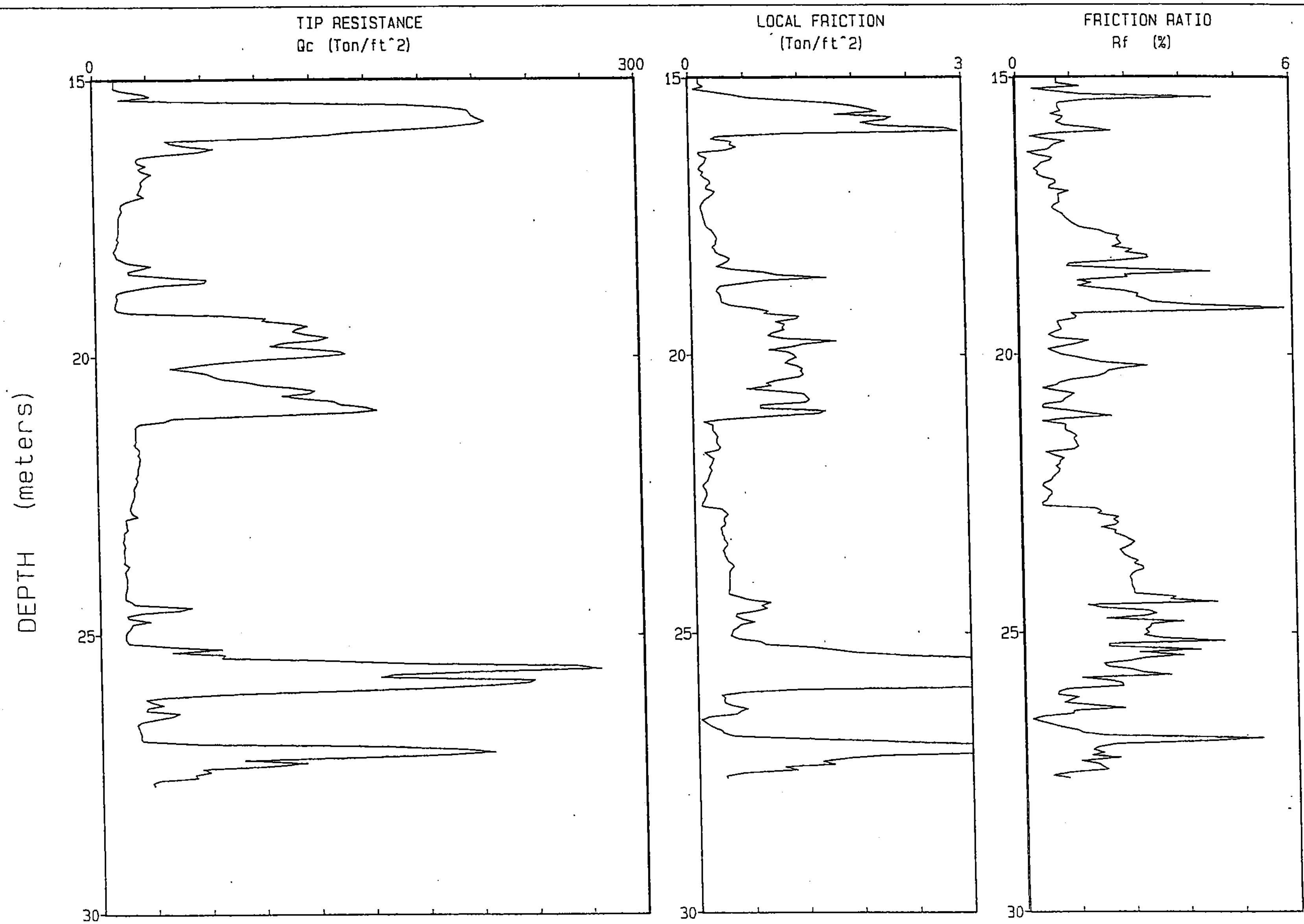
Depth Increment : .05 m

AGEC

Engineer : JM
Location : CL-1

CPT Date : 02/01/92 14:05
Cone Used : H215

Page No: 2 / 2
Job No. : 20591



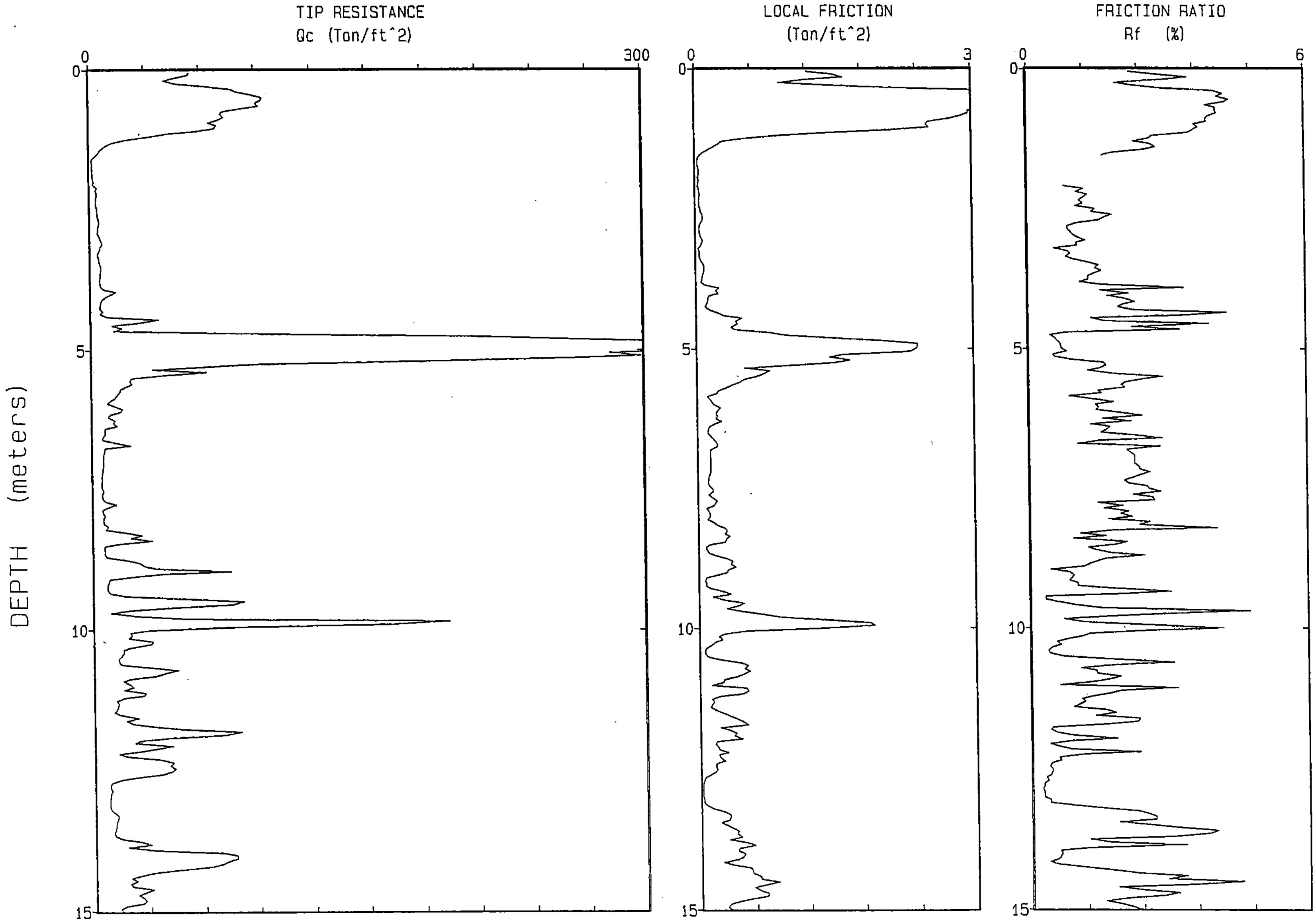
Depth Increment : .05 m

AGEC

Engineer : JM
Location : C-L3

CPT Date : 04/07/92 13:02
Cone Used : H215

Page No: 1 / 2
Job No. : 20591



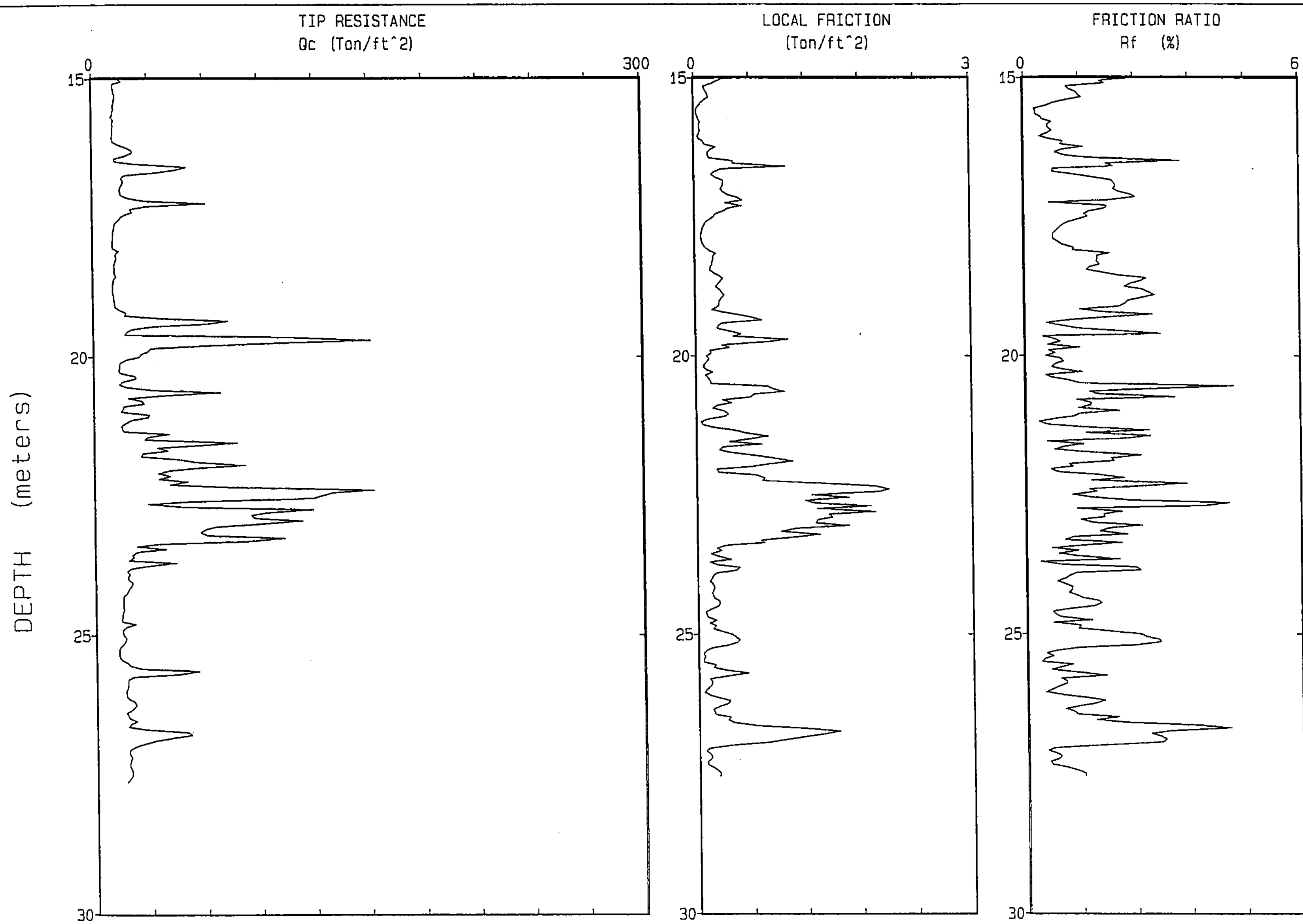
Depth Increment : .05 m

AGEC

Engineer : JM
Location : C-L3

CPT Date : 04/07/92 13:02
Cone Used : H215

Job No. : 20591

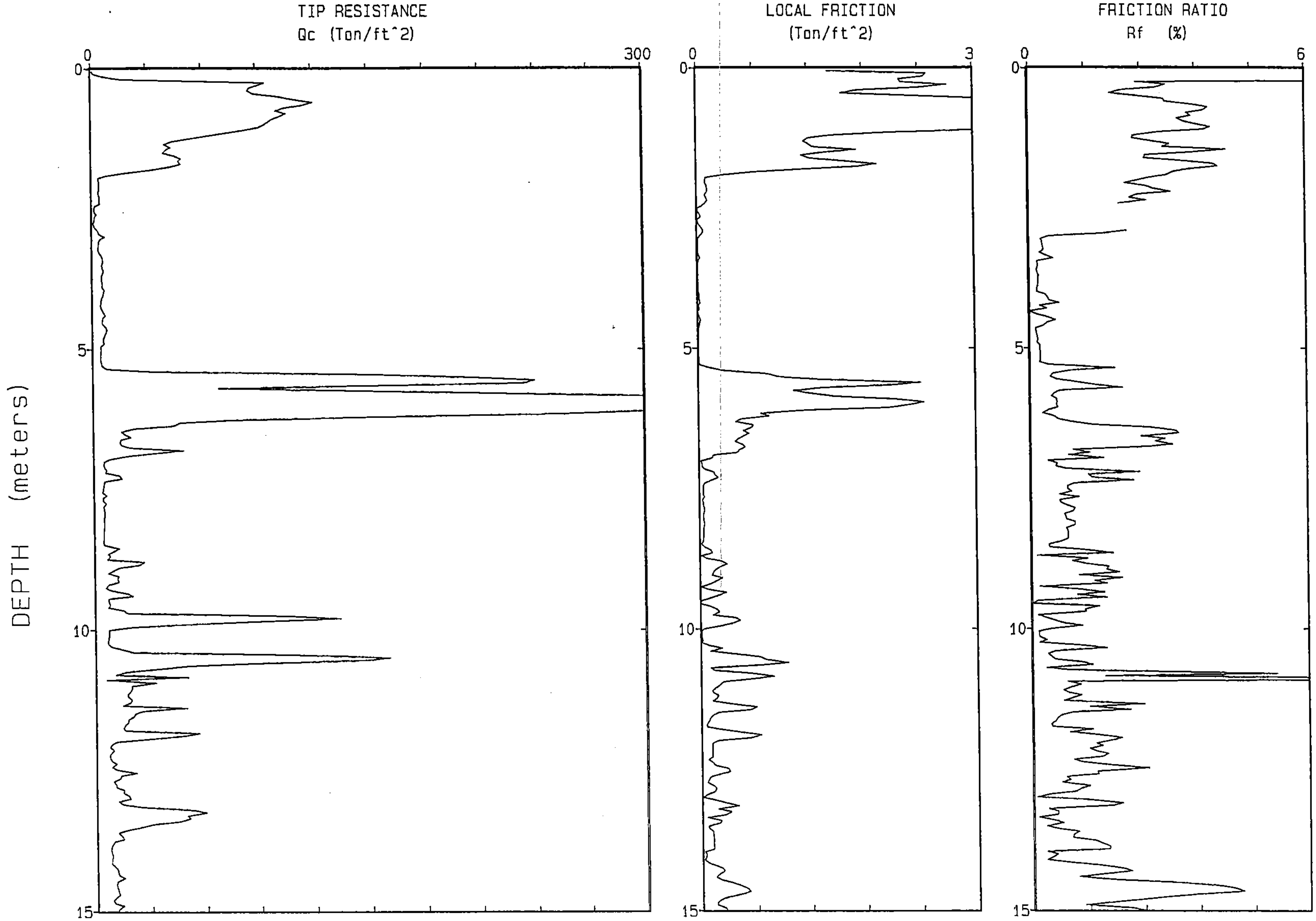


Depth Increment : .05 m

AGEC

Engineer : JM — CPT Date : 04/29/92 13:47 — Page No: 1 / 2

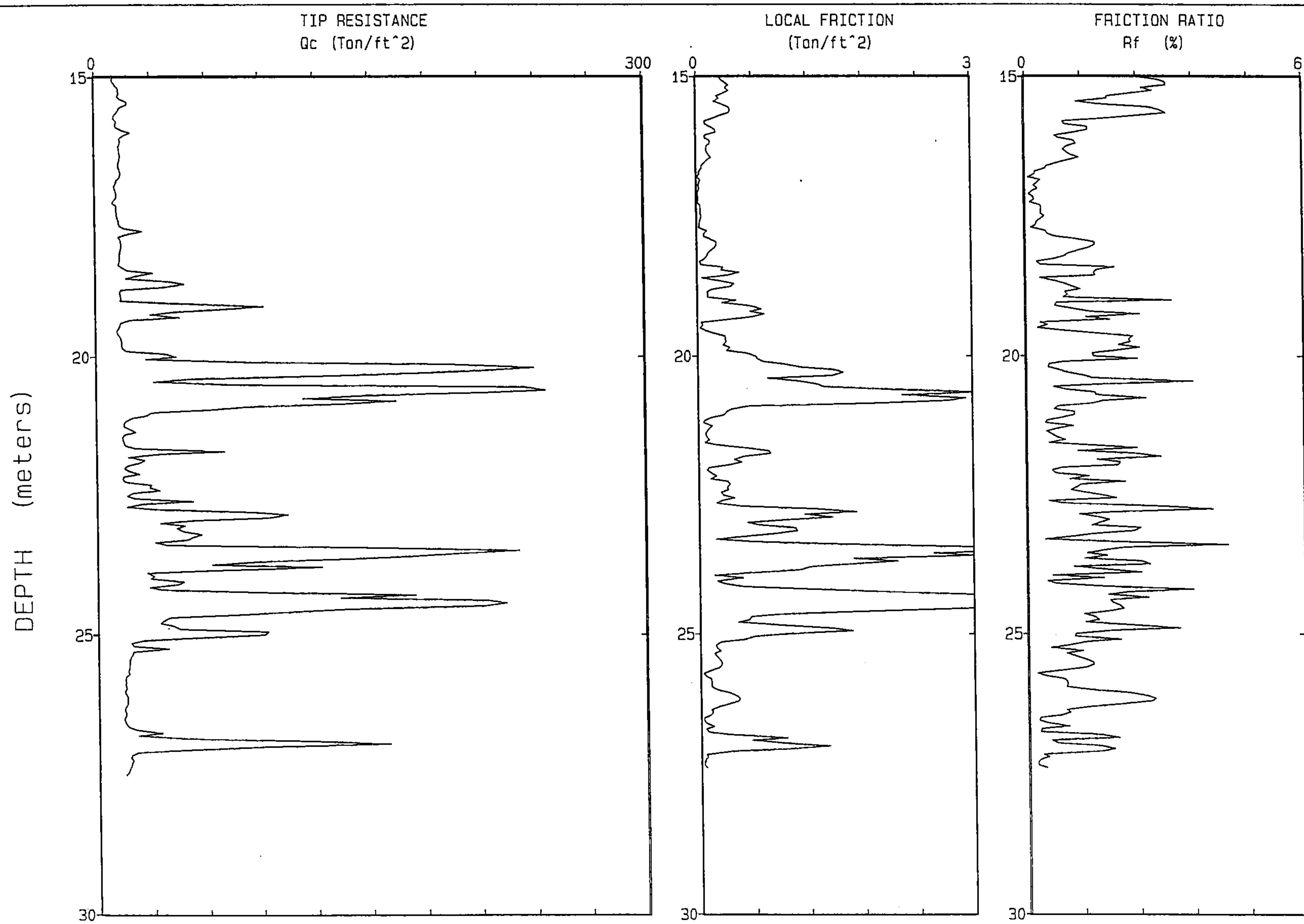
Location : C-L5 — Cone Used : H215 — Job No. : 20591



Depth Increment : .05 m

AGEC

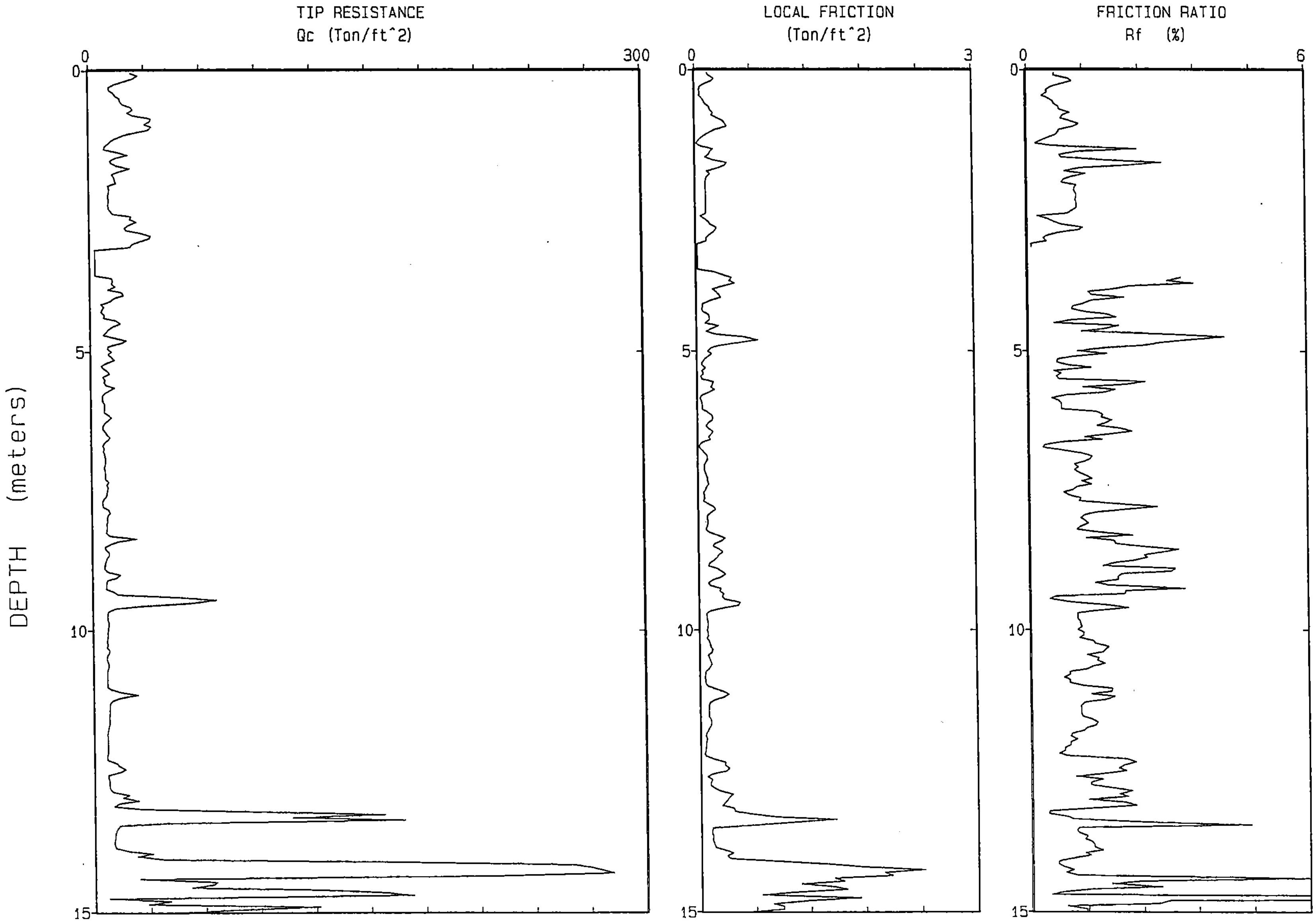
Engineer : JM
Location : C-L5
CPT Date : 04/29/92 13:47
Cone Used : H215
Page No: 2 / 2
Job No. : 20591



Depth Increment : .05 m

AGEC

Engineer : JM	CPT Date : 04/27/92 09:22	Page No: 1 / 2
Location : C-L7	Cone Used : H215	Job No. : 20591



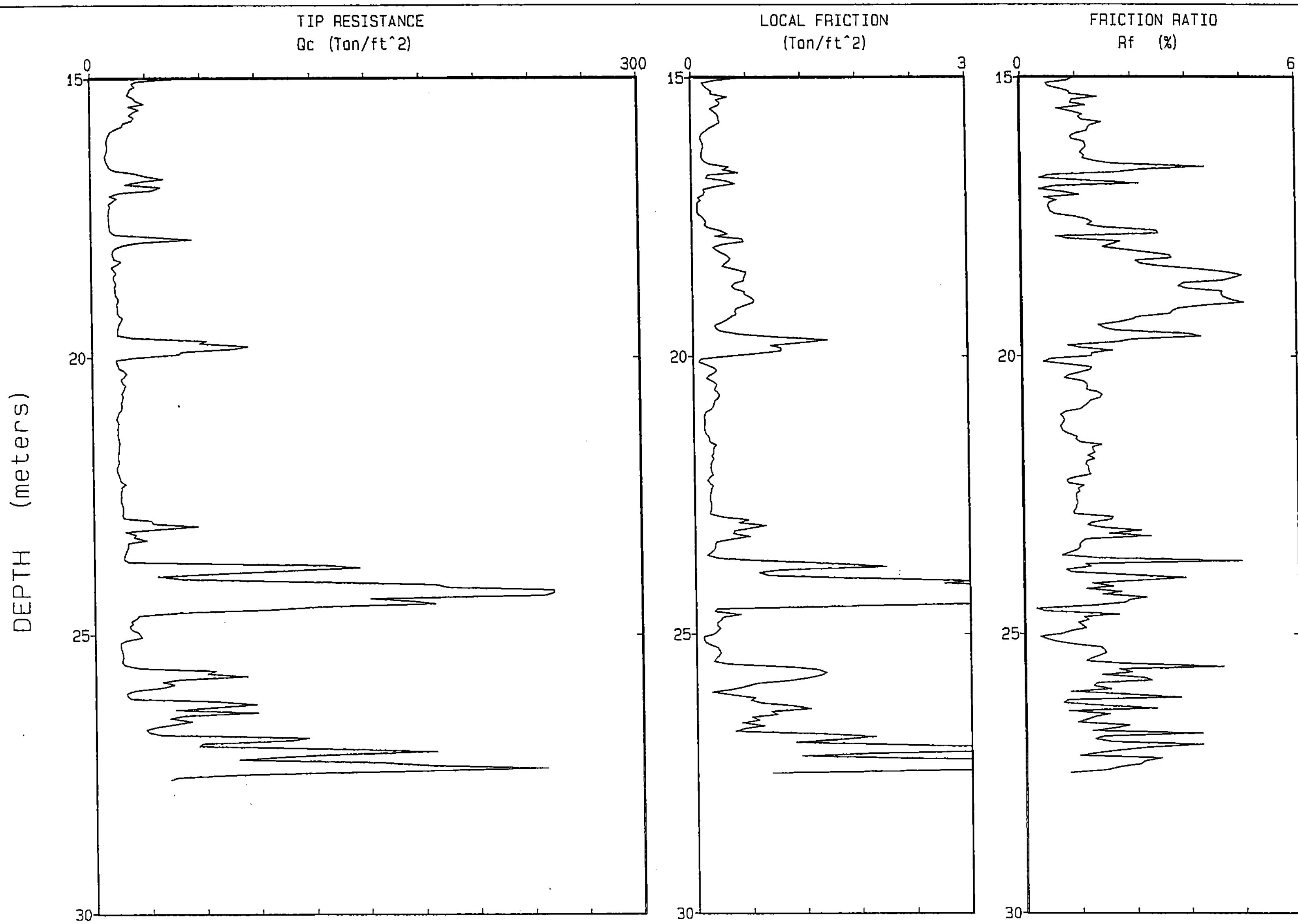
Depth Increment : .05 m

AGEC

Engineer : JM
Location : C-L7

CPT Date : 04/27/92 09:22
Cone Used : H215

Job No. : 20591

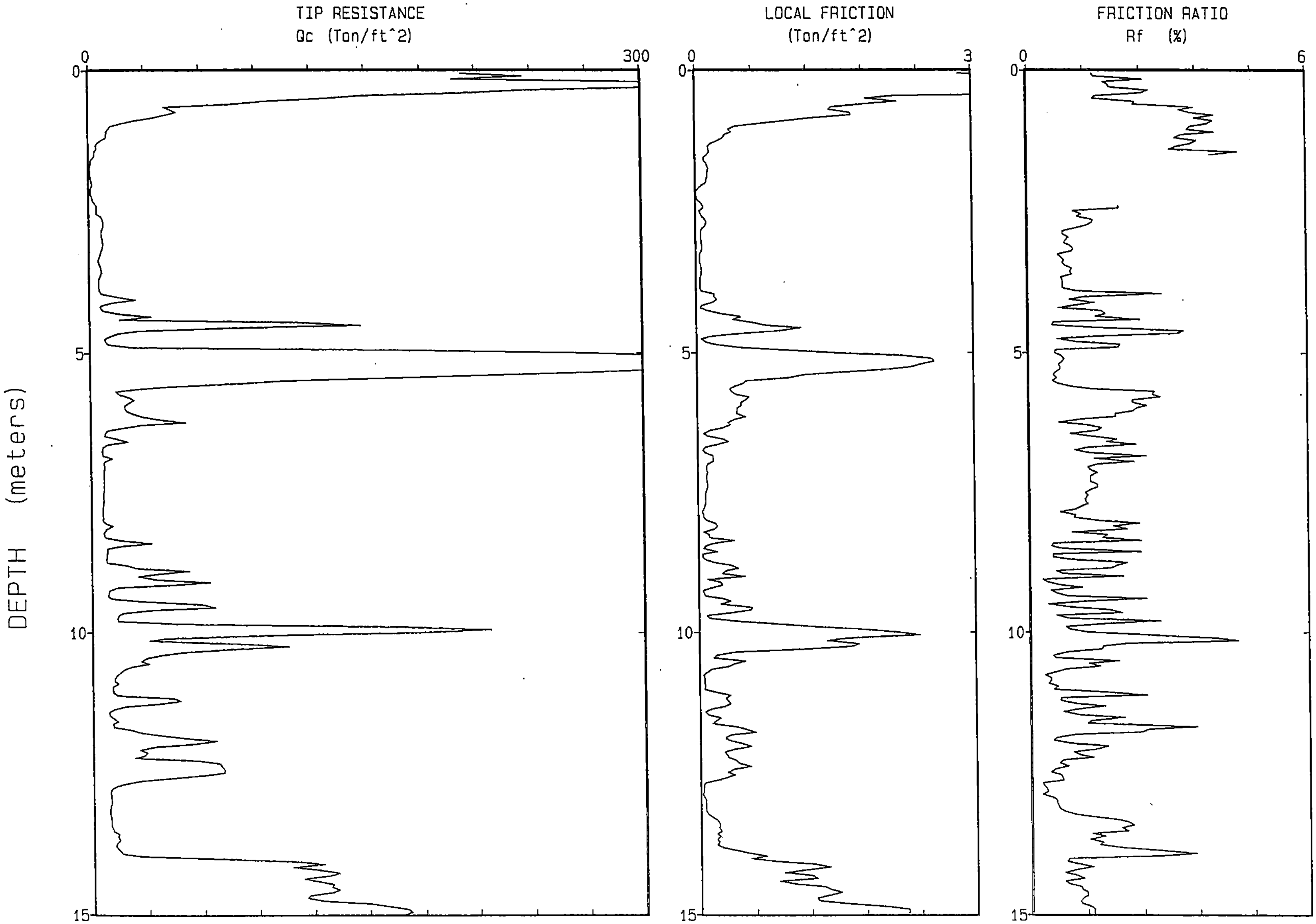


Depth Increment : .05 m

AGEC

Engineer : JM   CPT Date : 04/30/92 10:21   Page No: 1 / 2

Location : C-L9   Cone Used : H215   Job No. : 20591

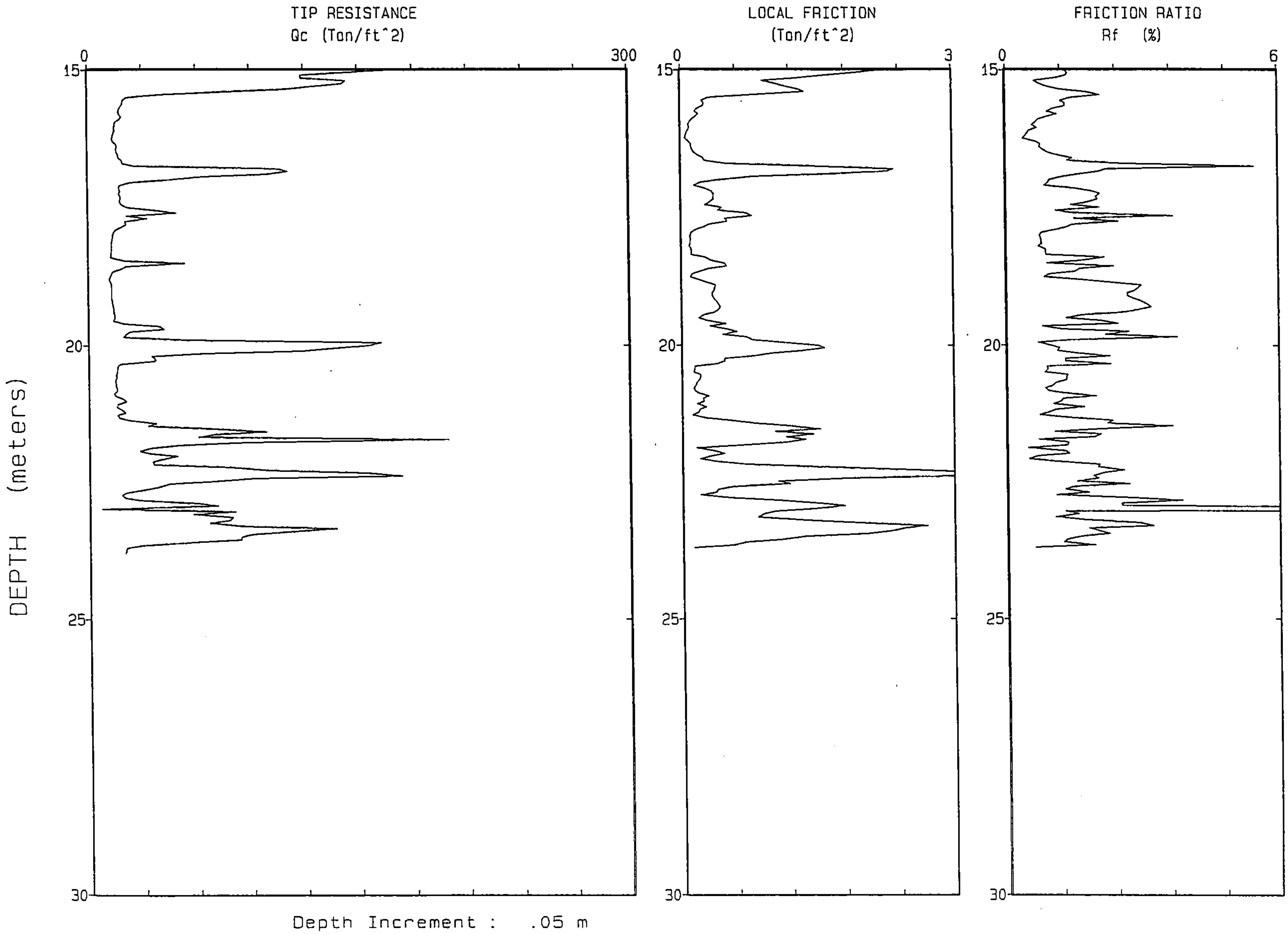


Depth Increment : .05 m

AGEC

Engineer : JM CPT Date : 04/30/92 10:21 Page No: 2 / 2

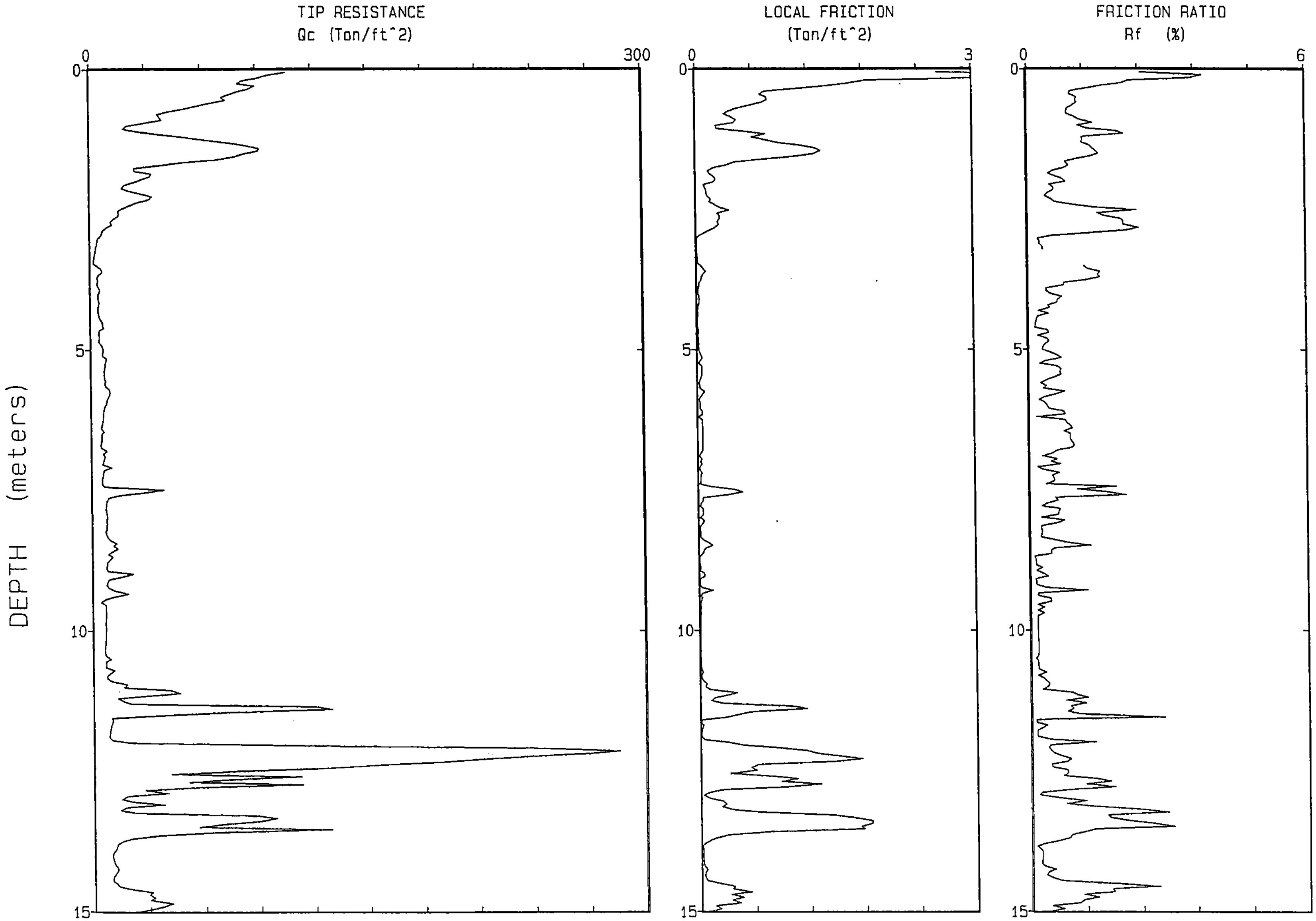
Location : C-L9 Cone Used : H215 Job No. : 20591



AGEC

Engineer : JM | CPT Date : 04/27/92 11:34 | Page No: 1 / 2

Location : C-L11 | Cone Used : H215 | Job No. : 20591



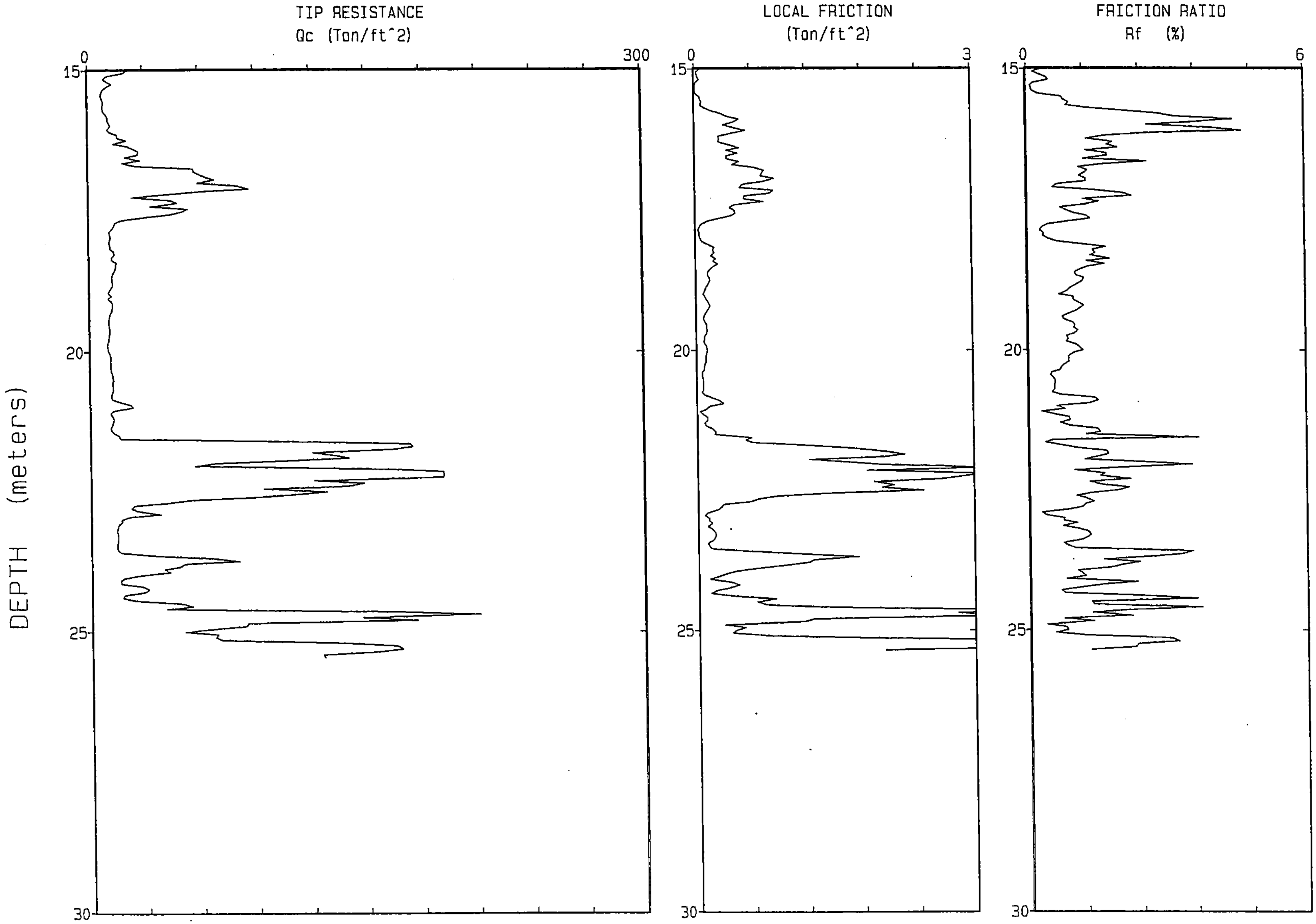
Depth Increment : .05 m

AGEC

Engineer : JM
Location : C-L11

CPT Date : 04/27/92 11:34
Cone Used : H215

Page No: 2 / 2
Job No. : 20591



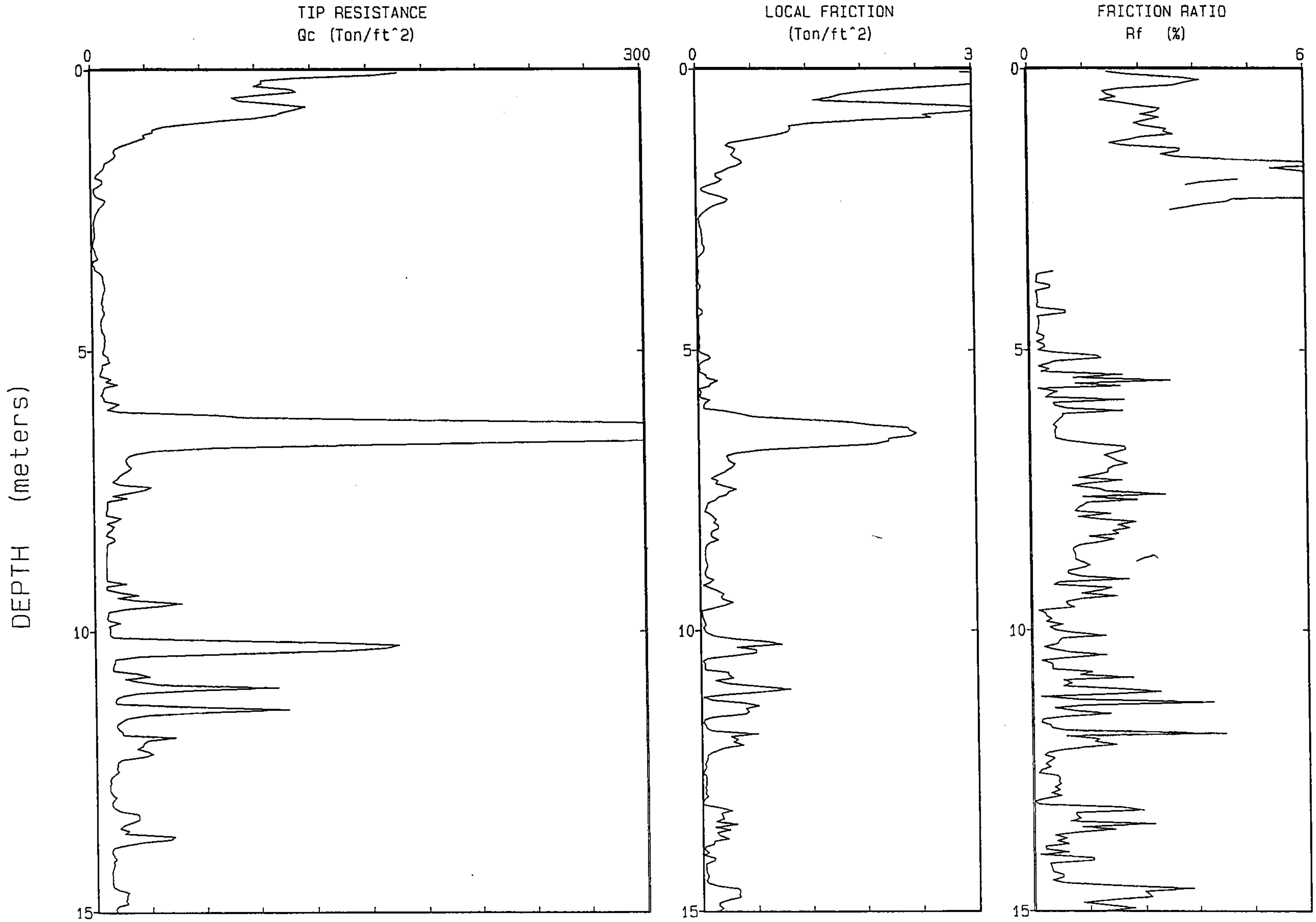
Depth Increment : .05 m

AGEC

Engineer : JM
Location : C-L13

CPT Date : 04/27/92 15:04
Cone Used : H215

Page No: 1 / 2
Job No. : 20591

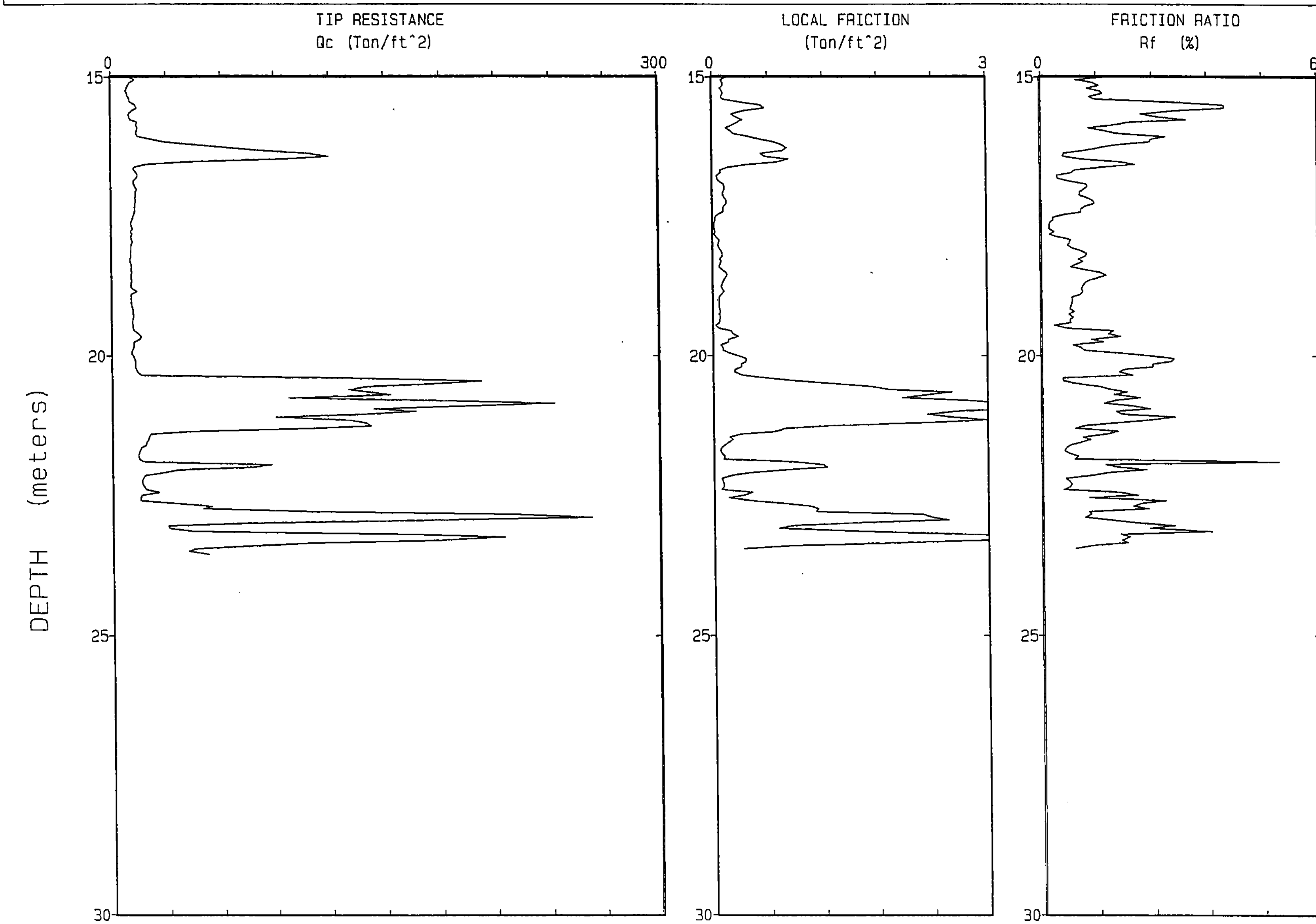


Depth Increment : .05 m

AGEC

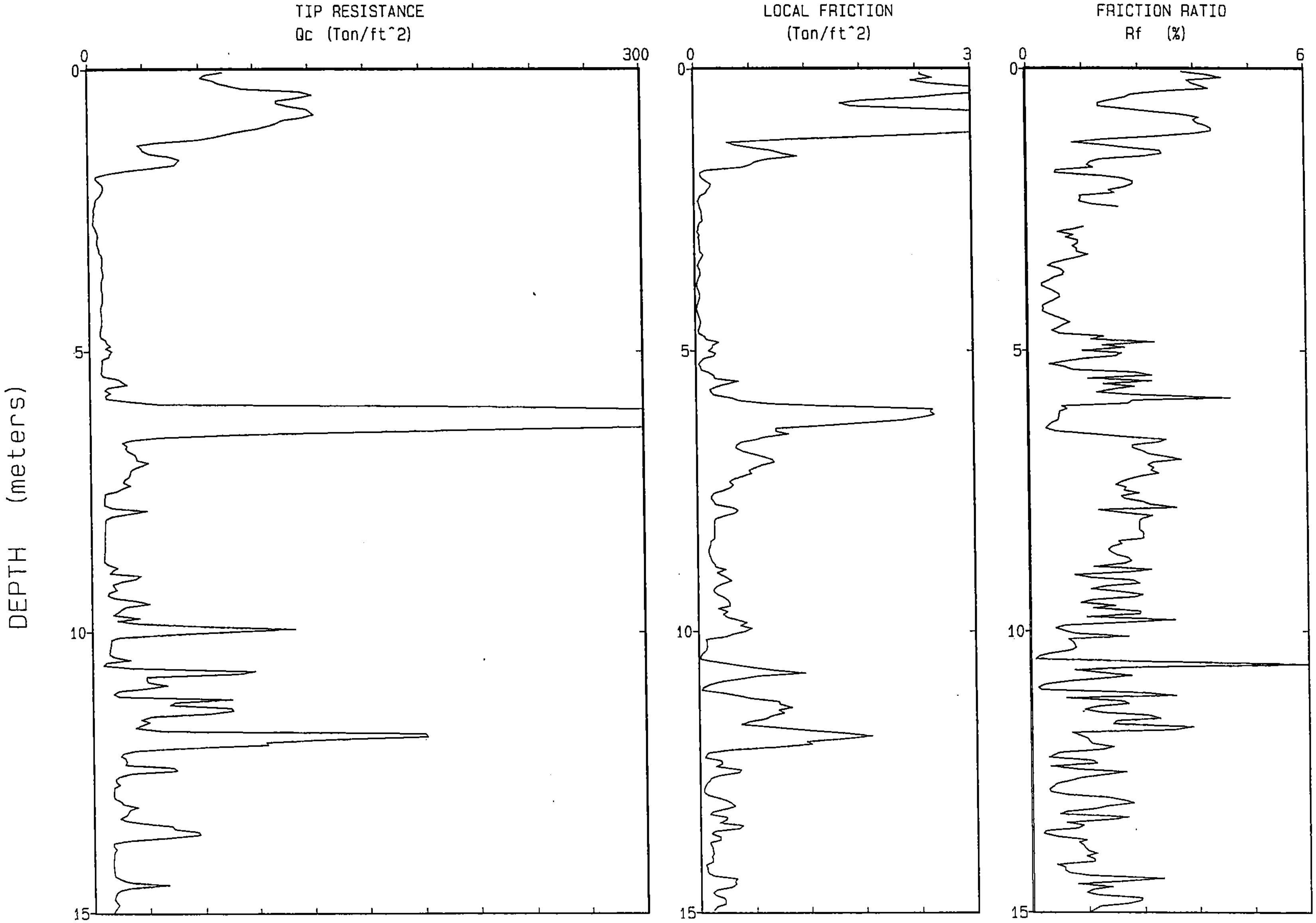
Engineer : JM | CPT Date : 04/27/92 15:04 | Page No: 2 / 2

Location : C-L13 | Cone Used : H215 | Job No. : 20591



Depth Increment : .05 m

Engineer : JM	CPT Date : 04/10/92 11:03	Page No: 1 / 2
Location : C-L14	Cone Used : H215	Job No. : 20591

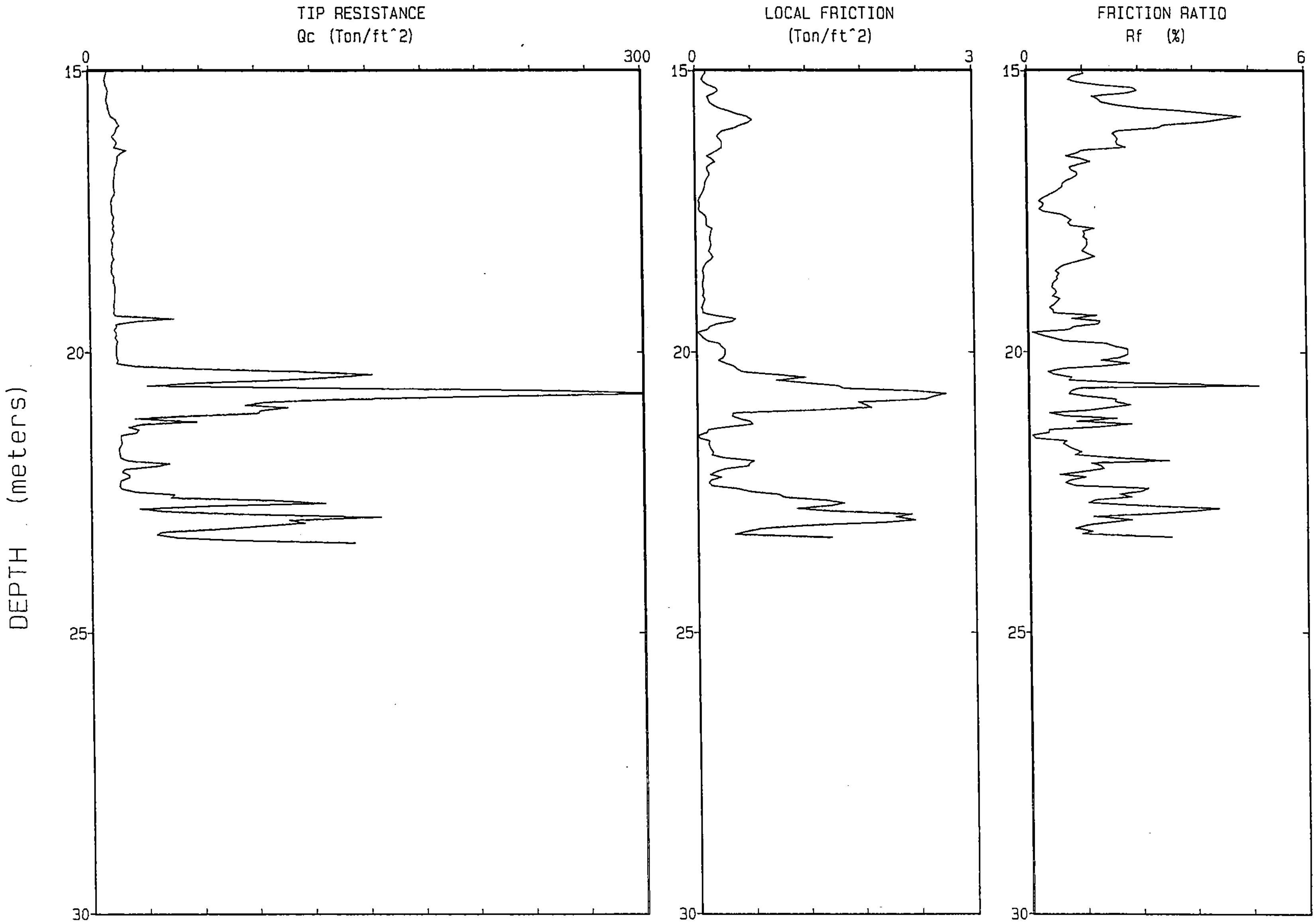


Depth Increment : .05 m

AGEC

Engineer : JM | CPT Date : 04/10/92 11:03 | Page No: 2 / 2

Location : C-L14 | Cone Used : H215 | Job No. : 20591

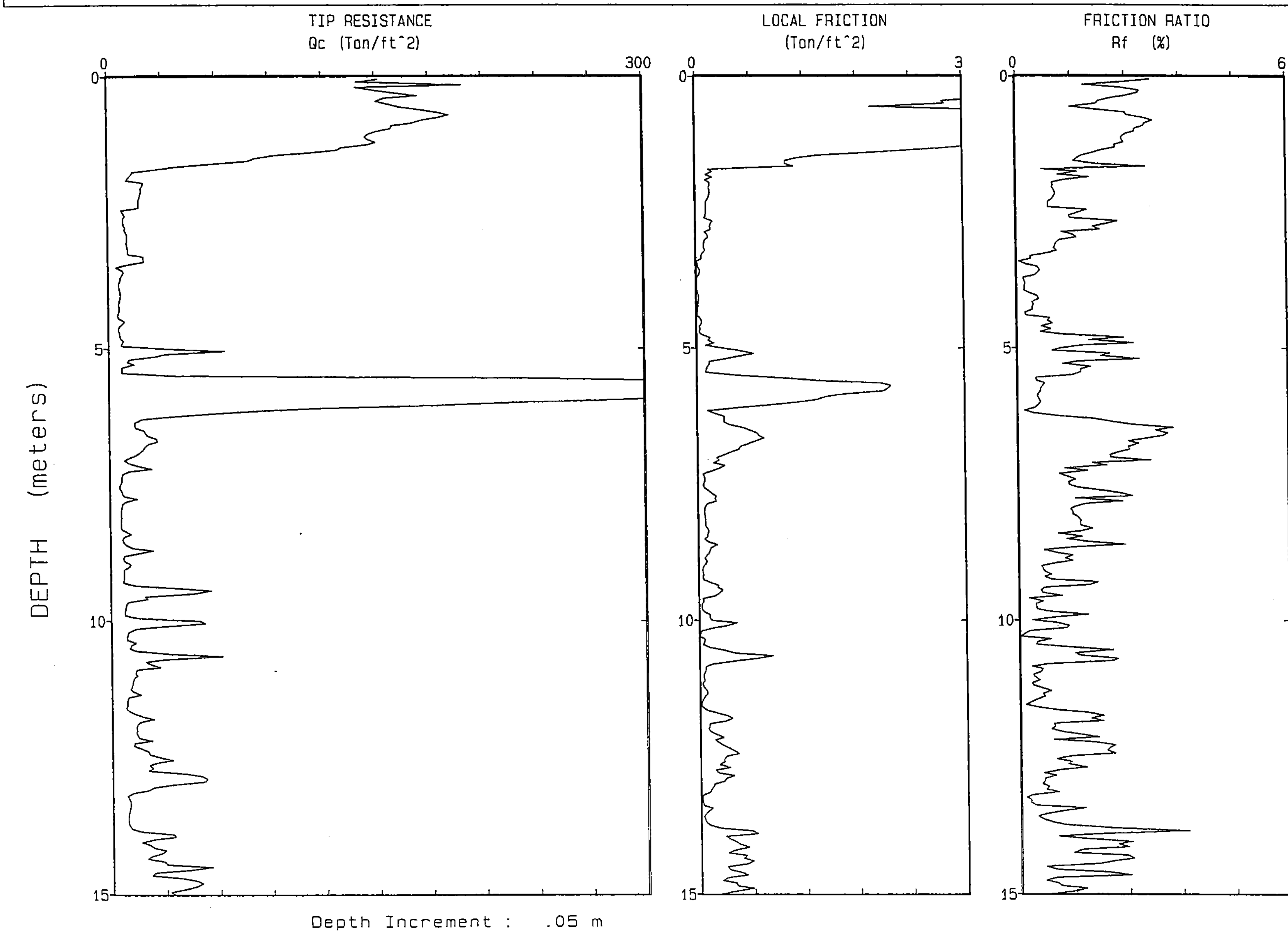


Depth Increment : .05 m

AGEC

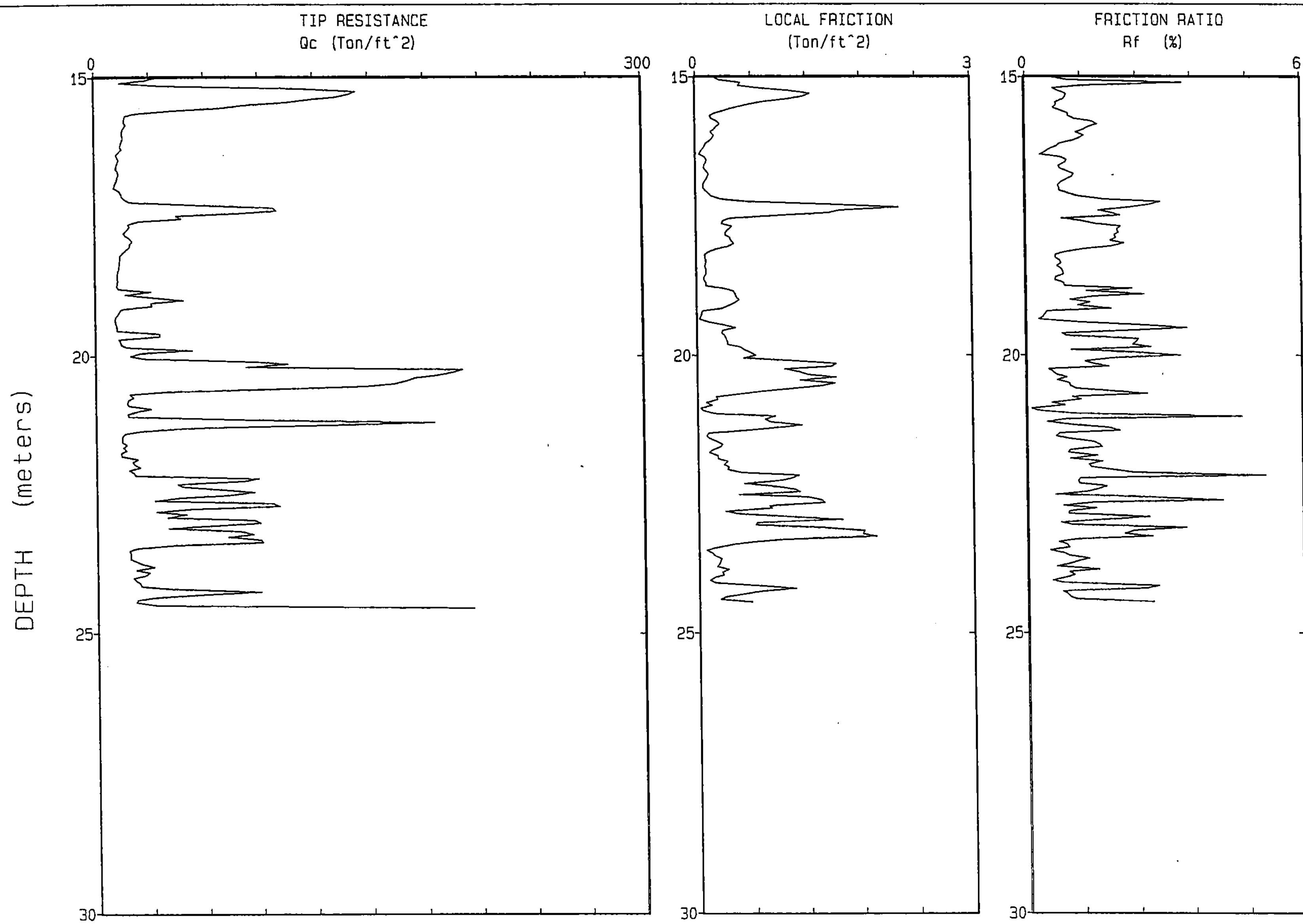
Engineer : JM | CPT Date : 04/27/92 15:04 | Page No: 1 / 2

Location : C-L16 | Cone Used : H215 | Job No. : 20591



AGEC

Engineer : JM
Location : C-L16
CPT Date : 04/27/92 15:04
Cone Used : H215
Page No: 2 / 2
Job No. : 20591

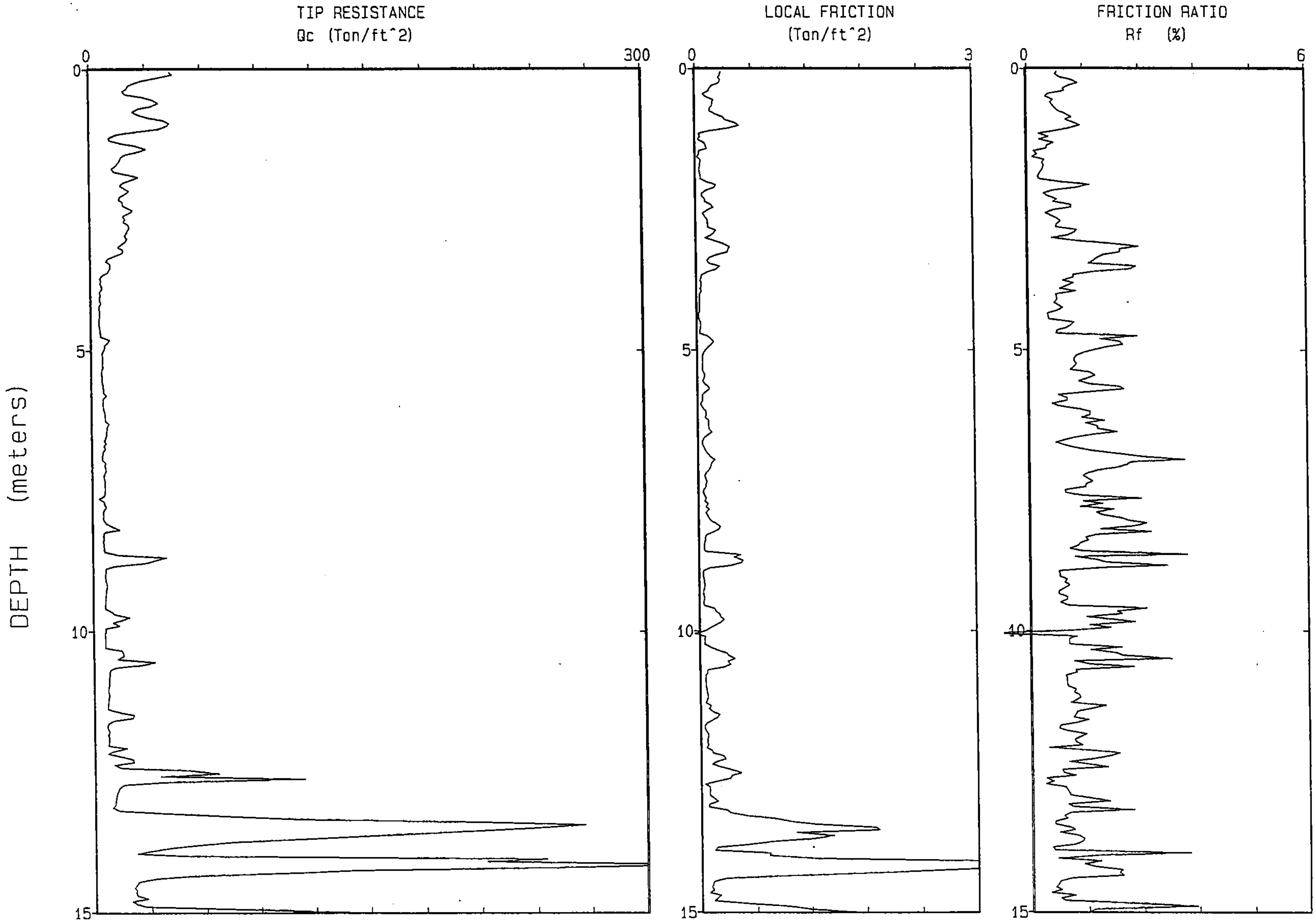


Depth Increment : .05 m

AGEC

Engineer : JM | CPT Date : 07/23/92 11:05 | Page No: 1 / 2

Location : C-L18 | Cone Used : H215 | Job No. : 20591

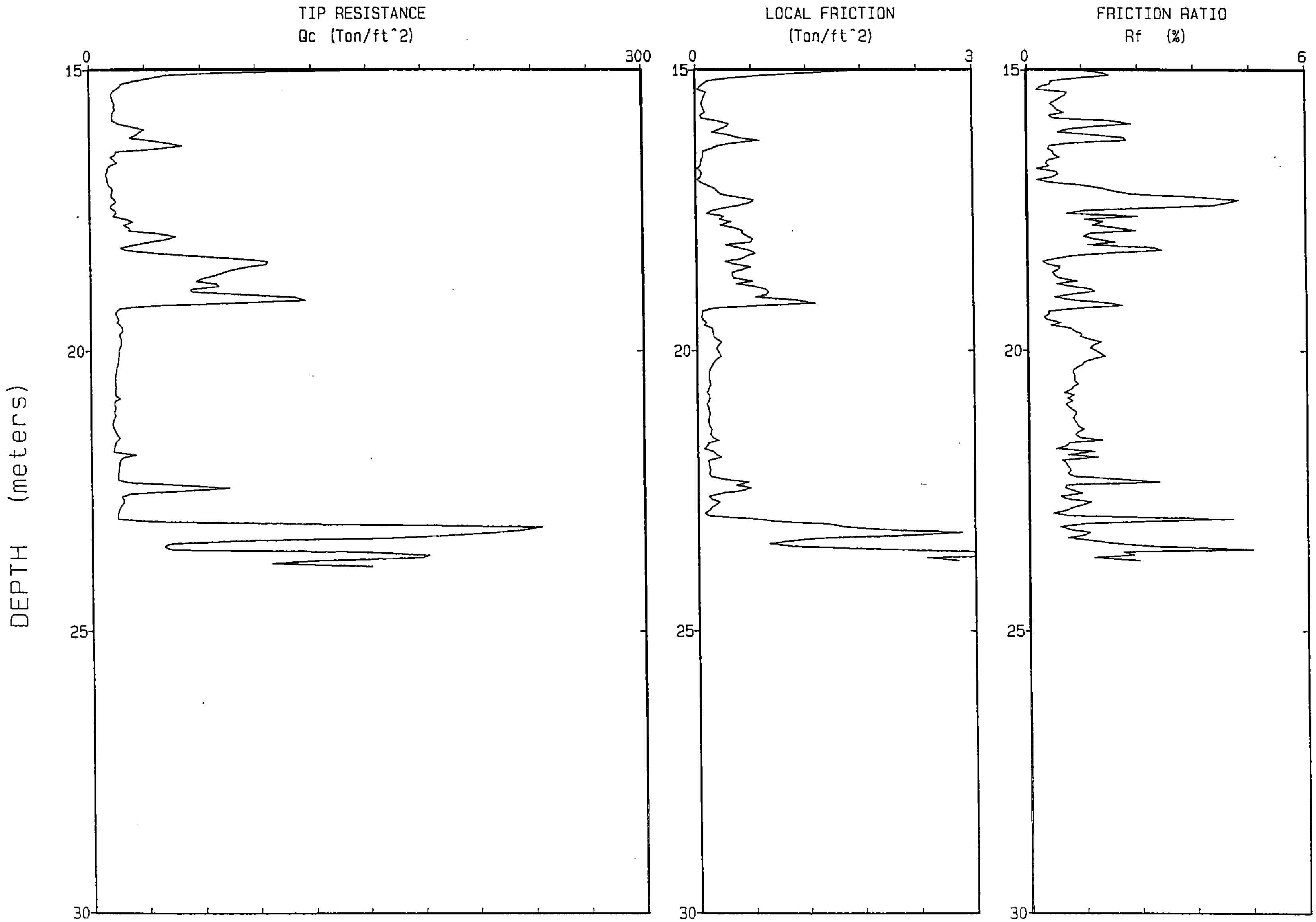


Depth Increment : .05 m

AGEC

Engineer : JM — CPT Date : 07/23/92 11:05 — Page No: 2 / 2

Location : C-L18 — Cone Used : H215 — Job No. : 20591

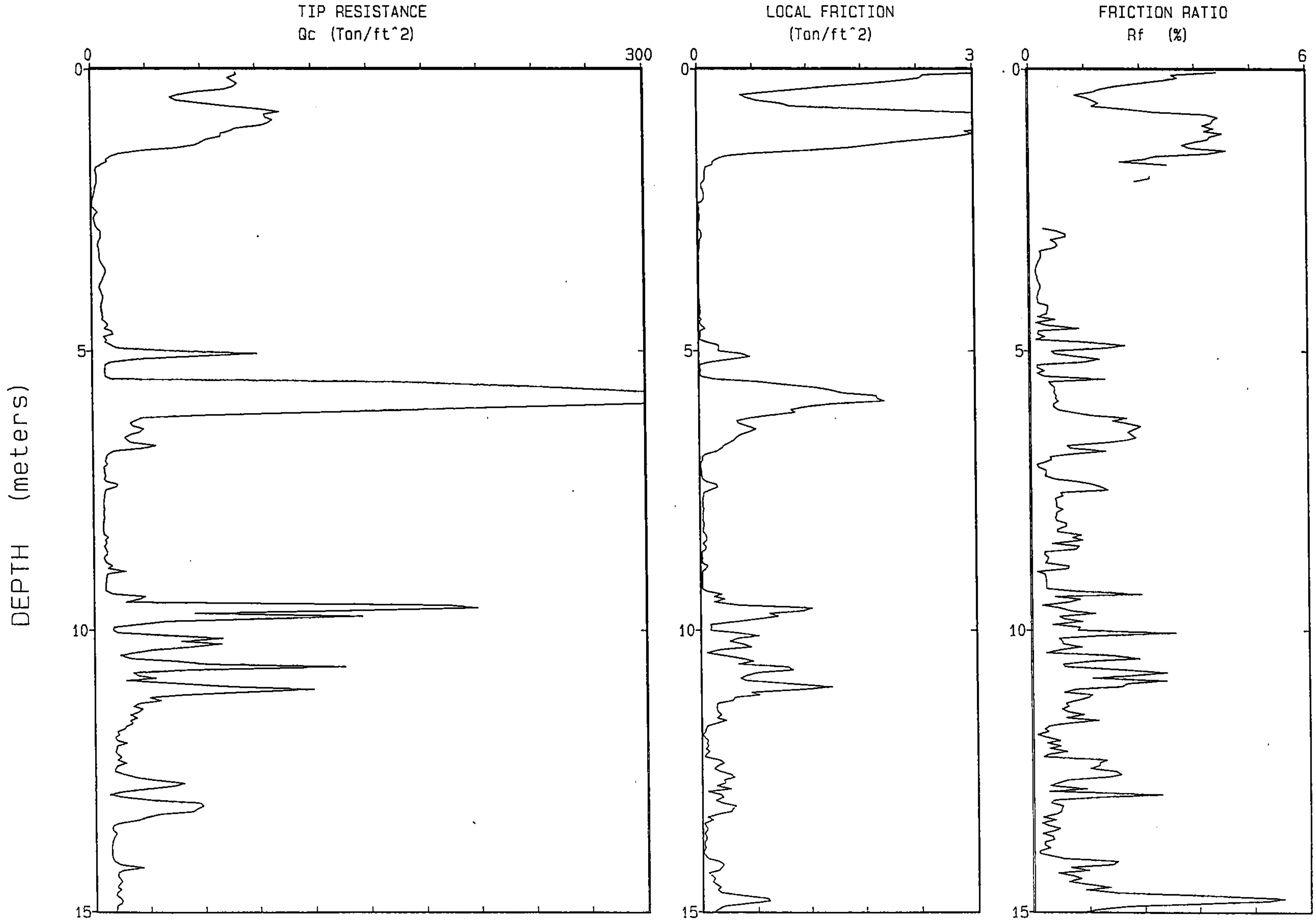


Depth Increment : .05 m

AGEC

Engineer : JM | CPT Date : 04/28/92 14:04 | Page No: 1 / 2

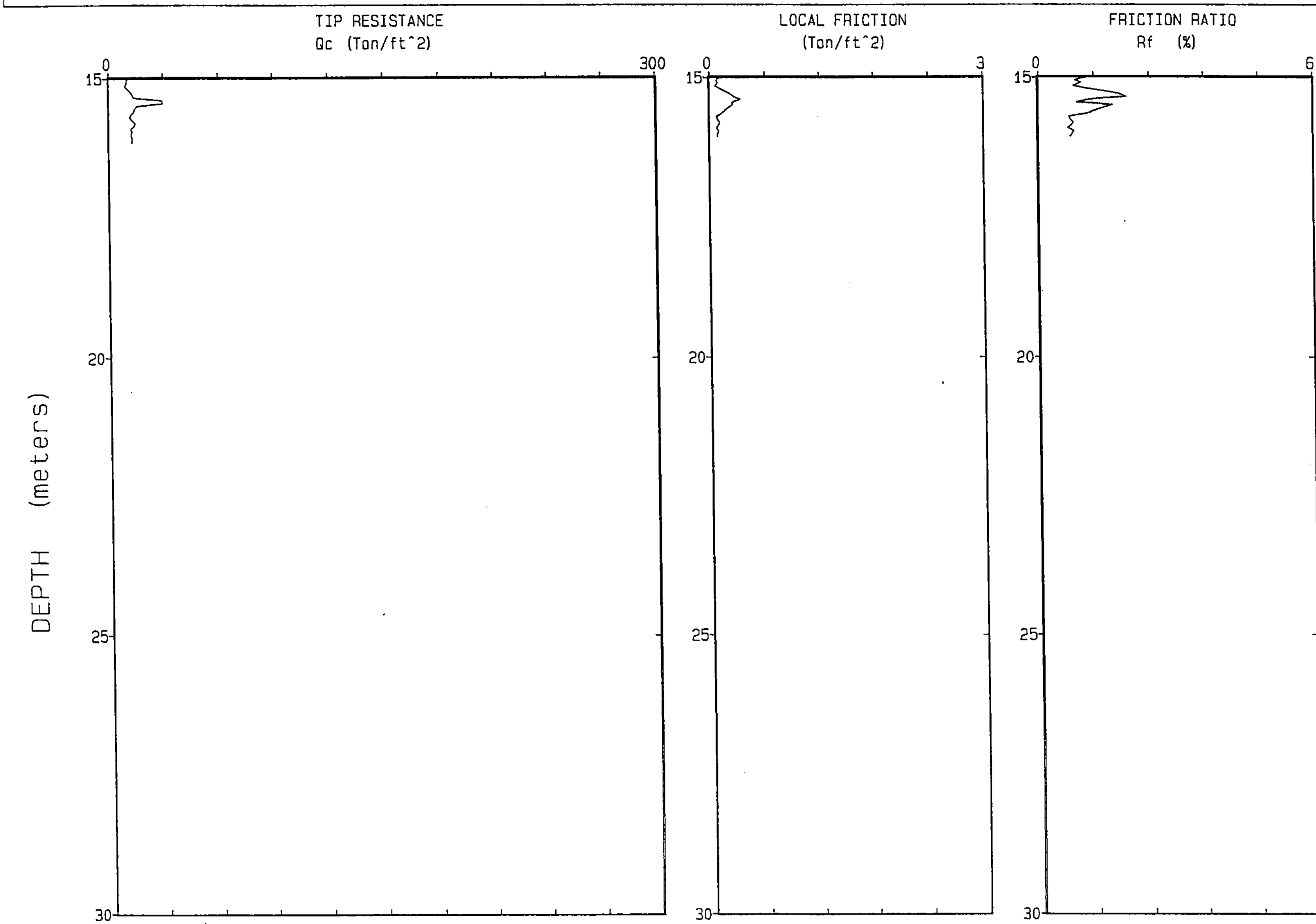
Location : C-L20 | Cone Used : H215 | Job No. : 20591



Depth Increment : .05 m

AGEC

Engineer : JM	CPT Date : 04/28/92 14:04	Page No: 2 / 2
Location : C-L20	Cone Used : H215	Job No. : 20591

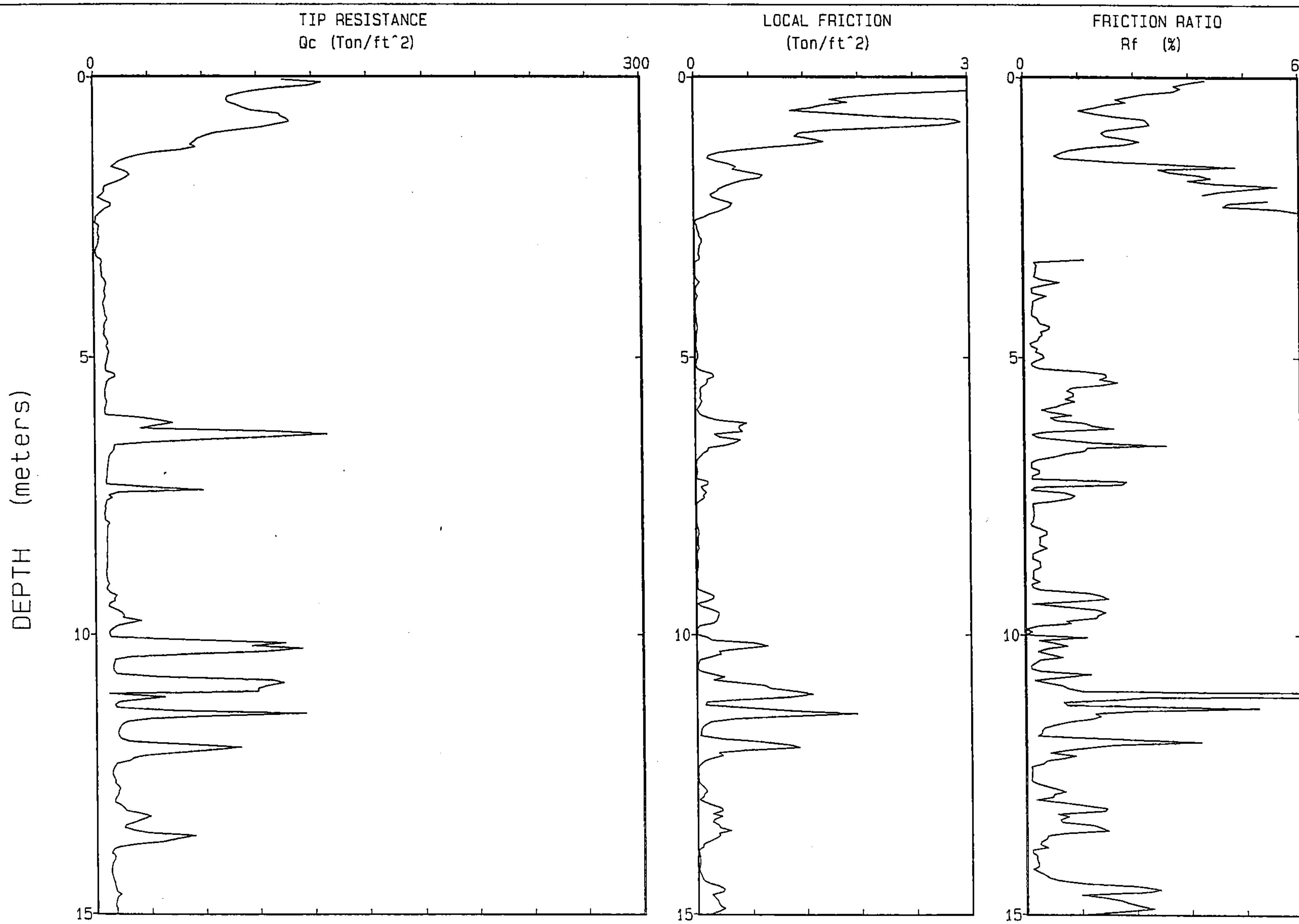


Depth Increment : .05 m

AGEC

Engineer : JM　　CPT Date : 04/29/92 10:22　　Page No: 1 / 2

Location : C-L22　　Cone Used : H215　　Job No. : 20591

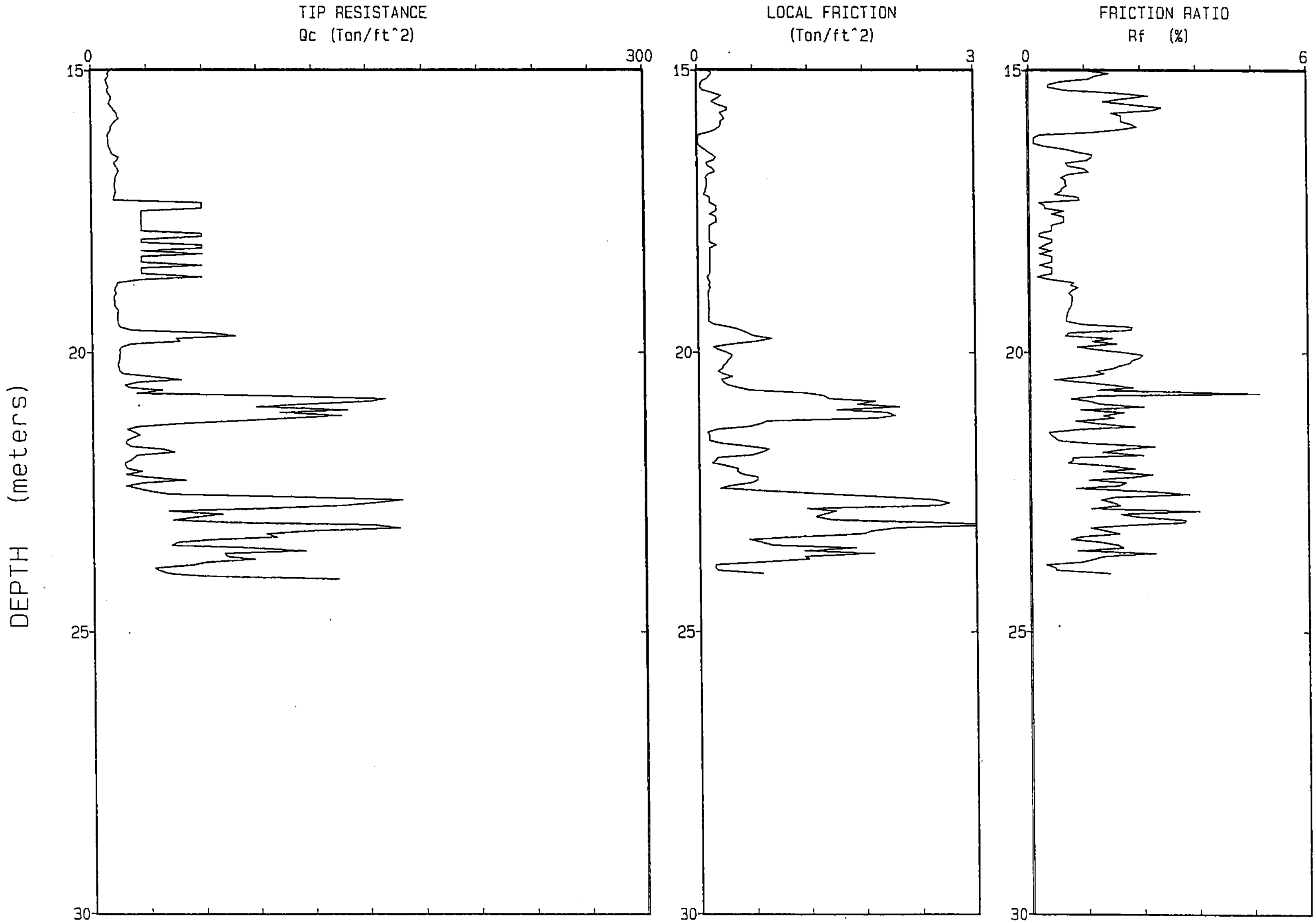


Depth Increment : .05 m

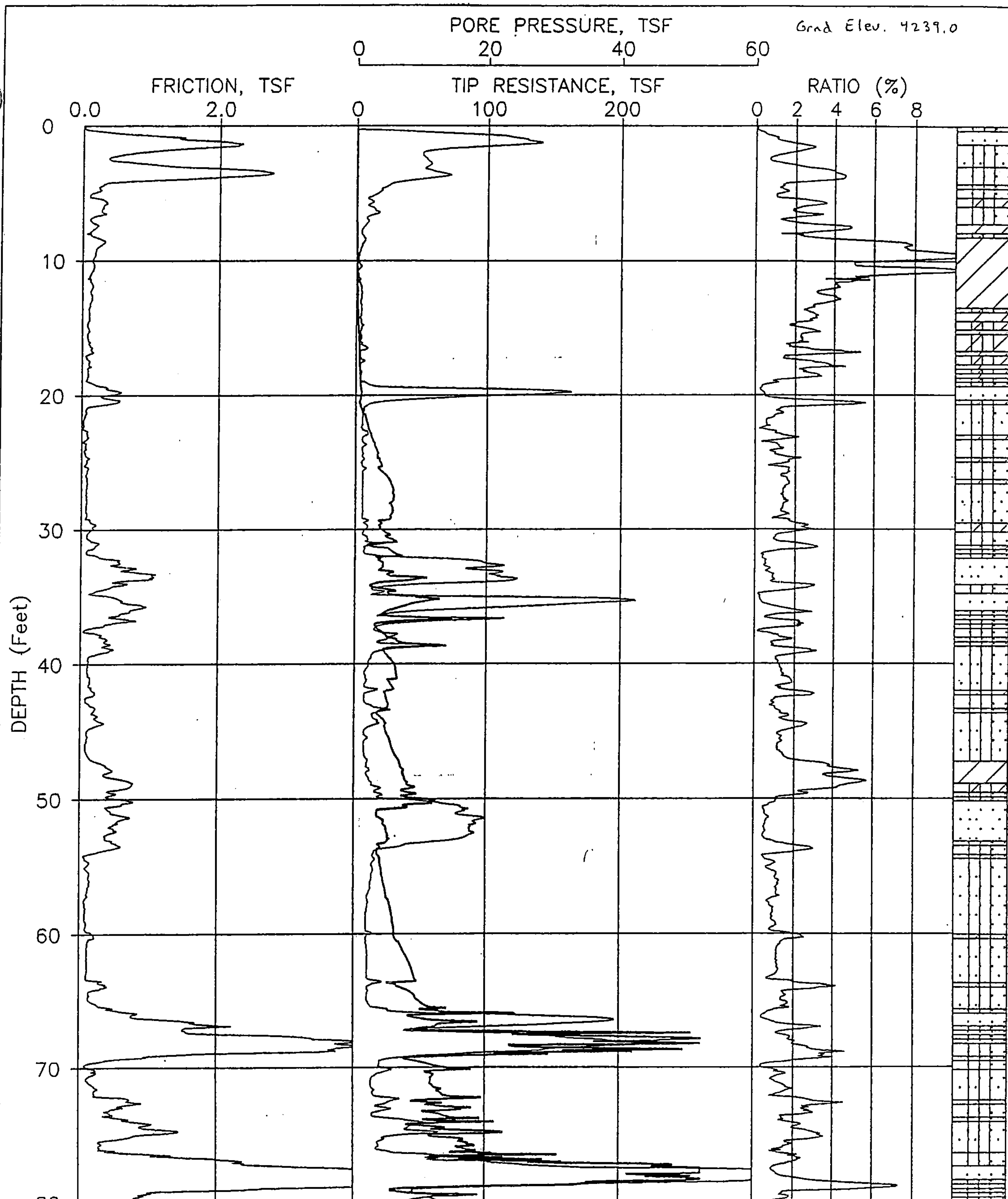
AGEC

Engineer : JM | CPT Date : 04/29/92 10:22 | Page No: 2 / 2

Location : C-L22 | Cone Used : H215 | Job No. : 20591

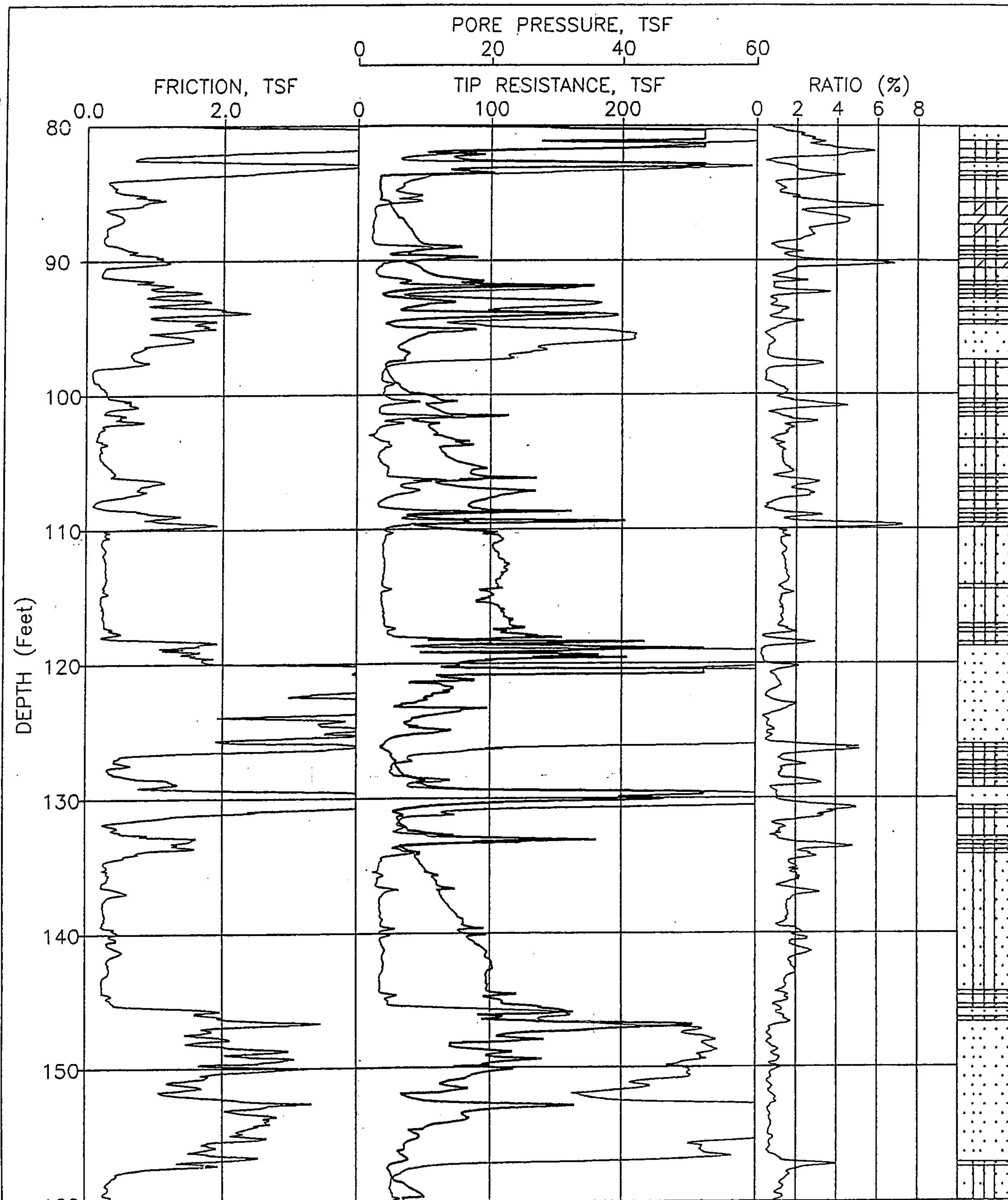


Depth Increment : .05 m



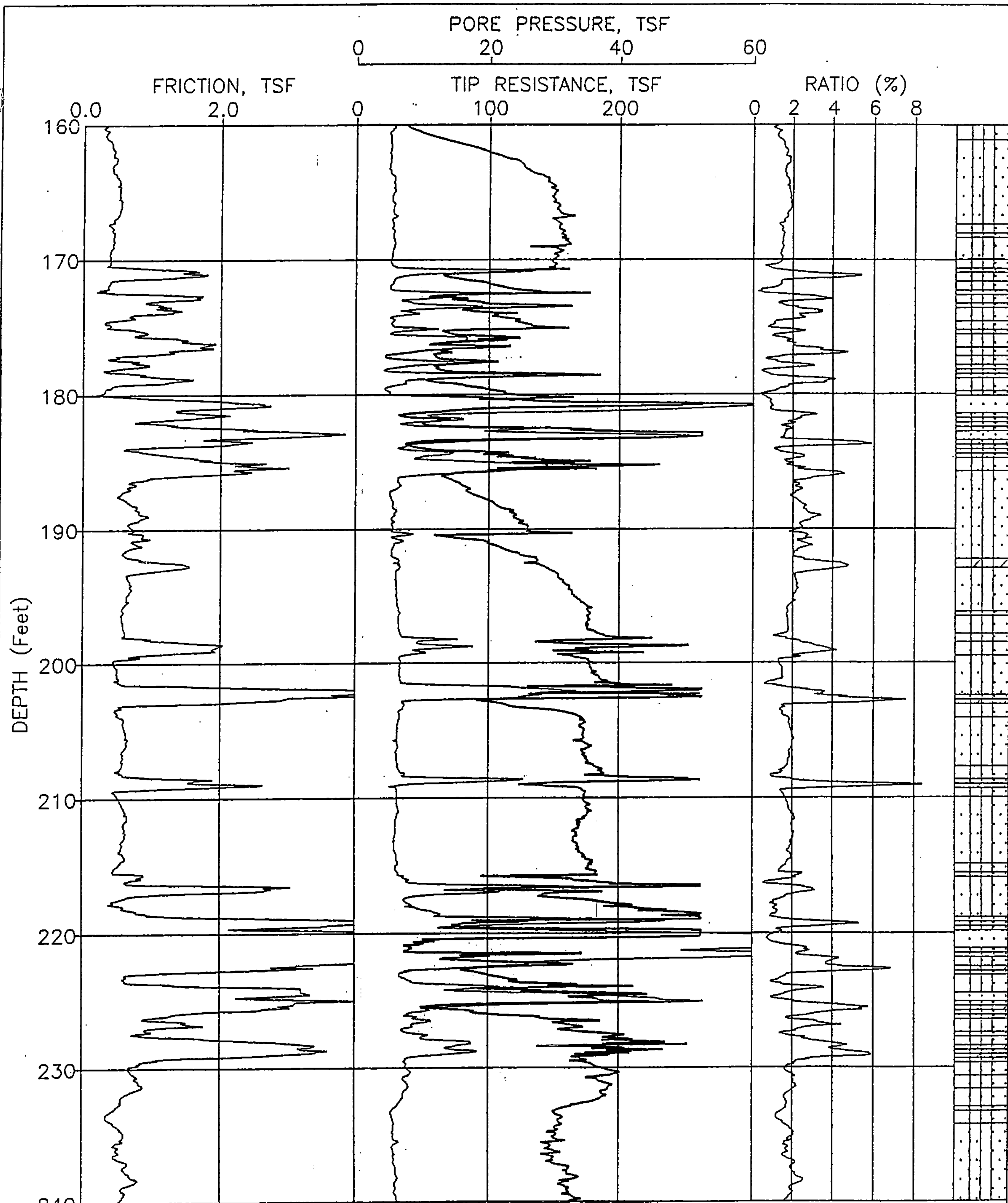
JOB NUMBER: 95-0110
ELEVATION: 4239.04
CPT NUMBER: CPT-L32
CONE NUMBER:F7.5CKEW852
DATE: 08-17-1995
PLATE: 1 OF 4

FUGRO GEOSCIENCES,INC



JOB NUMBER: 95-0110
ELEVATION: 4239.04
CPT NUMBER: CPT-L32
CONE NUMBER:F7.5CKEW852
DATE: 08-17-1995
PLATE: 2 OF 4

FUGRO GEOSCIENCES,INC

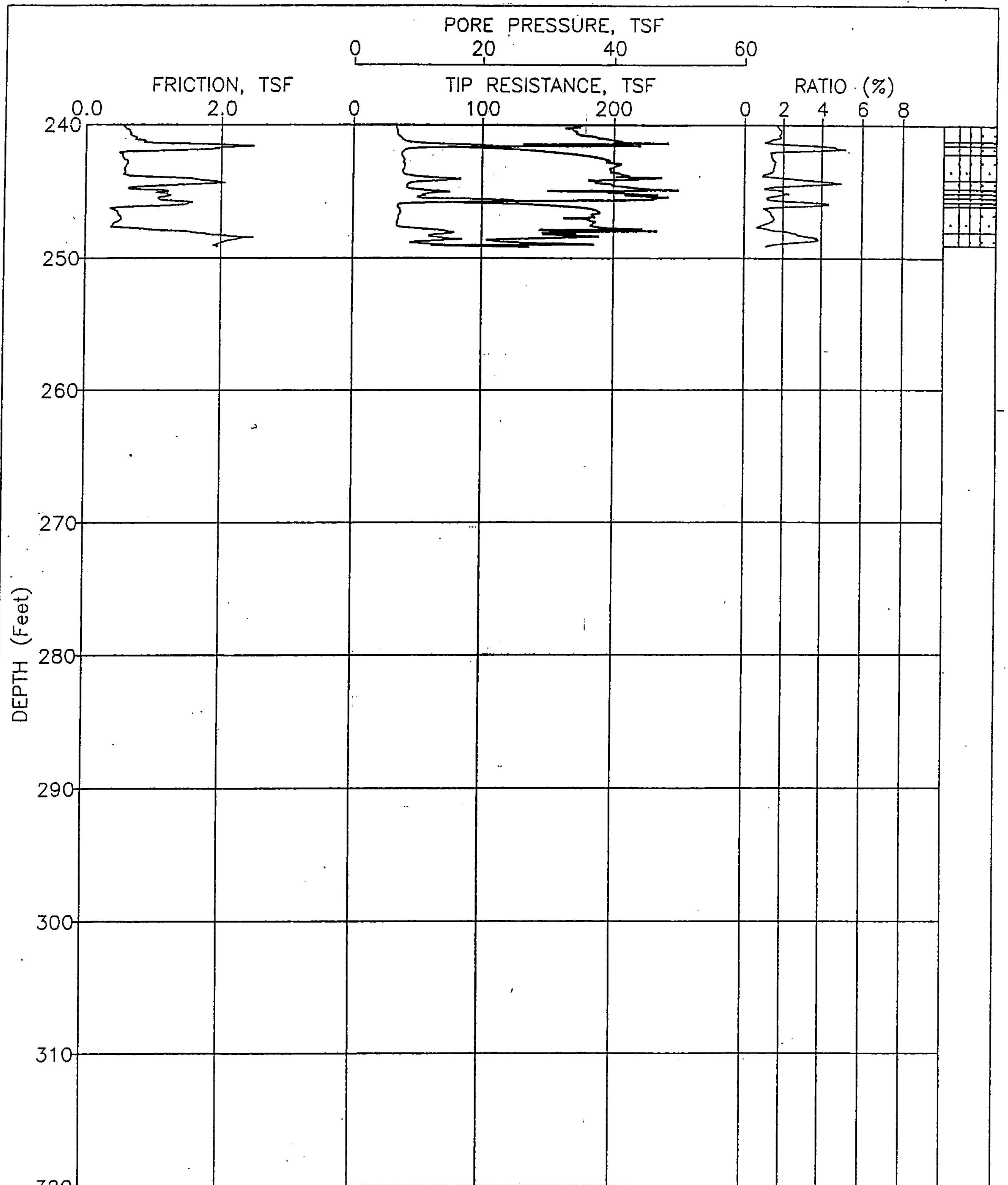


JOB NUMBER: 95-0110
ELEVATION: 4239.04

CPT NUMBER: CPT-L32
CONE NUMBER:F7.5CKEW852

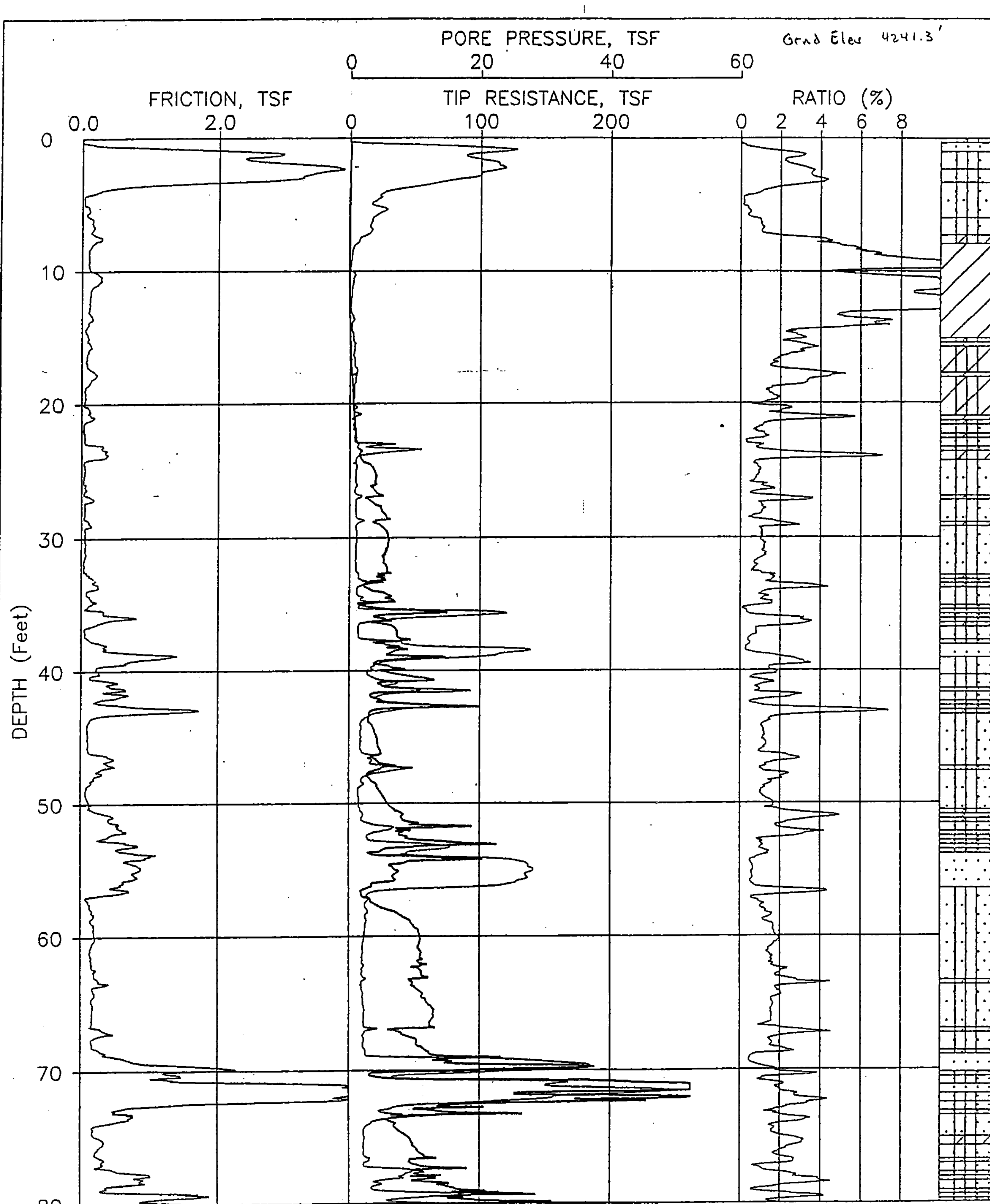
DATE: 08-17-1995
PLATE: 3 OF 4

FUGRO GEOSCIENCES,INC



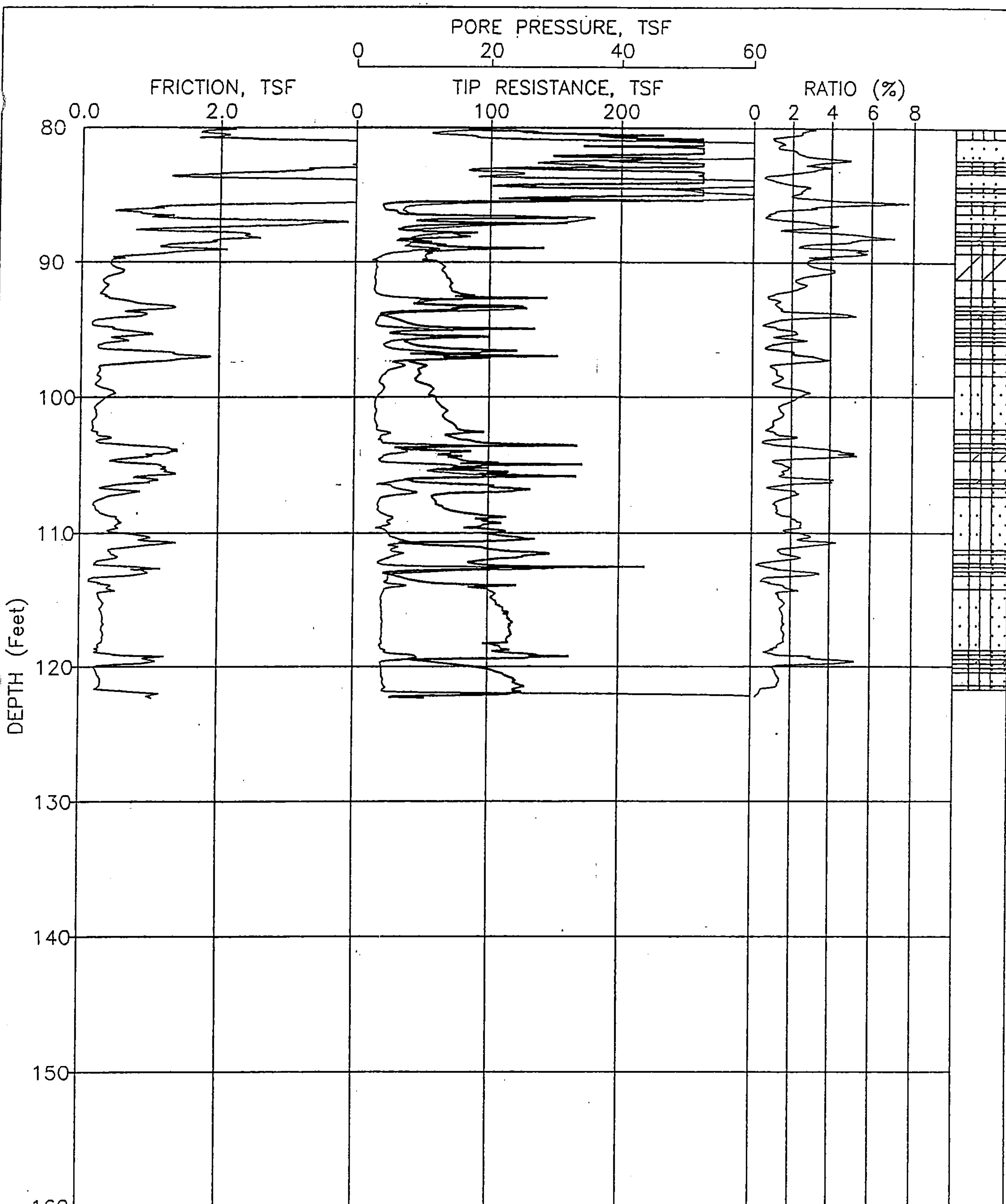
JOB NUMBER: 95-0110
ELEVATION: 4239.04
CPT NUMBER: CPT-L32
CONE NUMBER:F7.5CKEW852
DATE: 08-17-1995
PLATE: 4 OF 4

FUGRO GEOSCIENCES,INC



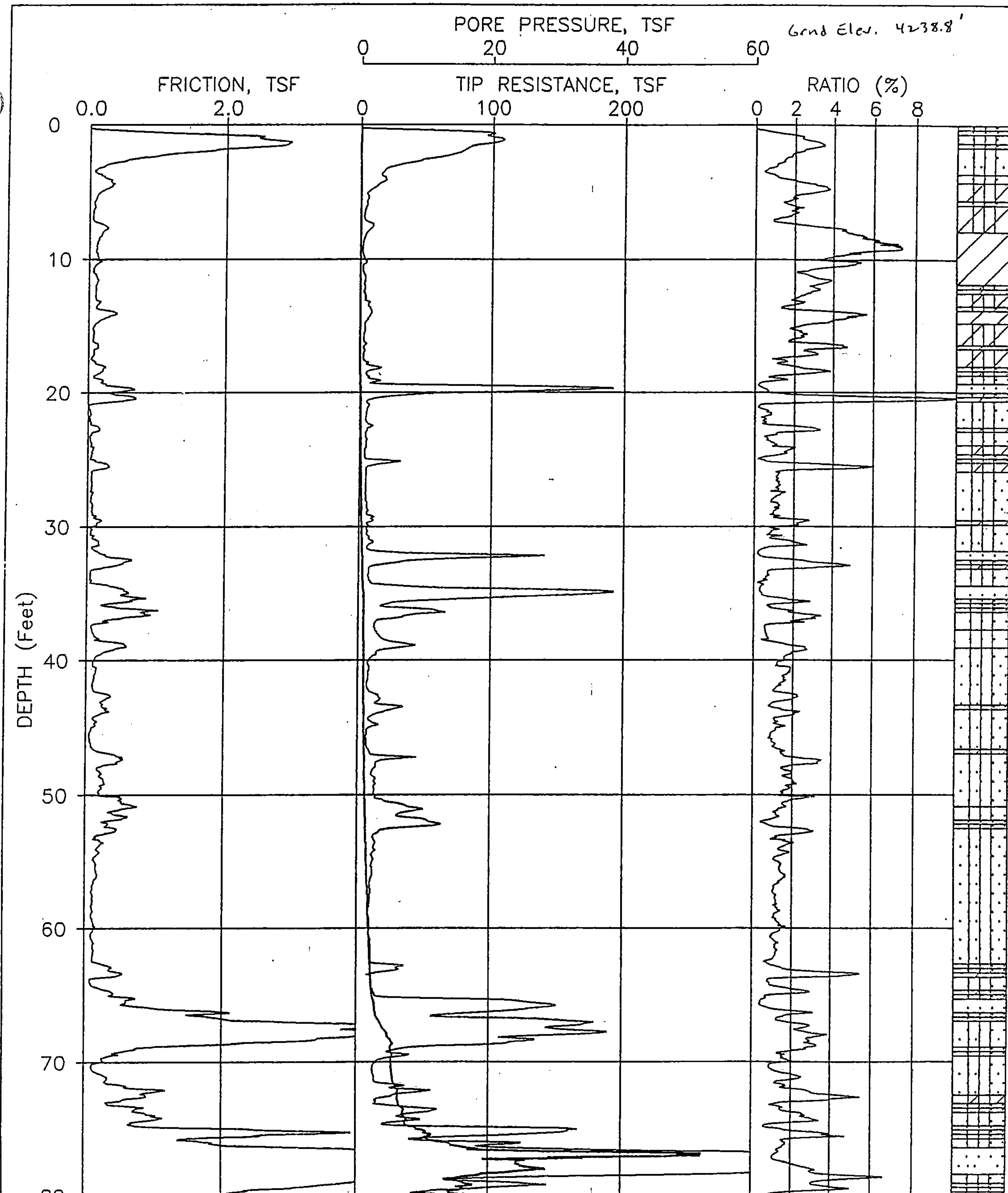
JOB NUMBER: 95-0110
ELEVATION: 0.00
CPT NUMBER: CPT-L33
CONE NUMBER:F7.5CKEW852
DATE: 08-17-1995
PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



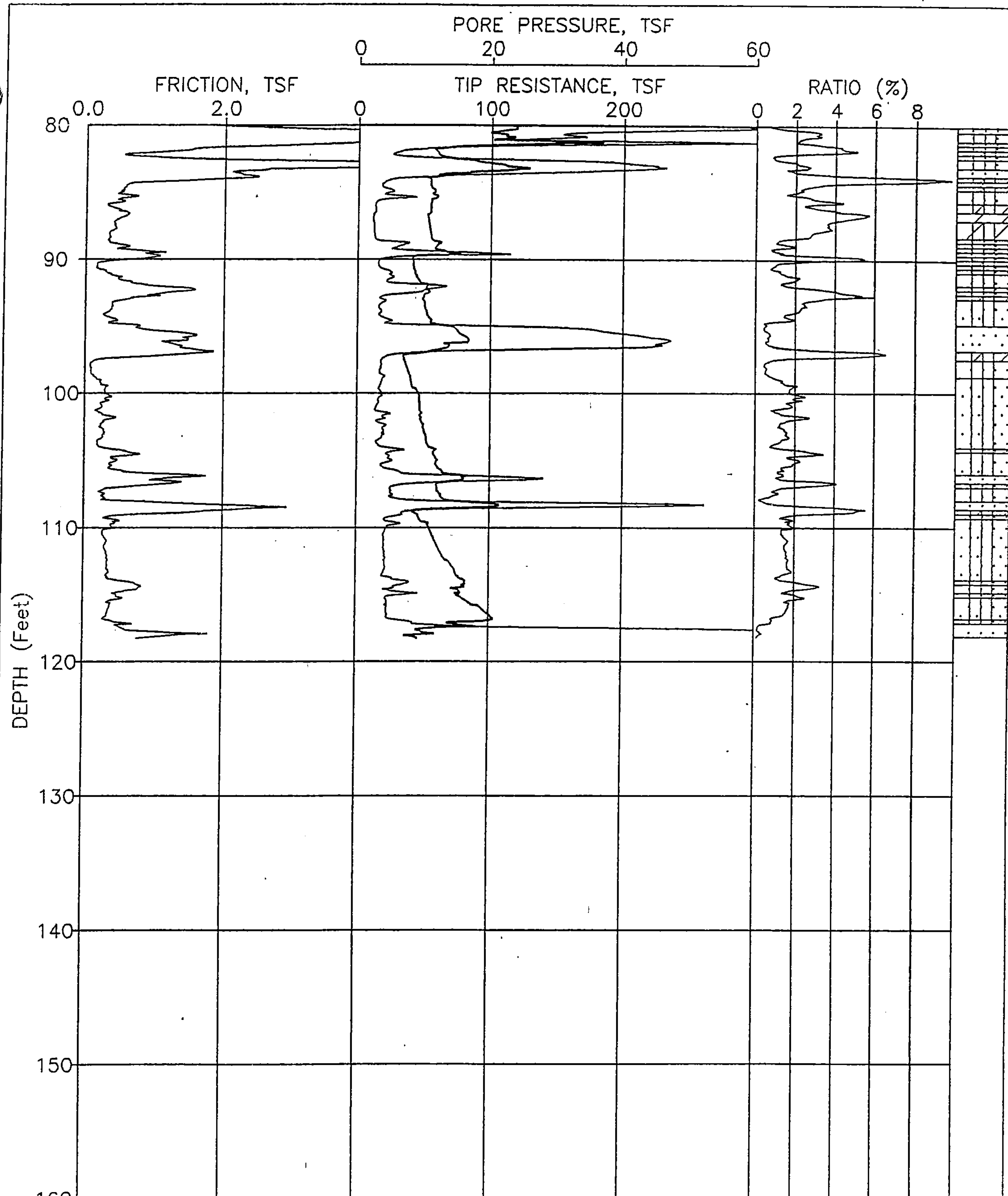
JOB NUMBER: 95-0110
ELEVATION: 0.00
CPT NUMBER: CPT-L33
CONE NUMBER:F7.5CKEW852
DATE: 08-17-1995
PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 95-0110
ELEVATION: 0.00
CPT NUMBER: CPT-L34
CONE NUMBER:F7.5CKEW852
DATE: 08-18-1995
PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 95–0110 CPT NUMBER: CPT–L34 DATE: 08–18–1995

ELEVATION: 0.00 CONE NUMBER:F7.5CKEW852 PLATE: 2 OF 2

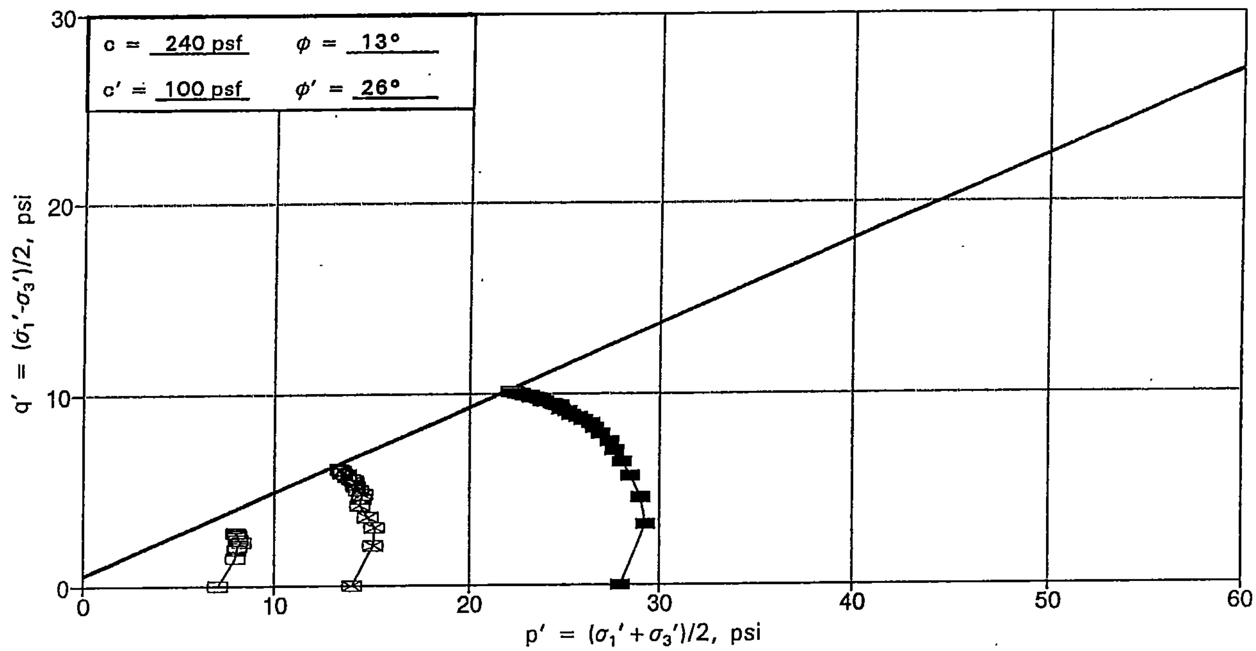
FUGRO GEOSCIENCES,INC

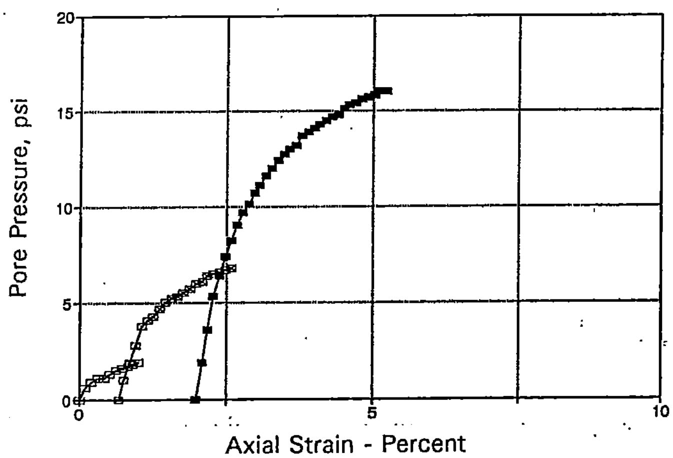
APPENDIX A-3

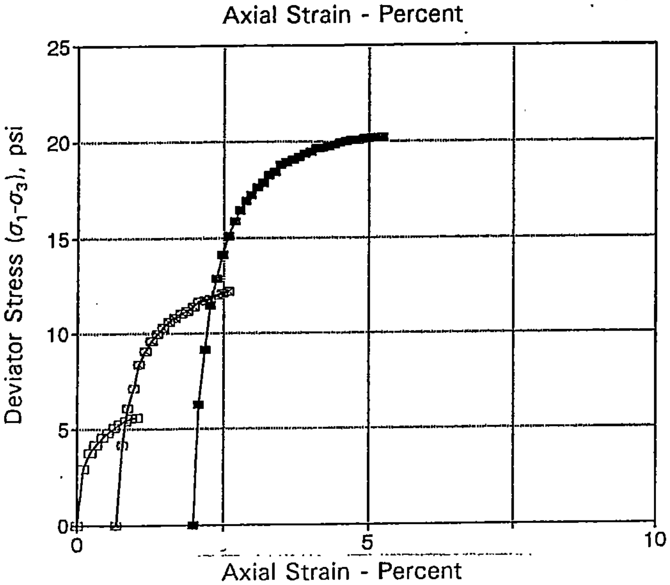
LABORATORY TEST RESULTS

PREVIOUS STUDIES

Applied Geotechnical Engineering Consultants, Inc.







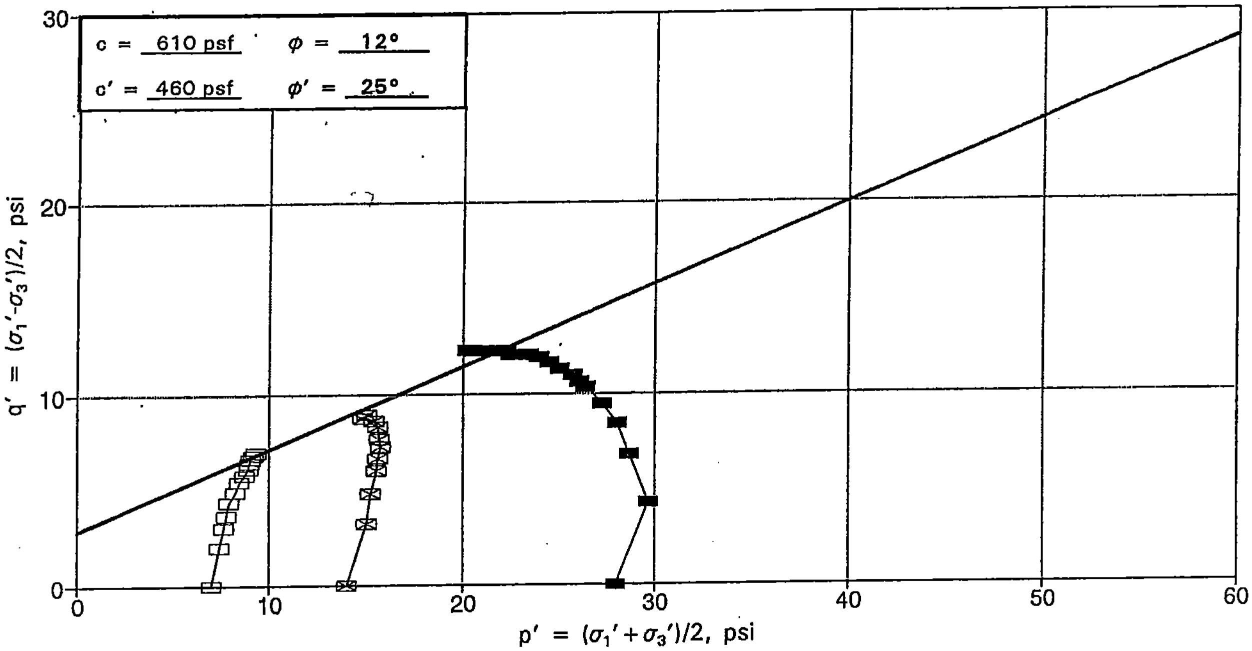
Test No.(Symbol)	1(□)	2(⊠)	3(■)
Sample Type	Undisturbed		
Length, in.	4.9		
Diameter, in.	2.39		
Dry Density, pcf	65		
Moisture Content, %	62		
Consol. Pressure, psi	7	14	28
"B" Parameter	1.0	0.97	0.86
Total Conf. Stress(σ_3), psi	7	14	28
Total Axial Stress(σ_1), psi	12.6	26.2	48.2
Deviator Stress(σ_1-σ_3), psi	5.6	12.2	20.2
Eff. Lateral Stress(σ_3'), psi	5.1	7.2	12.0
Eff. Axial Stress(σ_1'), psi	10.7	19.4	32.2
Pore Pressure(μ), psi	1.9	6.8	16.0
Strain(ϵ), %	1.0	2.6	5.2
Remarks	Staged, consolidated, undrained test with pore pressure measurement.		

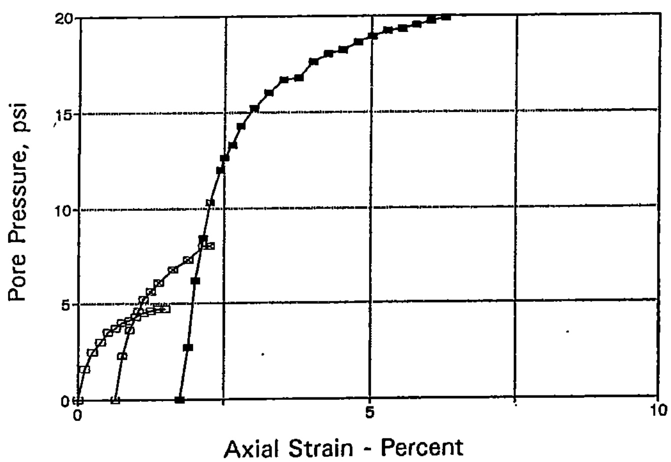
Sample Index Properties	
Natural Dry Density, pcf	65
Natural Moisture Content, %	62
Liquid Limit, %	66
Plasticity Index, %	40
Percent Gravel	-
Percent Sand	-
Percent Passing No. 200 Sieve	100

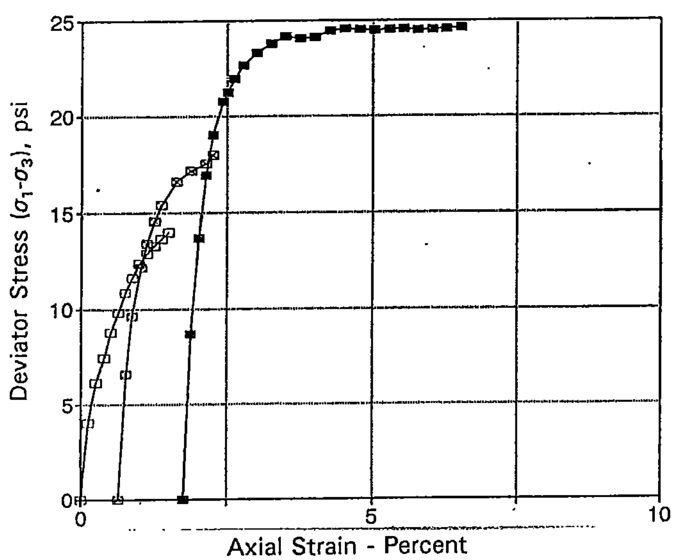
Sample Description Fat Clay (CH) From L-2 @ 30-1/2 feet

Project No. 20591 TRIAXIAL COMPRESSION TEST RESULTS Figure 12

Applied Geotechnical Engineering Consultants, Inc.







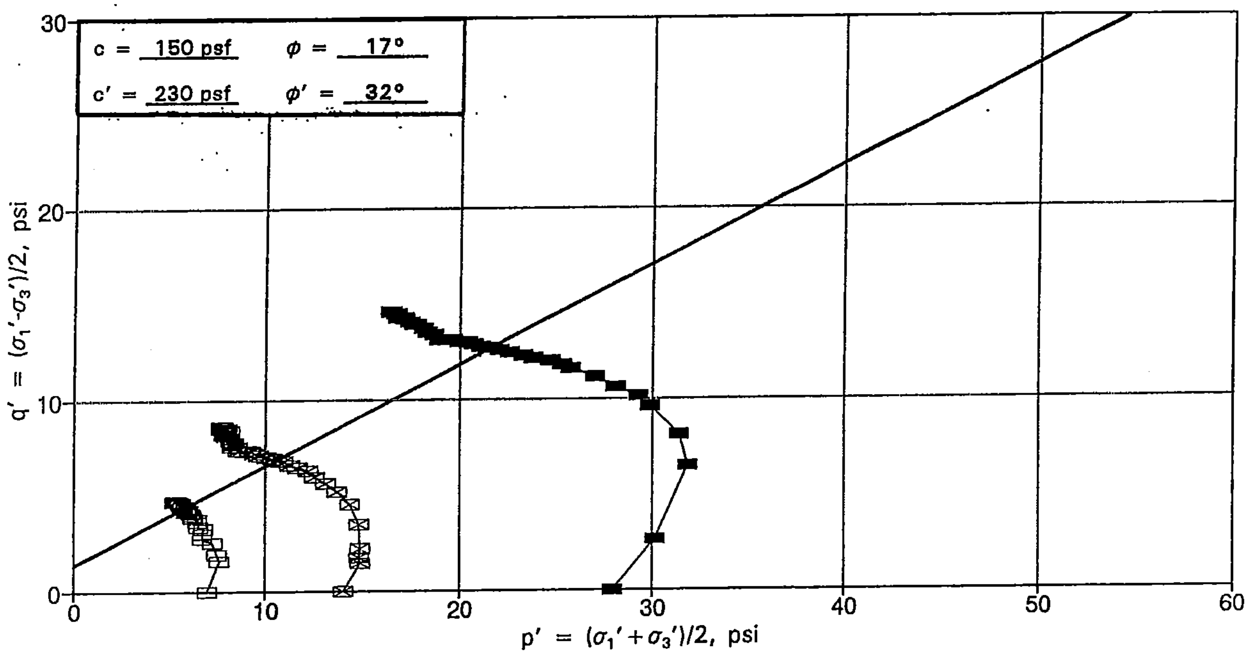
Test No.(Symbol)	1(□)	2(⊠)	3(■)
Sample Type	Undisturbed		
Length, in.	4.0		
Diameter, in.	1.93		
Dry Density, pcf	74		
Moisture Content, %	48		
Consol. Pressure, psi	7	14	28
"B" Parameter	0.99	0.96	0.91
Total Conf. Stress(σ_3), psi	7	14	28
Total Axial Stress(σ_1), psi	21.0	32.0	52.6
Deviator Stress(σ_1-σ_3), psi	14.0	18.0	24.6
Eff. Lateral Stress(σ_3'), psi	2.3	6.0	7.9
Eff. Axial Stress(σ_1'), psi	16.3	24.0	32.5
Pore Pressure(μ), psi	4.7	8.0	20.1
Strain(ϵ), %	1.5	2.3	6.5
Remarks	Staged, consolidated, undrained test with pore pressure measurement.		

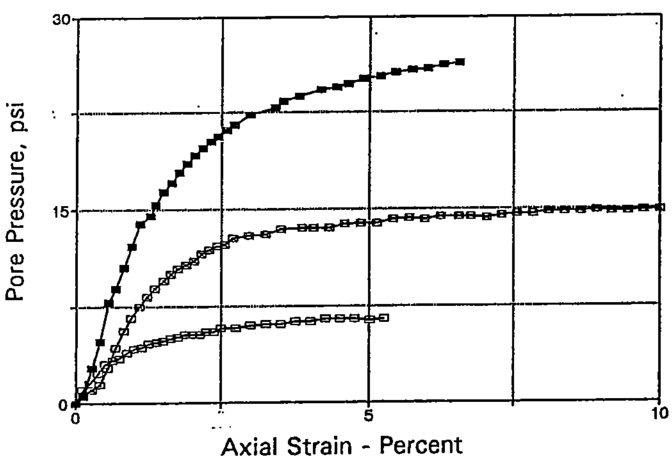
Sample Index Properties	
Natural Dry Density, pcf	74
Natural Moisture Content, %	48
Liquid Limit, %	46
Plasticity Index, %	25
Percent Gravel	-
Percent Sand	-
Percent Passing No. 200 Sieve	99

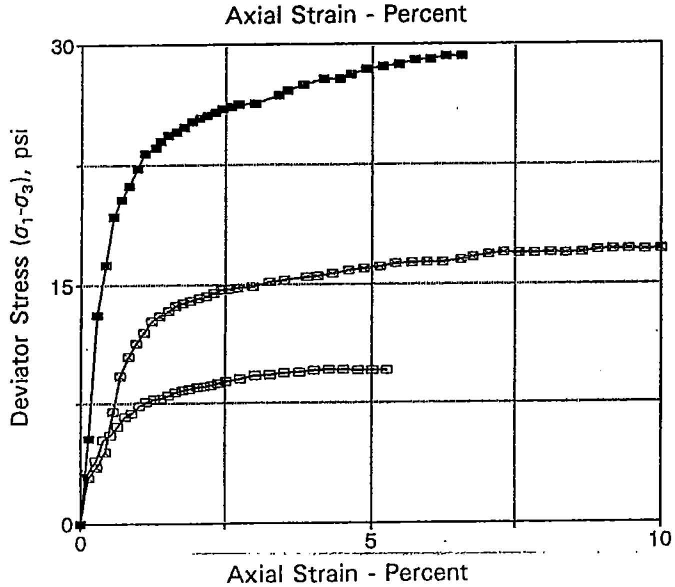
Sample Description Lean Clay (CL) From L-4 @ 23 feet

Project No. 20591 TRIAXIAL COMPRESSION TEST RESULTS Figure 13

Applied Geotechnical Engineering Consultants, Inc.







Test No.(Symbol)	1(□)	2(⊠)	3(■)
Sample Type	Undisturbed		
Length, in.	4.00	3.71	3.71
Diameter, in.	1.93	1.93	1.93
Dry Density, pcf	65	64	65
Moisture Content, %	58	61	60
Consol. Pressure, psi	7	14	28
"B" Parameter	1.0	0.95	0.95
Total Conf. Stress(σ_3), psi	7	14	28
Total Axial Stress(σ_1), psi	15.5	28.1	53.4
Deviator Stress(σ_1-σ_3), psi	8.5	14.1	25.4
Eff. Lateral Stress(σ_3'), psi	1.7	3.0	8.9
Eff. Axial Stress(σ_1'), psi	10.2	17.1	34.3
Pore Pressure(μ), psi	5.3	11.0	19.1
Strain(ϵ), %	2.0	2.0	2.0
Remarks	Consolidated, undrained test with pore pressure measurement.		

Sample Index Properties			
Natural Dry Density, pcf	65	64	65
Nat. Moisture Content, %	58	61	60
Liquid Limit, %	46	46	48
Plasticity Index, %	19	20	24
Percent Gravel	-	-	-
Percent Sand	-	-	-
% Passing No. 200 Sieve	100	100	100

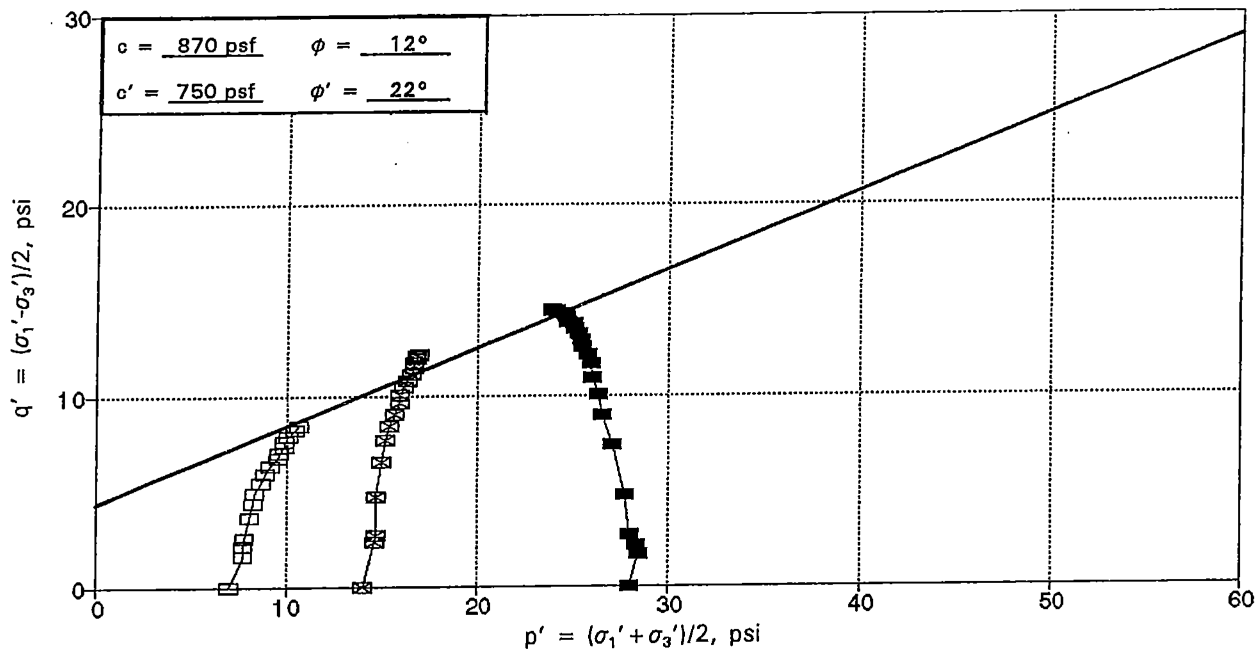
Sample Description Lean Clay (CL) Sample 1 From L-6 @ 20-1/2 feet

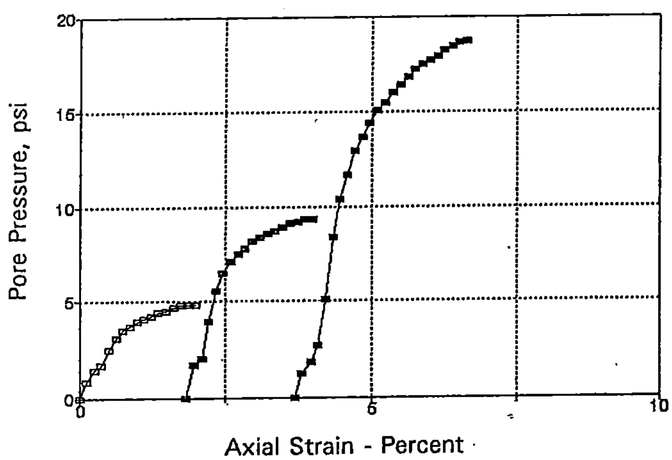
2 L-28 @ 20 feet

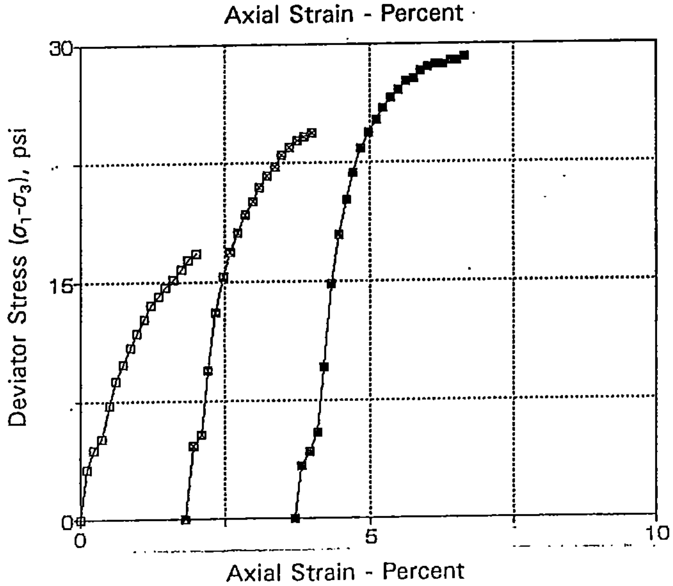
3 L-15 @ 32 feet

Project No. 20591 TRIAXIAL COMPRESSION TEST RESULTS Figure 14

Applied Geotechnical Engineering Consultants, Inc.







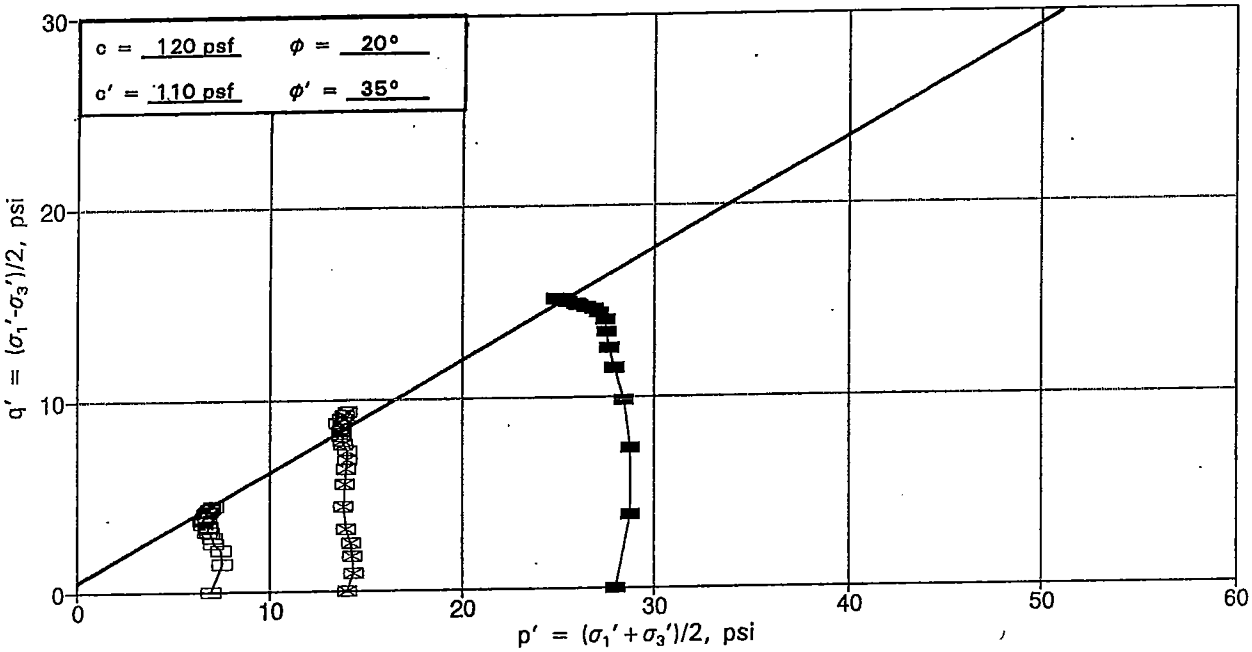
Test No.(Symbol)	1(□)	2(⊠)	3(■)
Sample Type	Undisturbed		
Length, in.	4.0		
Diameter, in.	1.93		
Dry Density, pcf	67		
Moisture Content, %	59		
Consol. Pressure, psi	7	14	28
"B" Parameter	0.97	0.95	0.94
Total Conf. Stress(σ_3), psi	7	14	28
Total Axial Stress(σ_1), psi	23.8	38.1	55.7
Deviator Stress(σ_1-σ_3), psi	16.8	24.1	27.7
Eff. Lateral Stress(σ_3'), psi	2.2	4.7	10.8
Eff. Axial Stress(σ_1'), psi	19.0	28.8	38.5
Pore Pressure(μ), psi	4.8	9.3	17.2
Strain(ϵ), %	2.0	3.9	5.8
Remarks	Staged, consolidated, undrained test with pore pressure measurement.		

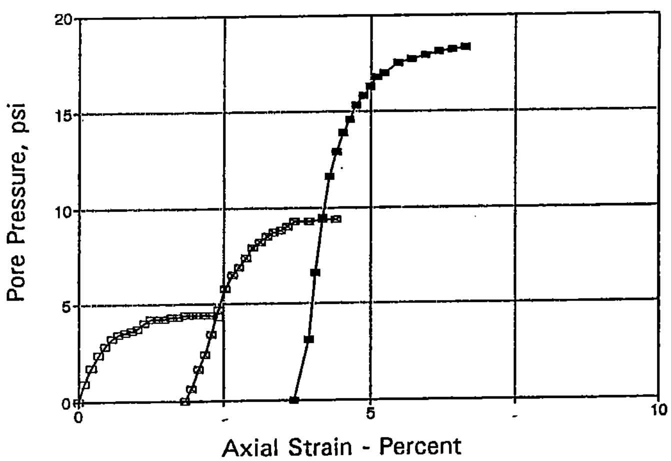
Sample Index Properties	
Natural Dry Density, pcf	67
Natural Moisture Content, %	59
Liquid Limit, %	63
Plasticity Index, %	36
Percent Gravel	-
Percent Sand	-
Percent Passing No. 200 Sieve	100

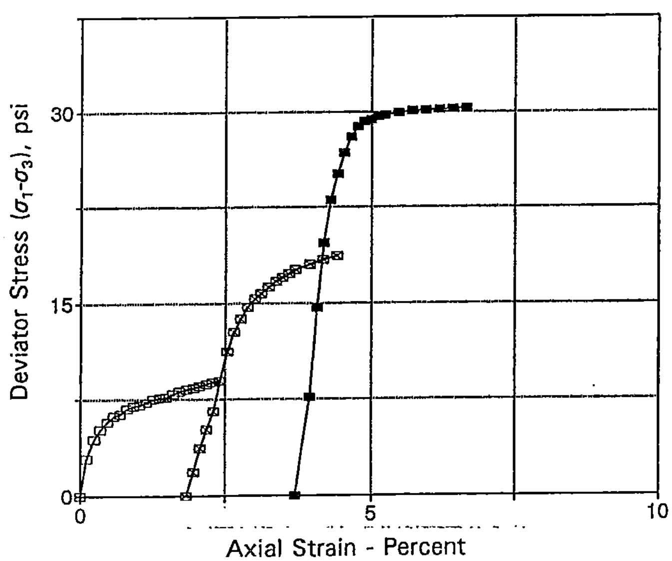
Sample Description Fat Clay (CH) From L-8 @ 60 Feet

Project No. 20591 TRIAXIAL COMPRESSION TEST RESULTS Figure 15

Applied Geotechnical Engineering Consultants, Inc.







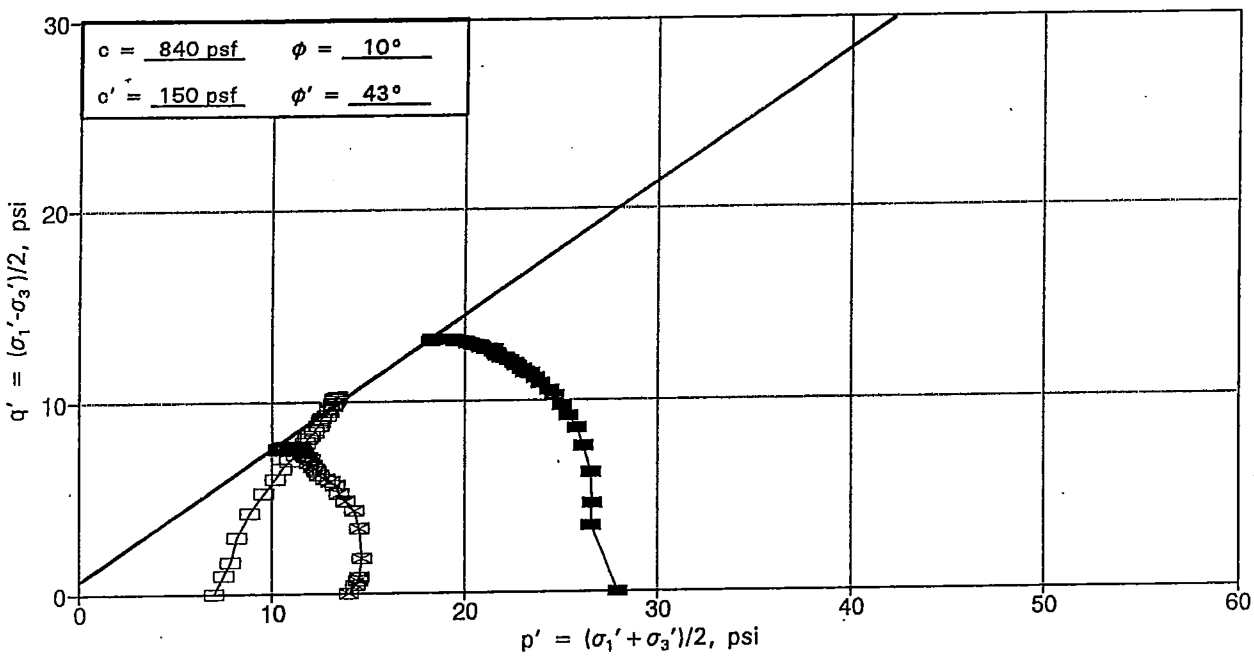
Test No.(Symbol)	1(□)	2(⊠)	3(■)
Sample Type	Undisturbed		
Length, in.	4.37		
Diameter, in.	2.42		
Dry Density, pcf	87		
Moisture Content, %	33		
Consol. Pressure, psi	7	14	28
"B" Parameter	0.97	0.96	0.92
Total Conf. Stress(σ_3), psi	7	14	28
Total Axial Stress(σ_1), psi	15.5	32.0	58.1
Deviator Stress(σ_1-σ_3), psi	8.5	18.0	30.1
Eff. Lateral Stress(σ_3'), psi	2.6	4.7	10.3
Eff. Axial Stress(σ_1'), psi	11.1	22.7	40.4
Pore Pressure(u), psi	4.4	9.3	17.7
Strain(ϵ), %	2.1	3.9	5.7
Remarks	Staged, consolidated, undrained test with pore pressure measurement.		

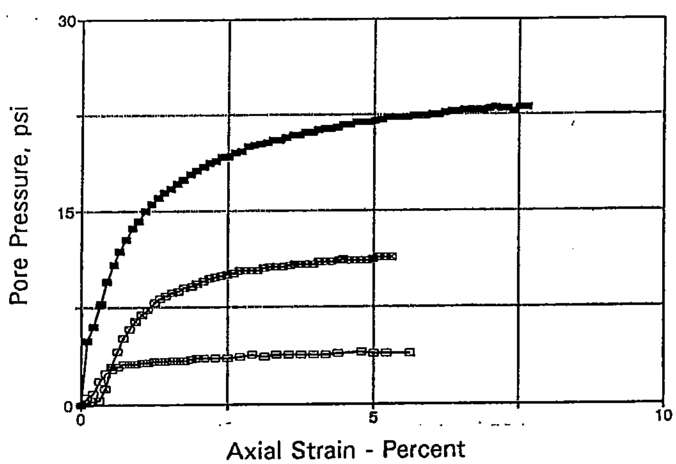
Sample Index Properties	
Natural Dry Density, pcf	87
Natural Moisture Content, %	33
Liquid Limit, %	29
Plasticity Index, %	11
Percent Gravel	-
Percent Sand	-
Percent Passing No. 200 Sieve	81

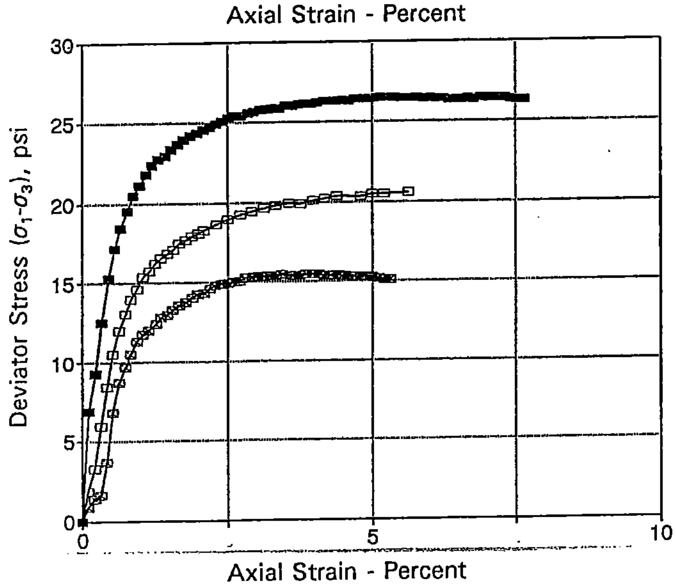
Sample Description Lean Clay with Sand (CL) From L-14 @ 45 feet

Project No. 20591 TRIAXIAL COMPRESSION TEST RESULTS Figure 16

Applied Geotechnical Engineering Consultants, Inc.







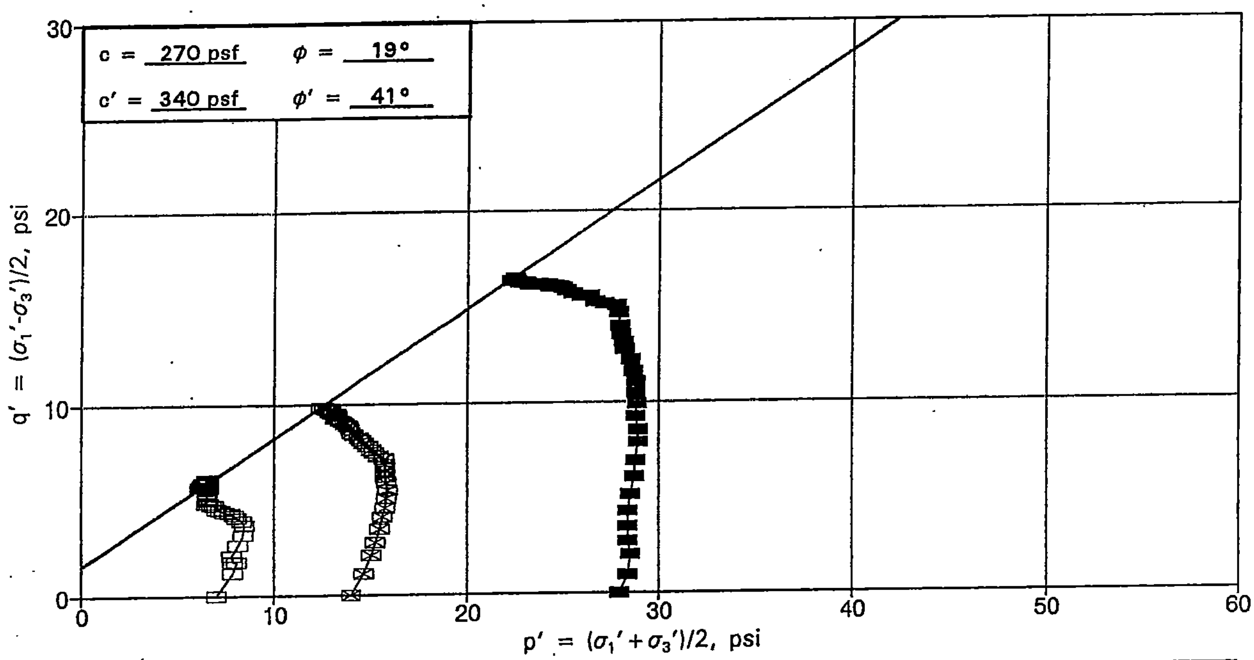
Test No.(Symbol)	1(□)	2(⊠)	3(■)
Sample Type	Undisturbed		
Length, in.	4.80	4.81	4.58
Diameter, in.	2.42	2.42	2.42
Dry Density, pcf		66	
Moisture Content, %		59	
Consol. Pressure, psi	7	14	28
"B" Parameter	0.92	0.96	0.95
Total Conf. Stress(σ_3), psi	7	14	28
Total Axial Stress(σ_1), psi	27.6	29.1	54.3
Deviator Stress(σ_1-σ_3), psi	20.6	15.1	26.3
Eff. Lateral Stress(σ_3'), psi	3.1	2.7	5.0
Eff. Axial Stress(σ_1'), psi	23.7	17.8	31.3
Pore Pressure(μ), psi	3.9	11.3	23.0
Strain(ϵ), %	5.6	5.3	7.6
Remarks	Consolidated, undrained test with pore pressure measurement.		

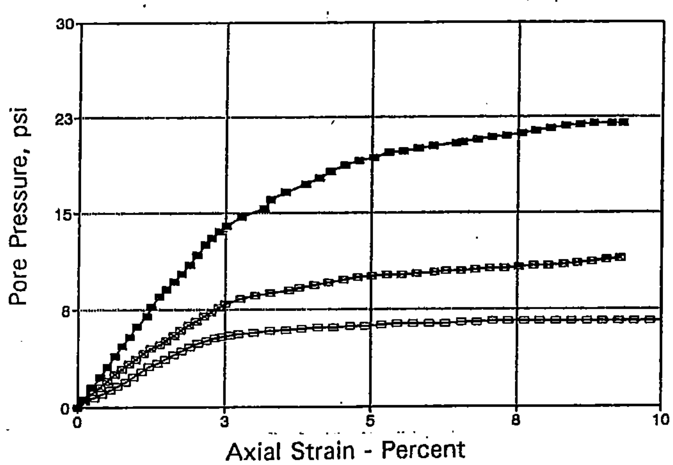
Sample Index Properties	
Natural Dry Density, pcf	66
Natural Moisture Content, %	59
Liquid Limit, %	
Plasticity Index, %	
Percent Gravel	-
Percent Sand	-
Percent Passing No. 200 Sieve	

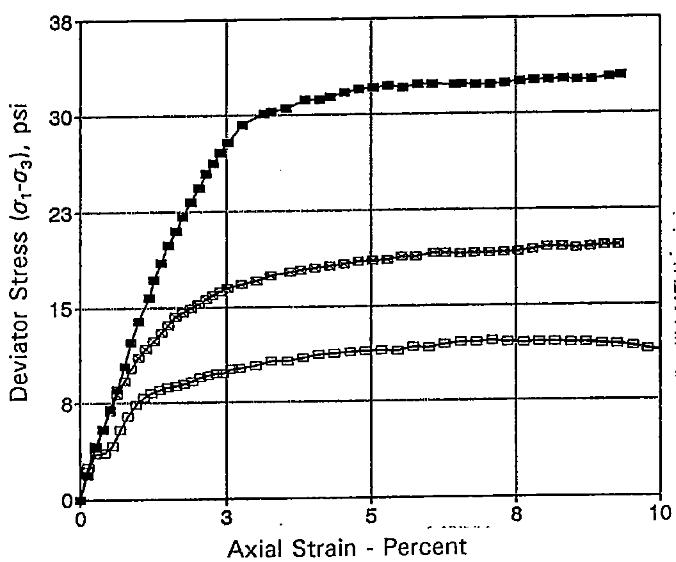
Sample Description Lean Clay (CL) From L-17 @ 8 feet

Project No. 20591 TRIAXIAL COMPRESSION TEST RESULTS Figure 17

Applied Geotechnical Engineering Consultants, Inc.







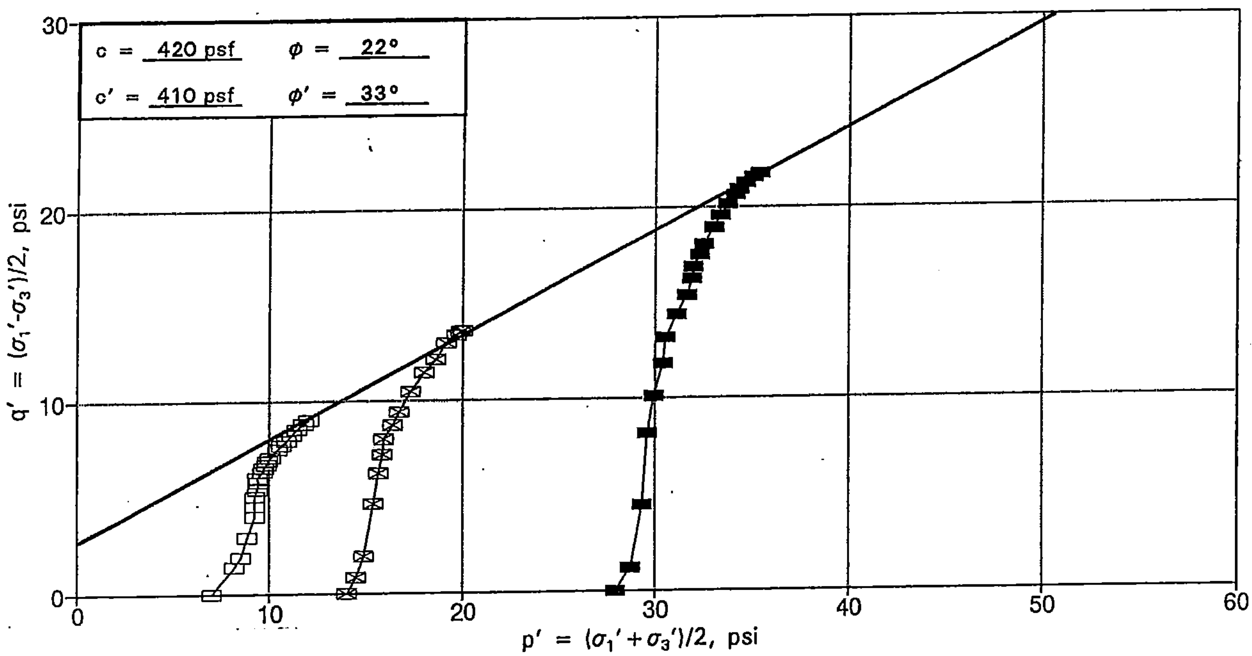
Test No.(Symbol)	1(□)	2(⊠)	3(■)
Sample Type	Undisturbed		
Length, in.	3.68	4.0	4.0
Diameter, in.	1.93	1.93	1.93
Dry Density, pcf	61	62	70
Moisture Content, %	67	68	52
Consol. Pressure, psi	7	14	28
"B" Parameter	0.92	0.95	0.95
Total Conf. Stress(σ_3), psi	7	14	28
Total Axial Stress(σ_1), psi	18.9	33.7	60.9
Deviator Stress(σ_1-σ_3), psi	11.9	19.7	32.9
Eff. Lateral Stress(σ_3'), psi	0.4	2.6	6.0
Eff. Axial Stress(σ_1'), psi	12.3	22.3	38.9
Pore Pressure(μ), psi	6.6	11.4	22.0
Strain(ϵ), %	9.3	9.3	9.3
Remarks	Consolidated, undrained test with pore pressure measurement.		

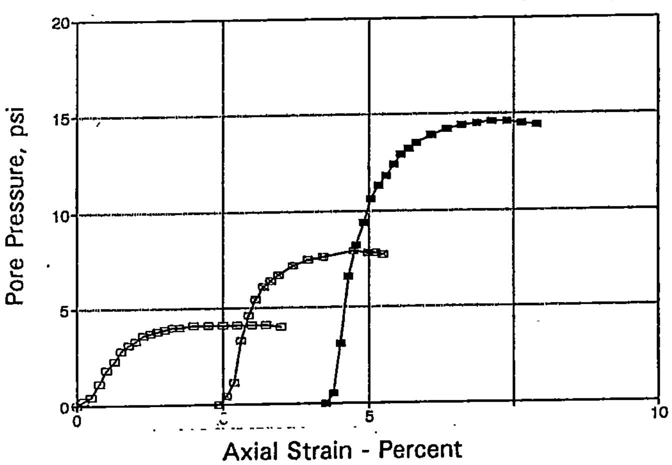
Sample Index Properties			
Natural Dry Density, pcf	61	62	70
Natural Moisture Content, %	67	68	52
Liquid Limit, %	65	66	49
Plasticity Index, %	29	34	25
Percent Gravel			
Percent Sand			
Percent Passing No. 200 Sieve	100	100	89

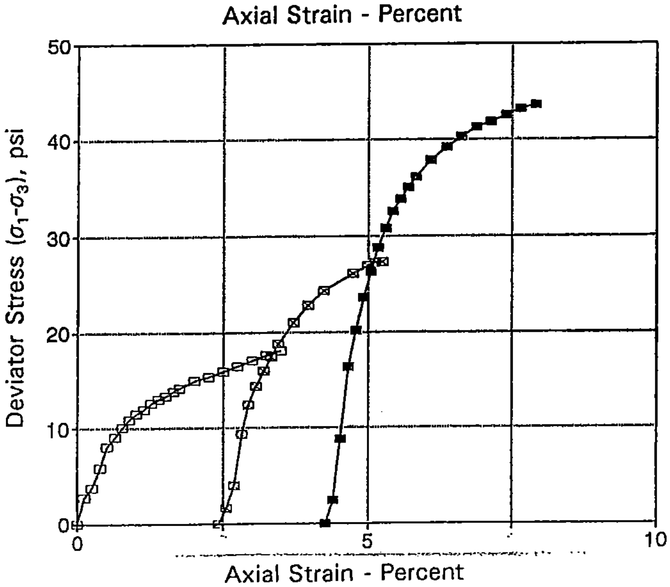
Sample Description	Sample	From
Lean Clay (CL)	1	L-17 @ 25½ feet
Fat Clay (CH)	2	L-21 @ 30 feet
Fat Clay (CH)	3	L-24 @ 30 feet

Project No. 20591 TRIAXIAL COMPRESSION TEST RESULTS Figure 18

Applied Geotechnical Engineering Consultants, Inc.







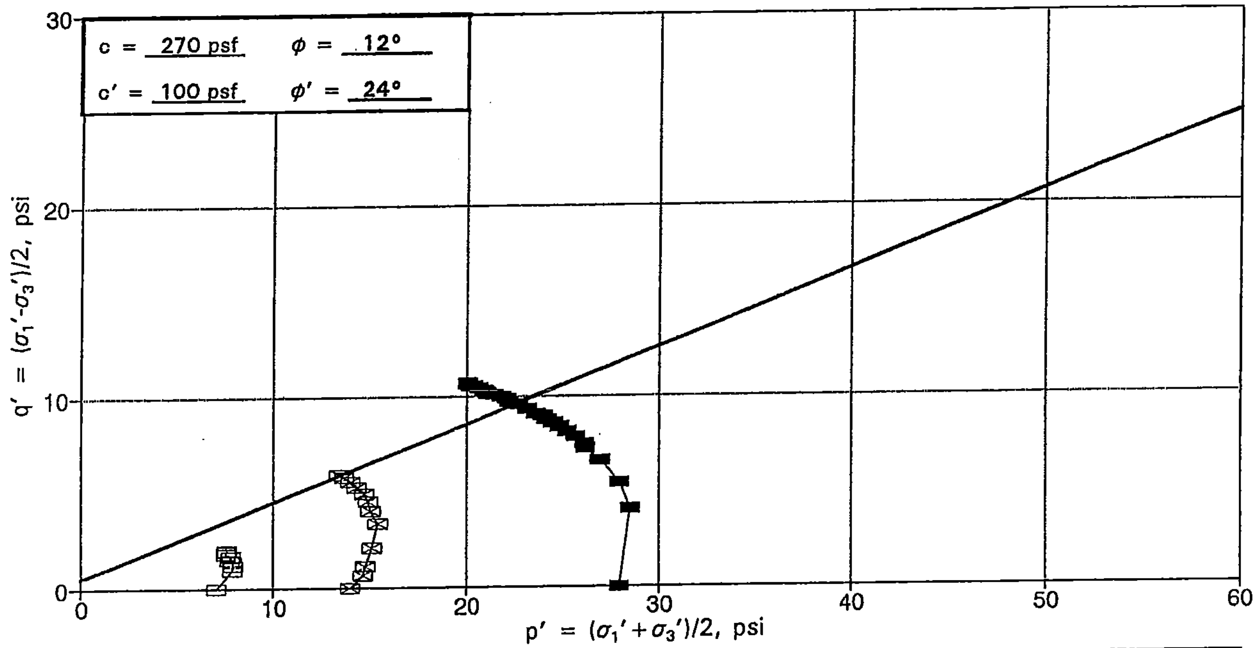
Test No.(Symbol)	1(□)	2(⊠)	3(■)
Sample Type	Undisturbed		
Length, in.	4.0		
Diameter, in.	1.93		
Dry Density, pcf	92		
Moisture Content, %	31		
Consol. Pressure, psi	7	14	28
"B" Parameter	0.96	0.94	0.91
Total Conf. Stress(σ_3), psi	7	14	28
Total Axial Stress(σ_1), psi	25.0	41.3	71.6
Deviator Stress(σ_1-σ_3), psi	18.0	27.3	43.6
Eff. Lateral Stress(σ_3'), psi	3.0	6.3	13.6
Eff. Axial Stress(σ_1'), psi	21.0	33.6	57.2
Pore Pressure(u), psi	4.0	7.7	14.4
Strain(ϵ), %	3.5	5.3	7.9
Remarks	Staged, consolidated, undrained test with pore pressure measurement.		

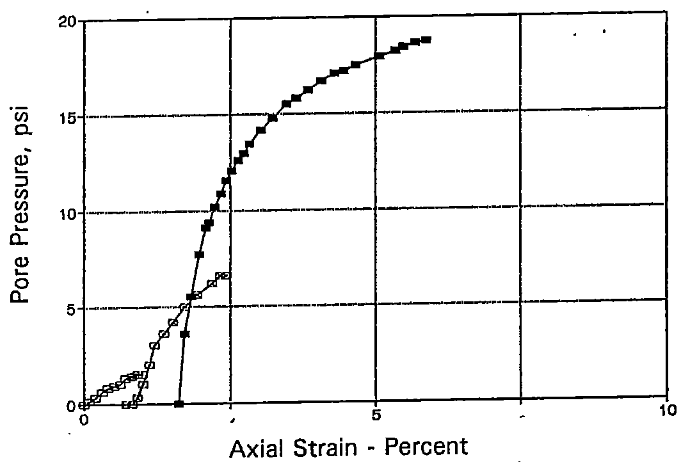
Sample Index Properties	
Natural Dry Density, pcf	92
Natural Moisture Content, %	31
Liquid Limit, %	45
Plasticity Index, %	25
Percent Gravel	-
Percent Sand	-
Percent Passing No. 200 Sieve	100

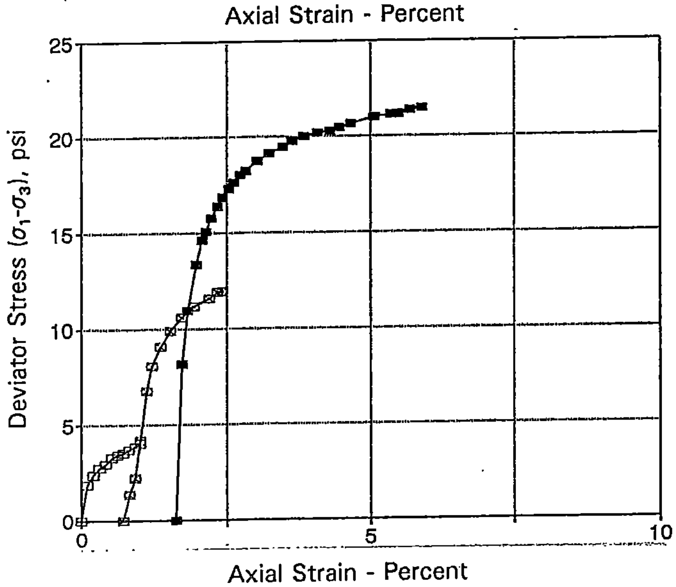
Sample Description Lean Clay (CL) From L-19 @ 50 feet

Project No. 20591 TRIAXIAL COMPRESSION TEST RESULTS Figure 19

Applied Geotechnical Engineering Consultants, Inc.







Test No.(Symbol)	1(□)	2(⊠)	3(■)
Sample Type	Undisturbed		
Length, in.	4.96		
Diameter, in.	2.42		
Dry Density, pcf	60		
Moisture Content, %	67		
Consol. Pressure, psi	7	14	28
"B" Parameter	0.95	0.90	0.98
Total Conf. Stress(σ_3), psi	7	14	28
Total Axial Stress(σ_1), psi	11.0	24.6	45.6
Deviator Stress(σ_1-σ_3), psi	4.0	10.6	17.6
Eff. Lateral Stress(σ_3'), psi	5.5	9.0	15.4
Eff. Axial Stress(σ_1'), psi	9.5	19.6	33.0
Pore Pressure(μ), psi	1.5	5.0	12.6
Strain(ϵ), %	1.0	1.7	2.6
Remarks	Staged, consolidated, undrained test with pore pressure measurement.		

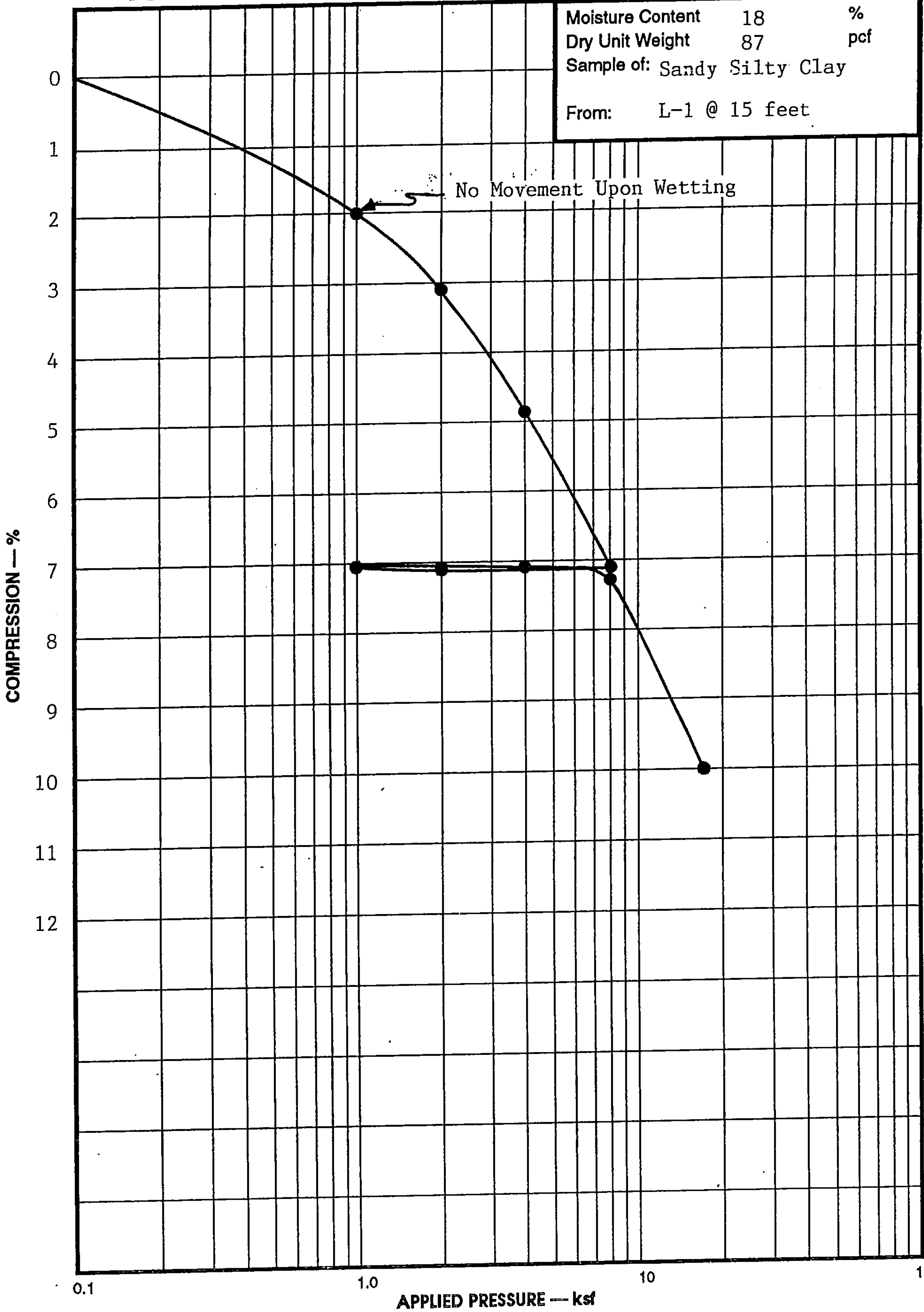
Sample Index Properties	
Natural Dry Density, pcf	60
Natural Moisture Content, %	67
Liquid Limit, %	68
Plasticity Index, %	42
Percent Gravel	-
Percent Sand	-
Percent Passing No. 200 Sieve	100

Sample Description Fat Clay (CH) From L-24 @ 35 feet

Project No. 20591 TRIAXIAL COMPRESSION TEST RESULTS Figure 20

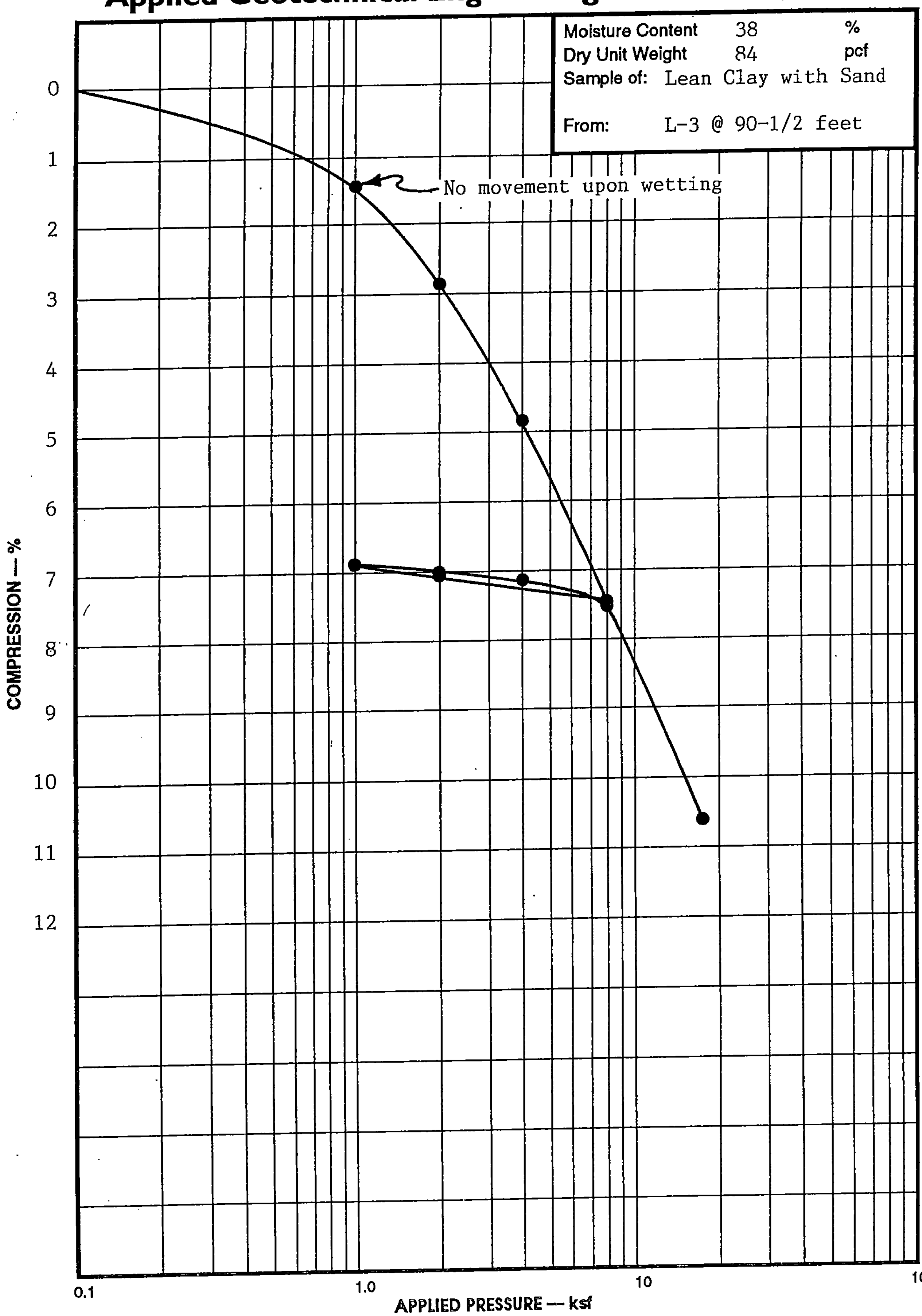
Applied Geotechnical Engineering Consultants, Inc.

Moisture Content	18	%
Dry Unit Weight	87	pcf
Sample of:	Sandy Silty Clay	
From:	L-1 @ 15 feet	



Project No. 20591 **CONSOLIDATION TEST RESULTS** Figure 21

Applied Geotechnical Engineering Consultants, Inc.

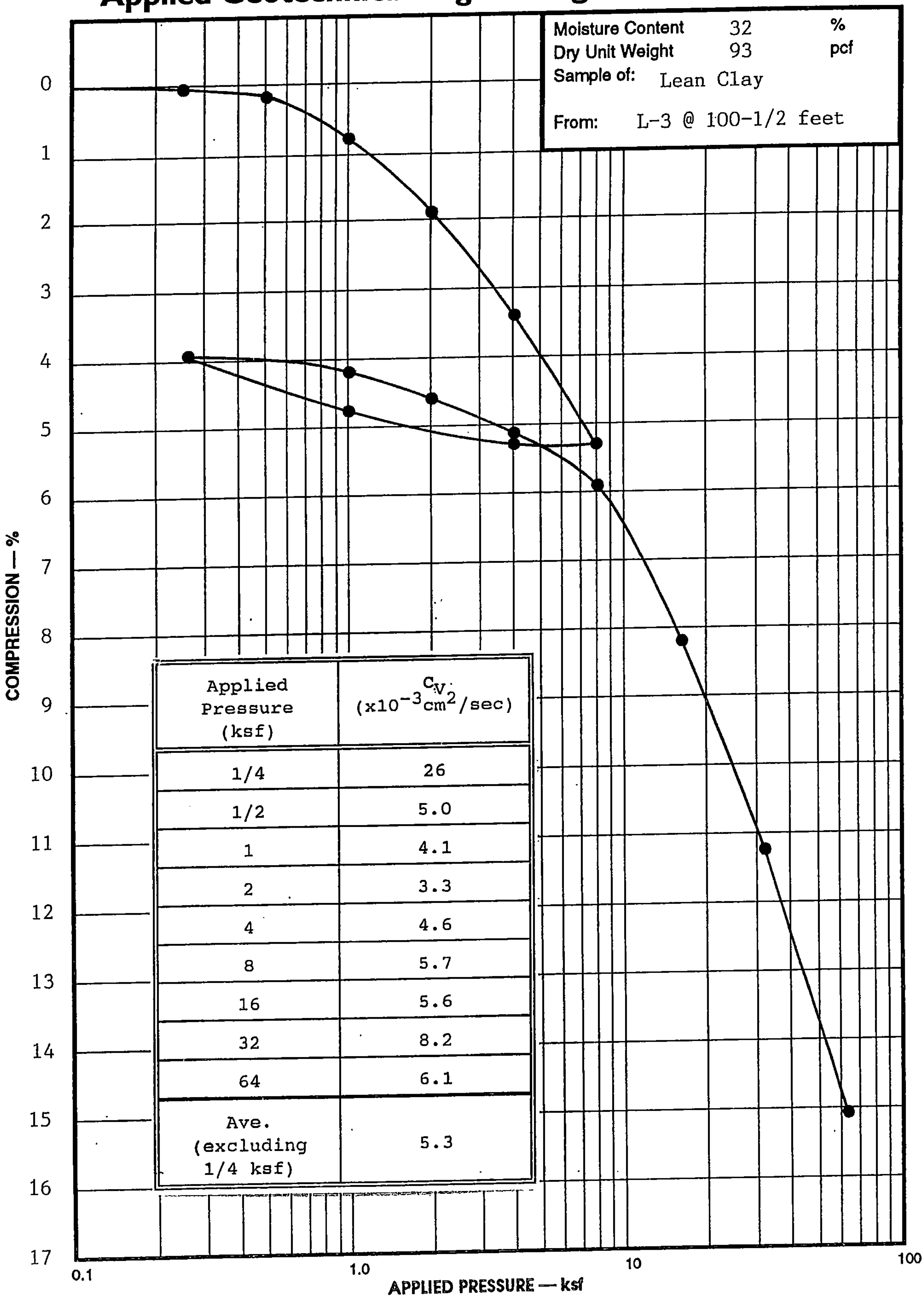


Project No. 20591 **CONSOLIDATION TEST RESULTS** Figure 22

Applied Geotechnical Engineering Consultants, Inc.

Moisture Content 32 %
Dry Unit Weight 93 pcf
Sample of: Lean Clay

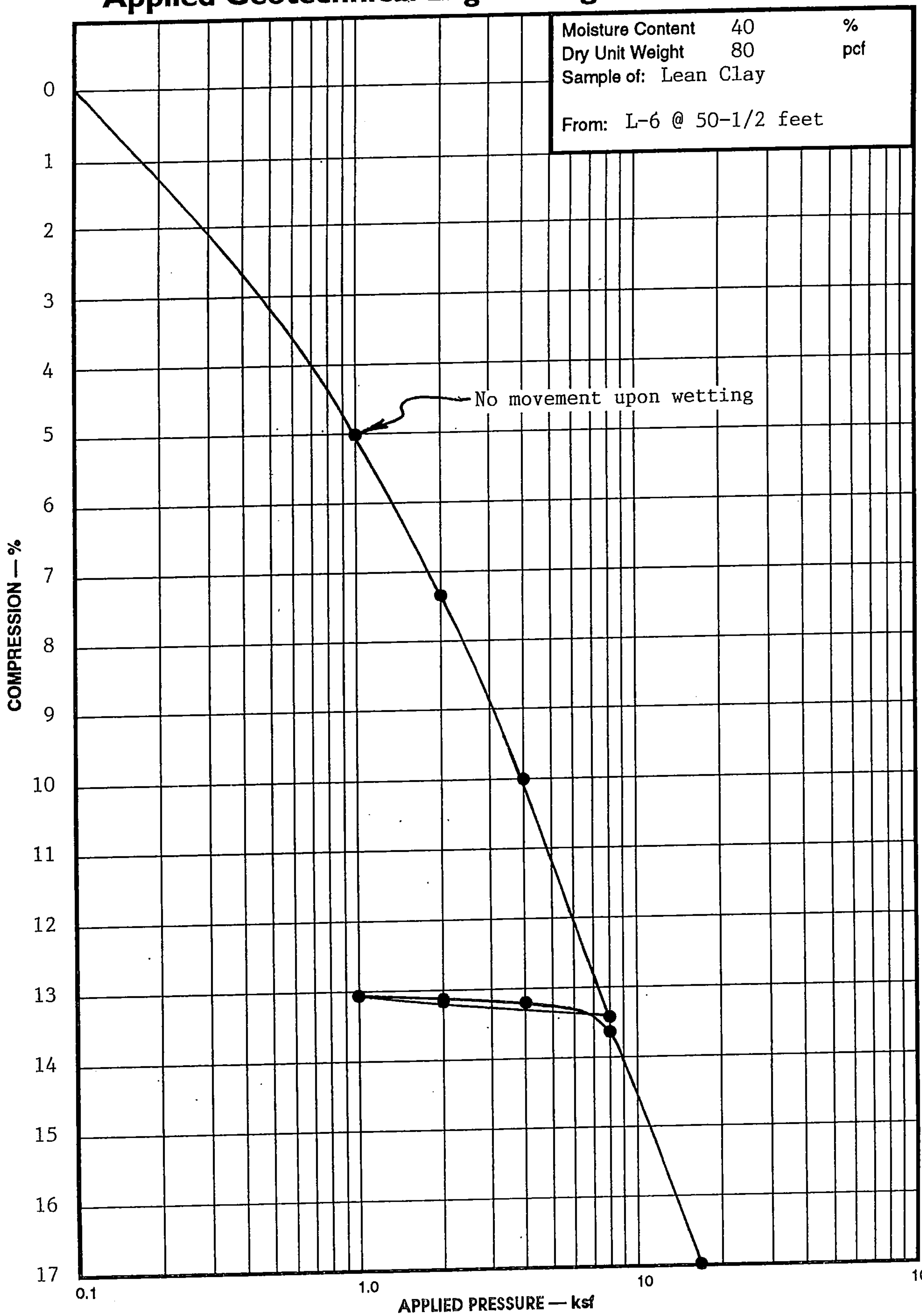
From: L-3 @ 100-1/2 feet



Applied Pressure (ksf)	C_V ($x10^{-3}cm^2$/sec)
1/4	26
1/2	5.0
1	4.1
2	3.3
4	4.6
8	5.7
16	5.6
32	8.2
64	6.1
Ave. (excluding 1/4 ksf)	5.3

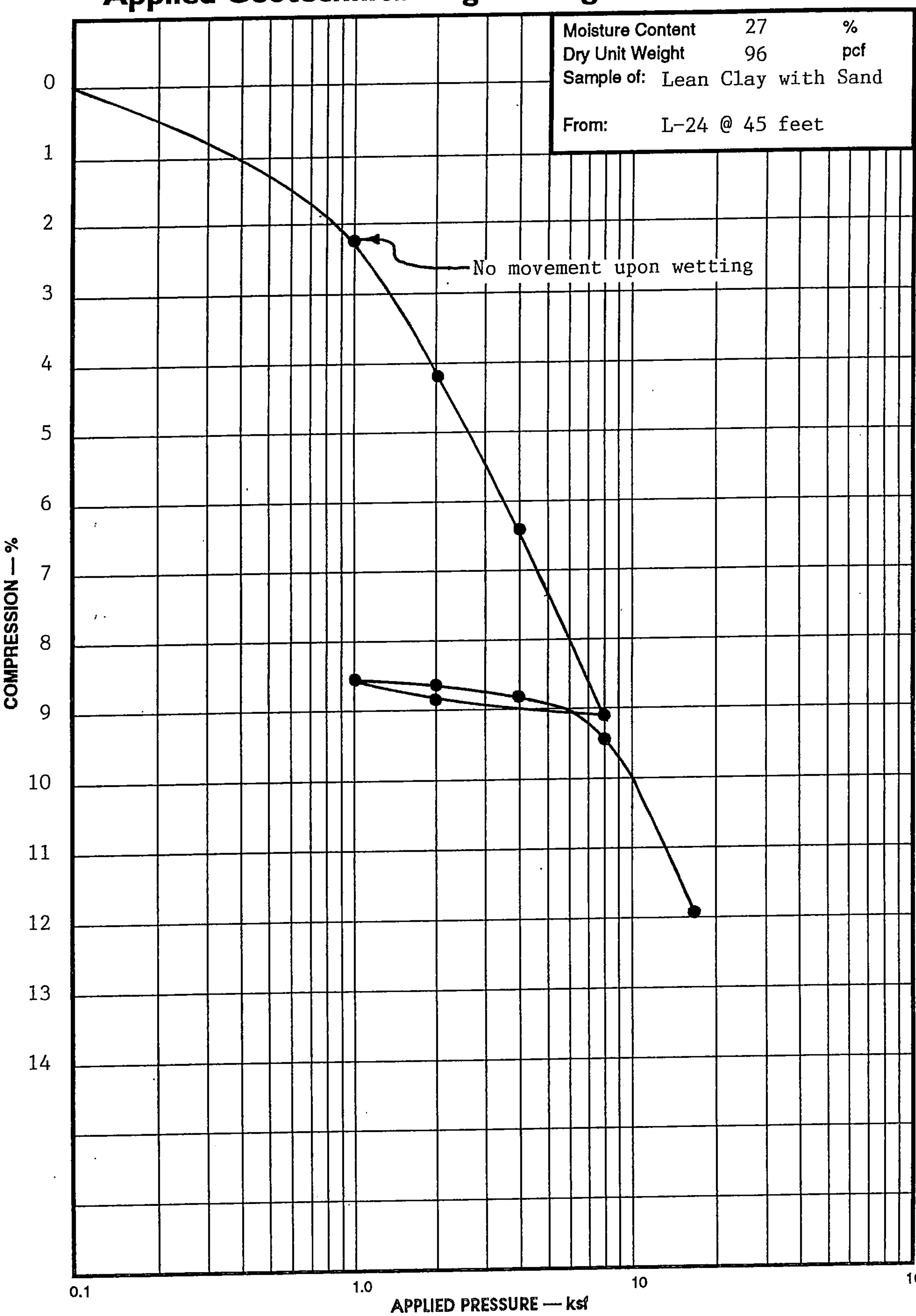
Project No. 20591 **CONSOLIDATION TEST RESULTS** Figure 23

Applied Geotechnical Engineering Consultants, Inc.



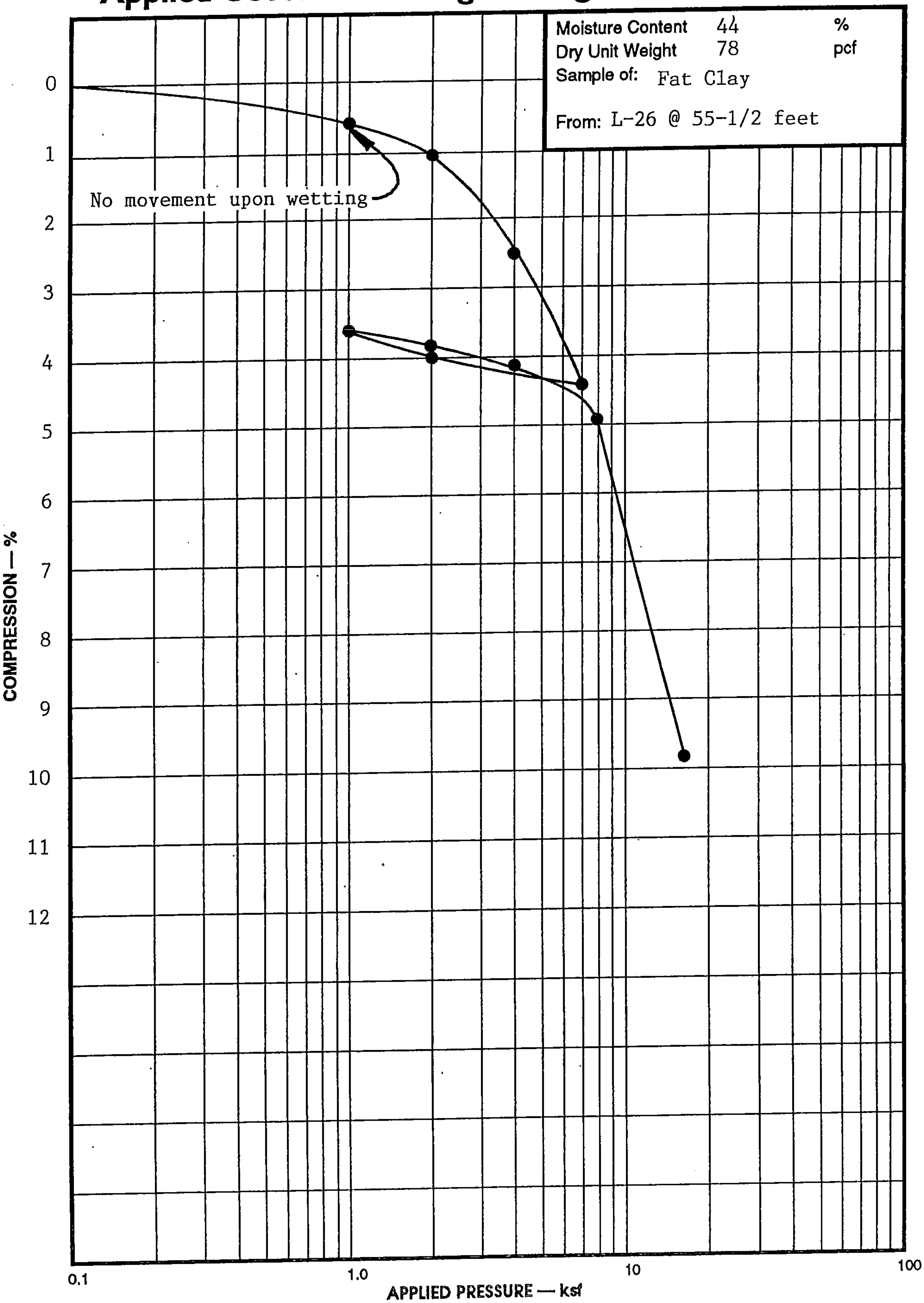
Project No. 20591 **CONSOLIDATION TEST RESULTS** Figure 24

Applied Geotechnical Engineering Consultants, Inc.



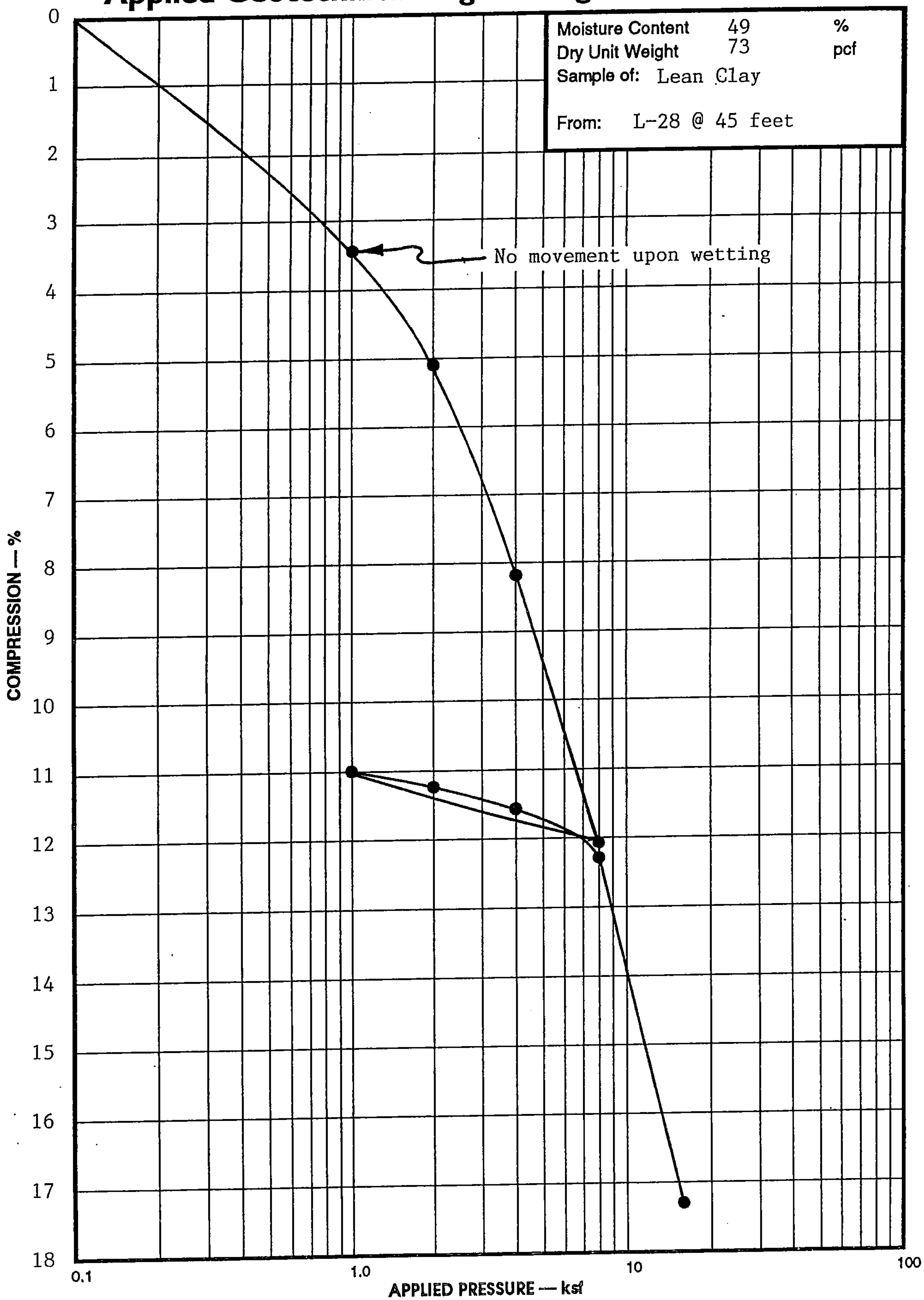
Project No. 20591 **CONSOLIDATION TEST RESULTS** Figure 25

Applied Geotechnical Engineering Consultants, Inc.



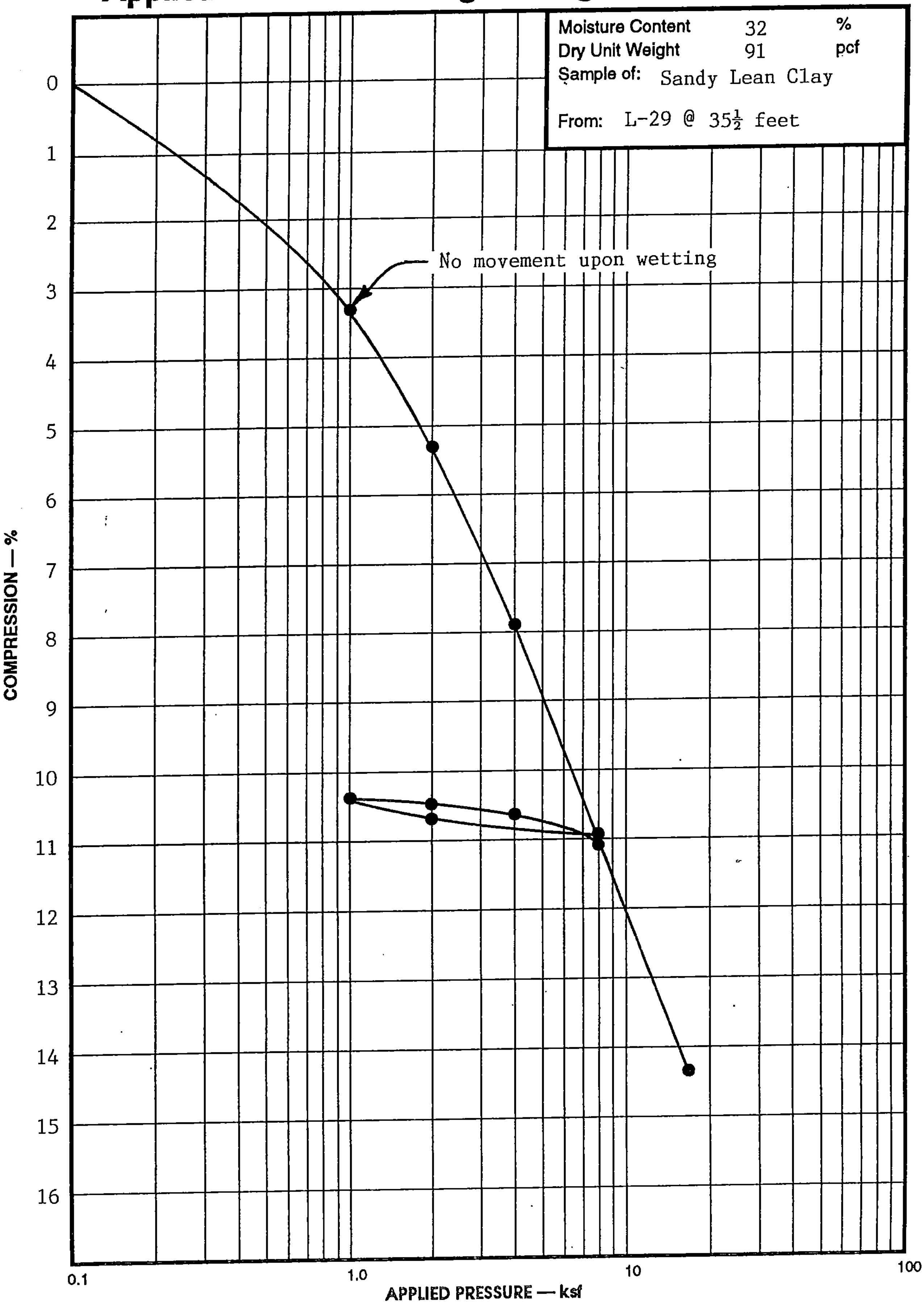
Project No. 20591 **CONSOLIDATION TEST RESULTS** Figure 26

Applied Geotechnical Engineering Consultants, Inc.



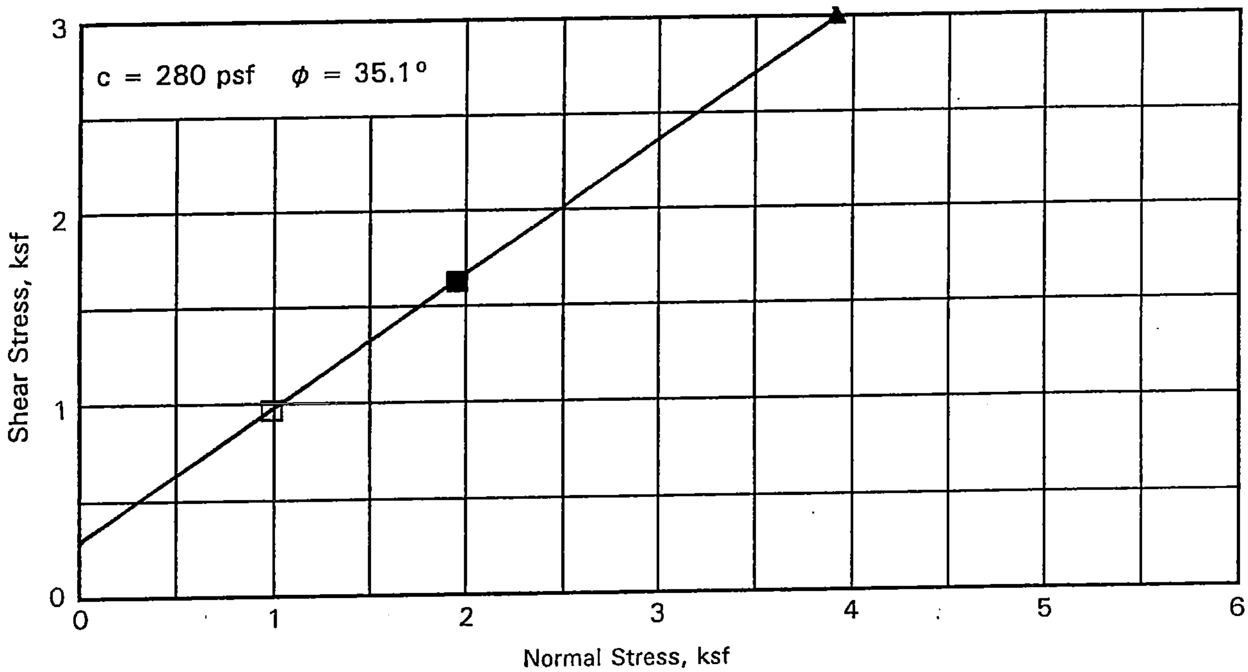
Project No. 20591 **CONSOLIDATION TEST RESULTS** Figure 27

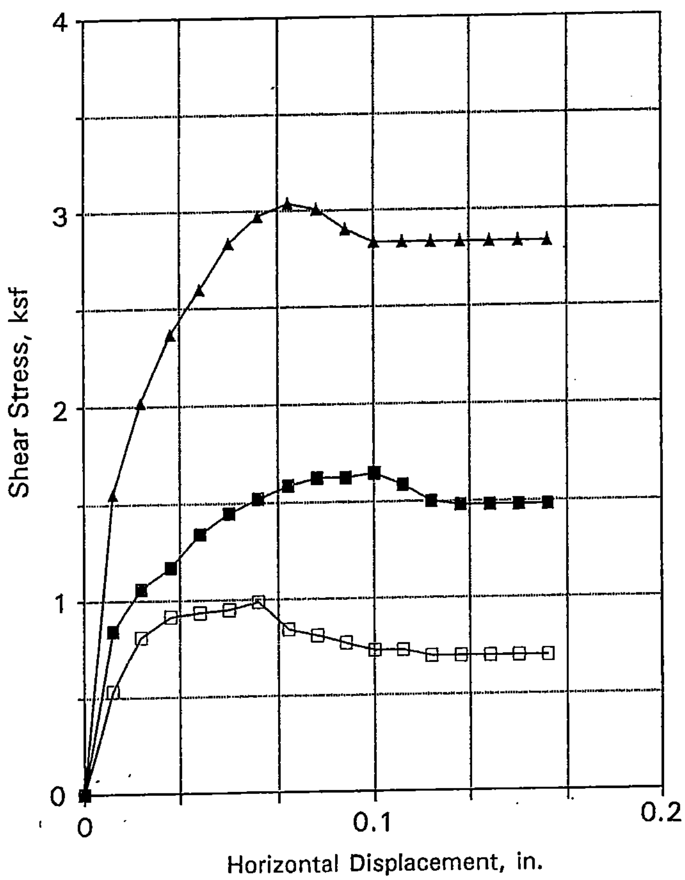
Applied Geotechnical Engineering Consultants, Inc.



Project No. 20591 **CONSOLIDATION TEST RESULTS** Figure 28

Applied Geotechnical Engineering Consultants, Inc.





Test No.(Symbol)	1(□)	2(■)	3(▲)
Sample Type	Undisturbed		
Length, in.	1.0		
Diameter, in.	1.93		
Dry Density, pcf	104	106	104
Moisture Content, %	24	28	26
Consolidation Load,	0.98	1.95	3.91
Normal Load, ksf	0.98	1.95	3.91
Shear Stress, ksf	0.98	1.62	3.04
Remarks	Strain rate, 0.05 in/min		
	Sample wetted before test		

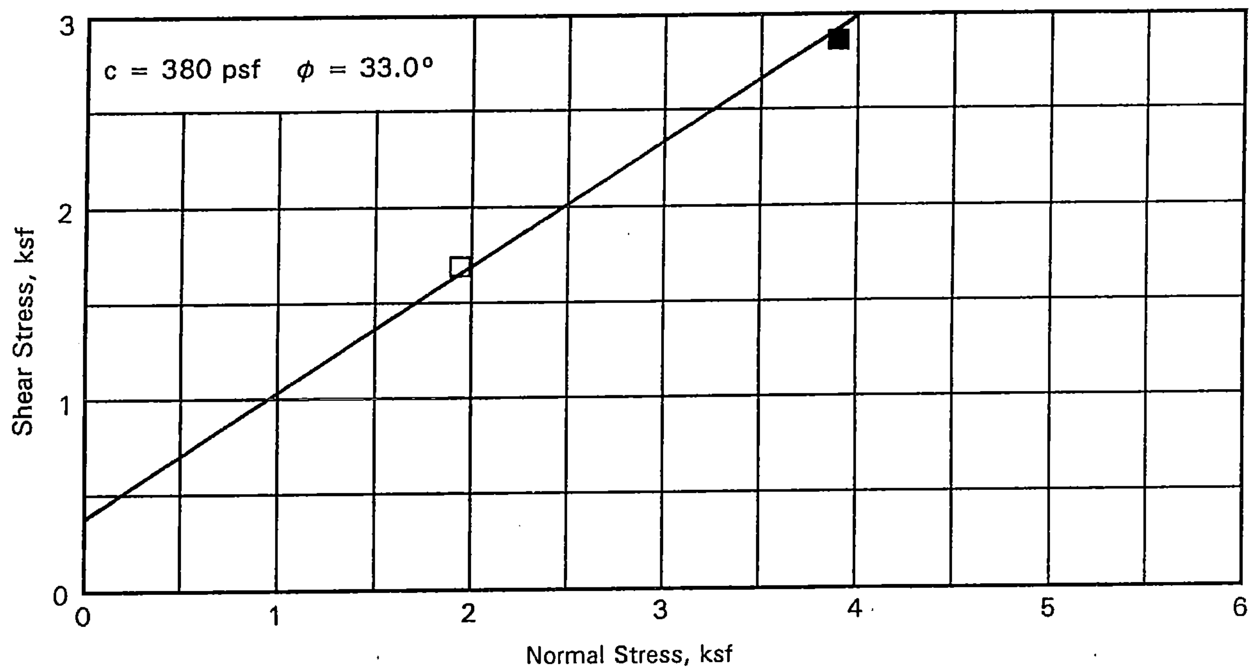
Sample Index Properties	
Natural Dry Density, pcf	
Natural Moisture Content, %	
Liquid Limit, %	
Plasticity Index, %	
Percent Gravel	
Percent Sand	
Percent Passing No. 200 Sieve	62

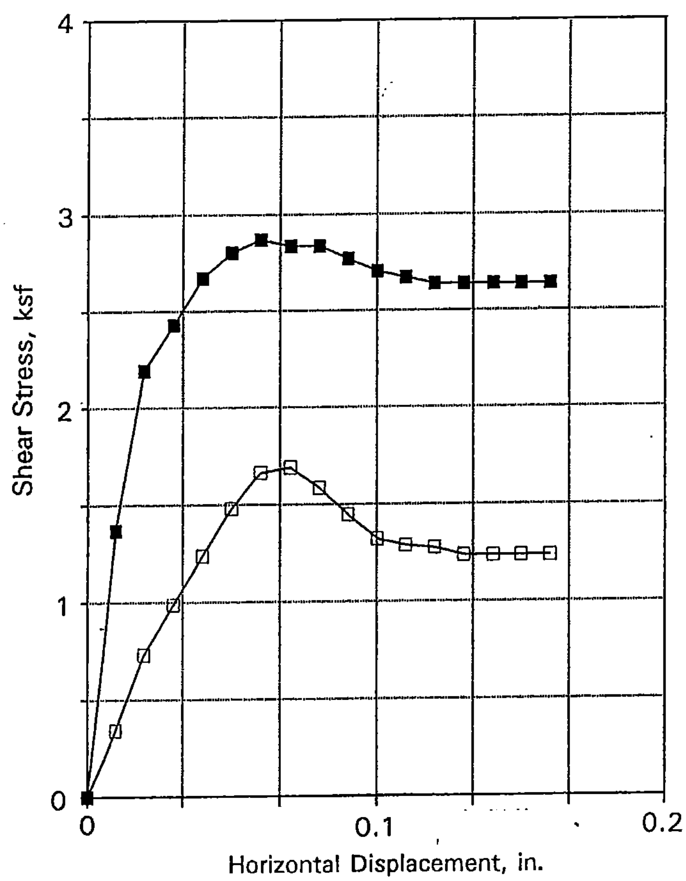
Type of Test Consolidated, Undrained

Sample Description Sandy Silt (ML) From L-1 @ 95 Feet

Project No. 20591 DIRECT SHEAR TEST RESULTS Figure 29

Applied Geotechnical Engineering Consultants, Inc.





Test No.(Symbol)	1(□)	2(■)
Sample Type	Undisturbed	
Length, in.	1.0	
Diameter, in.	1.93	
Dry Density, pcf	100	105
Moisture Content, %	24	24
Consolidation Load, ksf	1.95	3.91
Normal Load, ksf	1.95	3.91
Shear Stress, ksf	1.69	2.87
Remarks	Strain rate, 0.05 in/min	
	Sample wetted before test	

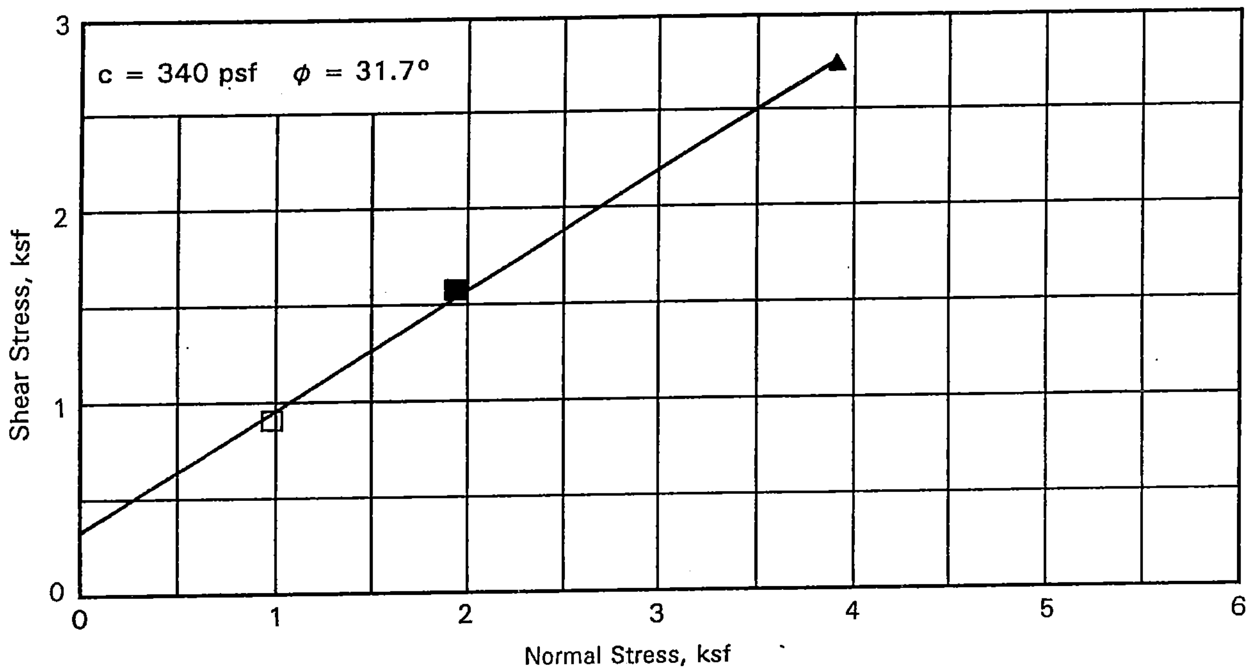
Sample Index Properties	
Natural Dry Density, pcf	
Natural Moisture Content, %	
Liquid Limit, %	
Plasticity Index, %	
Percent Gravel	
Percent Sand	
Percent Passing No. 200 Sieve	28

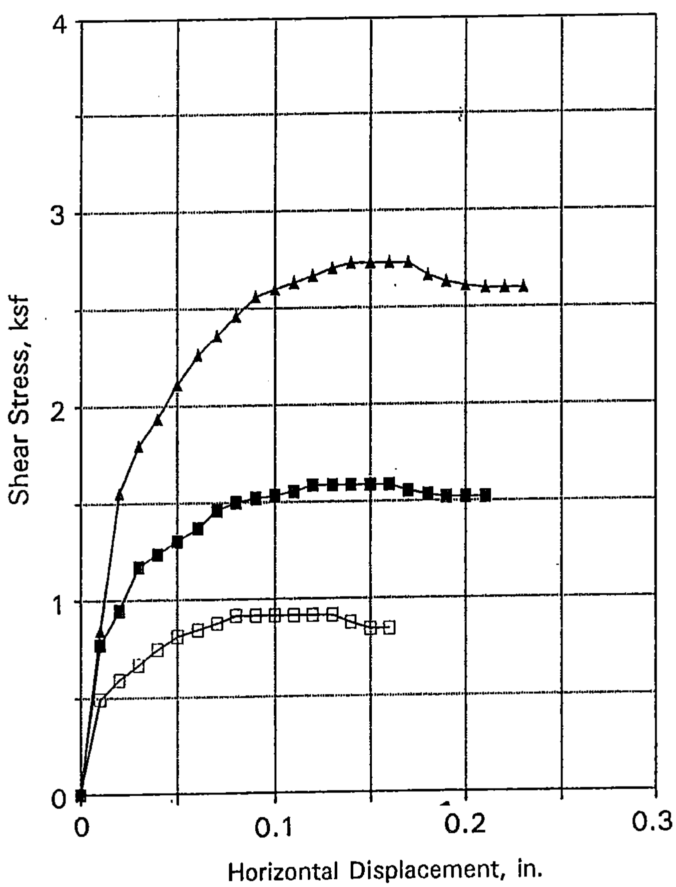
Type of Test Consolidated, Undrained

Sample Description Silty Sand (SM) From L-14 @ 35 Feet

Project No. 20591 DIRECT SHEAR TEST RESULTS Figure 30

Applied Geotechnical Engineering Consultants, Inc.





Test No.(Symbol)	1(□)	2(■)	3(▲)
Sample Type	Undisturbed		
Length, in.	0.75		
Diameter, in.	1.93		
Dry Density, pcf	88	90	98
Moisture Content, %	30	35	29
Consolidation Load,	0.98	1.95	3.91
Normal Load, ksf	0.98	1.95	3.91
Shear Stress, ksf	0.91	1.58	2.73
Remarks	Strain rate, 0.05 in/min		
	Sample wetted before test		

Sample Index Properties	
Natural Dry Density, pcf	
Natural Moisture Content, %	
Liquid Limit, %	
Plasticity Index, %	
Percent Gravel	
Percent Sand	
Percent Passing No. 200 Sieve	20

Type of Test Consolidated, Undrained

Sample Description Silty Sand (SM) From L-27 @ 15 Feet

Project No. 20591 DIRECT SHEAR TEST RESULTS Figure 31

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.
TABLE I - SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 20591

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	SAMPLE CLASSIFICATION
BORING	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)		
L-1	15	18	87			53	21	5		Sandy Silty Clay
	50	20	108			22				Silty Sand
	95		105			62				Sandy Silt
L-2	30½	65	62			100	66	40		Fat Clay
L-3	25	54	69			90			375	Lean Clay
	85½	28	96			87			890	Lean Clay
	90½	38	84			82	43	21		Lean Clay with Sand
	100½	32	93			98	43	22		Lean Clay
L-4	23	48	74			99	46	25		Lean Clay
	50½	23	103			57			1,150	Sandy Lean Clay
L-6	20½	58	65			100	46	19		Lean Clay
	50½	40	80			89				Lean Clay
L-8	60	59	67			100	63	36		Fat Clay
L-10	40½	59	65						820	Lean Clay with Sand
	50½	17	111			11		NP		Poorly-graded Sand with Silt
	60½	28	91			82			900	Lean Clay with Sand
L-12	60	42	78			95			950	Lean Clay

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.
TABLE I - SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 20591

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	SAMPLE CLASSIFICATION
BORING	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)		
L-14	20	20	107			4				Poorly-graded Sand
	35		105			28				Silty Sand
	45	33	87			81	29	11		Lean Clay with Sand
	60	39	81						1,020	Lean Clay
L-15	20	19	112			6				Poorly-graded Sand with Silt
	32	60	65			100	48	24		Lean Clay
L-17	8	59	66							Lean Clay
	25½	67	61			100	65	29		Fat Clay
	35½	26	98			67			2,370	Sandy Lean Clay
	55½	38	83			91			745	Lean Clay
L-19	40	33	89			65			475	Sandy Silt and Lean Clay
	45	31	90			79			420	Sandy Silt and Lean Clay
	50	31	92			100	45	25		Lean Clay
L-21	20	35	81			55			690	Sandy Lean Clay
	30	68	62			100	66	34		Fat Clay
L-23	50	43	75			100			1,255	Lean Clay
L-24	20	49	72			99			775	Lean Clay
	30	52	70			89	49	25		Lean Clay

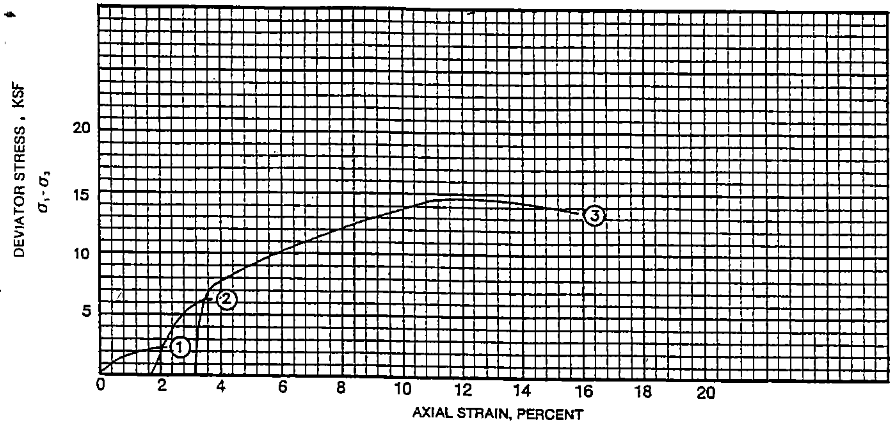
PROJECT NUMBER 20591

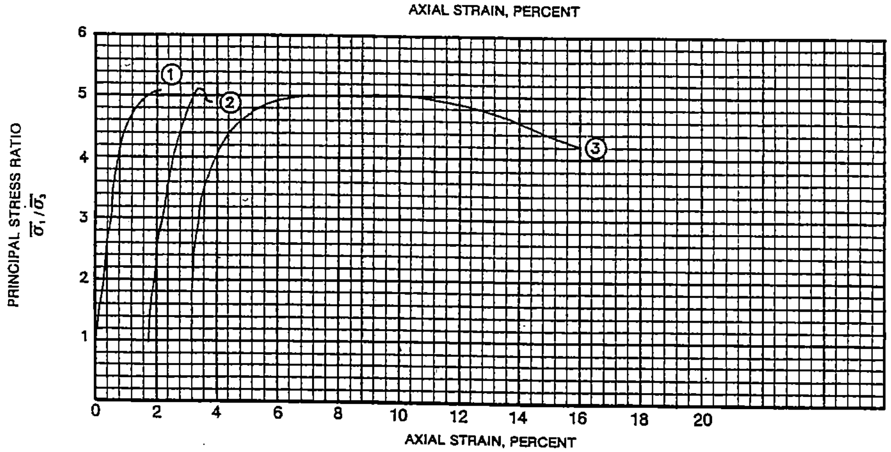
APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.
TABLE I - SUMMARY OF LABORATORY TEST RESULTS

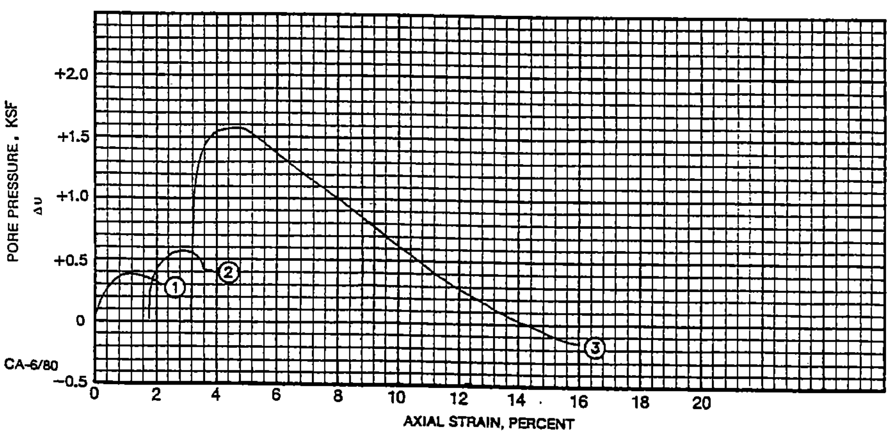
SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	SAMPLE CLASSIFICATION
BORING	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)		
L-24	35	67	60			100	68	42		Fat Clay
	45	27	96			74	37	24		Lean Clay with Sand
L-26	15½	38	78			99			365	Lean Clay
	55½	44	78			99	52	30		Fat Clay
	60½	35	85			84			575	Lean Clay with Sand
L-27	15		92			20				Silty Sand
	20	60	63			100			920	Lean Clay
	30	22	96	21	61	18				Silty Sand
	40	30	92			77			1,385	Lean Clay with Sand
L-28	20	61	64			100	46	20		Lean Clay
	30	23	79			76				Lean Clay with Sand
	40	33	86			81				Lean Clay with Sand
	45	49	73			89	46	24		Lean Clay
L-29	20½	51	72			85			495	Lean Clay with Sand
	35½	32	91			64	30	15		Sandy Lean Clay
L-30	35	30	92			62			630	Sandy Lean Clay
	75	14	116			52				Sandy Silt

SHEAR STRENGTH OF SOIL IN TRIAXIAL COMPRESSION

Job No. 11791 -
Date 3-15-91
Type of Test MULTI-STAGED; SATURATED, CONSOLIDATED, UNDRAINED WITH PORE PRESSURE MEASUREMENTS

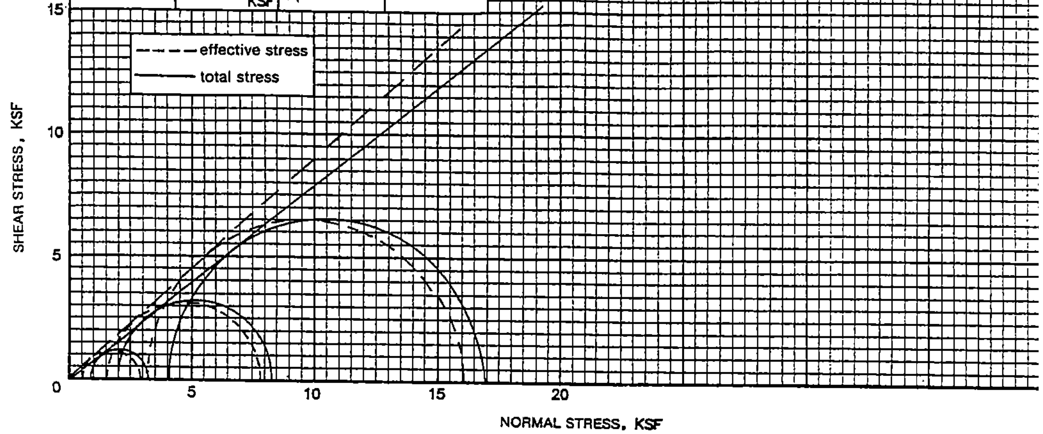






CA-6/80

SHEAR VALUES			
Effective Stresses		Total Stresses	
$\bar{\phi}$ = 42°	$\bar{C}$ = 0.02 KSF	ϕ = 38°	C = ~ 0



Stage Number	Specimen Location: Boring Number	Specimen Location: Depth (Ft)	Initial Specimen Data: Sample Type	Length (in)	Diameter (in)	Dry Density (P.C.F.)	Moisture Content (%)	Soil Description
1	C6-7	0	Cal. liner	3.788	1.928	116.7	13.7	SLIGHTLY SANDY CLAY *
2	C6-7	0	Cal. liner	–	–	–	–	SLIGHTLY SANDY CLAY *
3	C6-7	0	Cal. liner	–	–	–	–	SLIGHTLY SANDY CLAY *

Test Values at Failure–Maximum Principal Stress Ratio

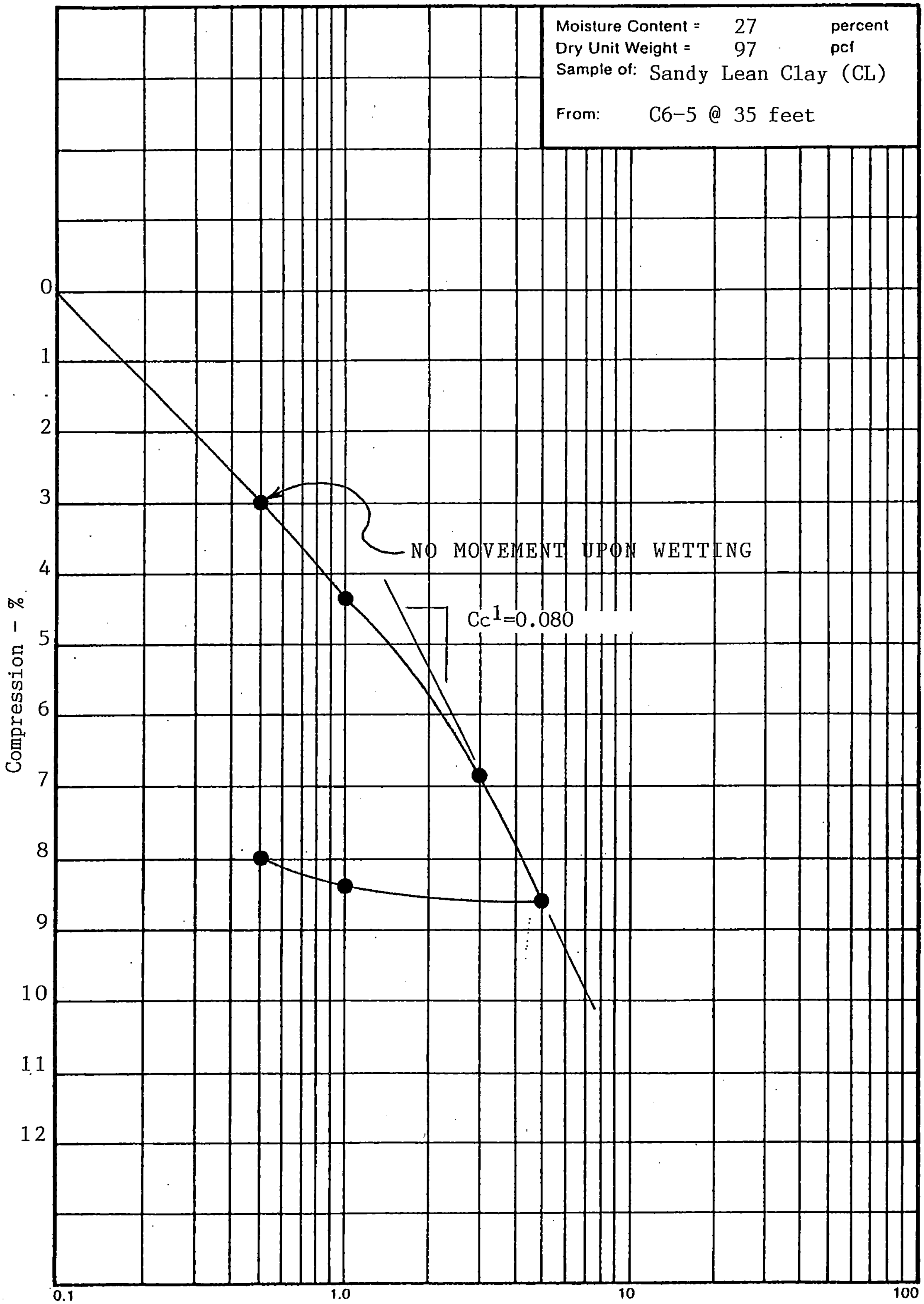
Stage Number	"B" Parameter	Total Confining Stress σ_3	Total Axial Stress σ_1	Deviator Stress $\sigma_1-\sigma_3$	Effective Lateral Stress $\bar{\sigma}_3$	Effective Axial Stress $\bar{\sigma}_1$	Pore Pressure μ	Δ Percent Strain ∈%	Remarks
1	0.96	0.86	3.14	2.28	0.56	2.84	0.30	2.2	UNITS IN KSF
2	–	2.02	8.27	6.25	1.53	7.78	0.49	1.6	UNITS IN KSF
3	–	4.03	16.80	12.77	3.17	15.94	0.86	5.5	UNITS IN KSF

Remarks:

* Percent passing no. 200 sieve = 88%

Fig. A-1

Applied Geotechnical Engineering Consultants

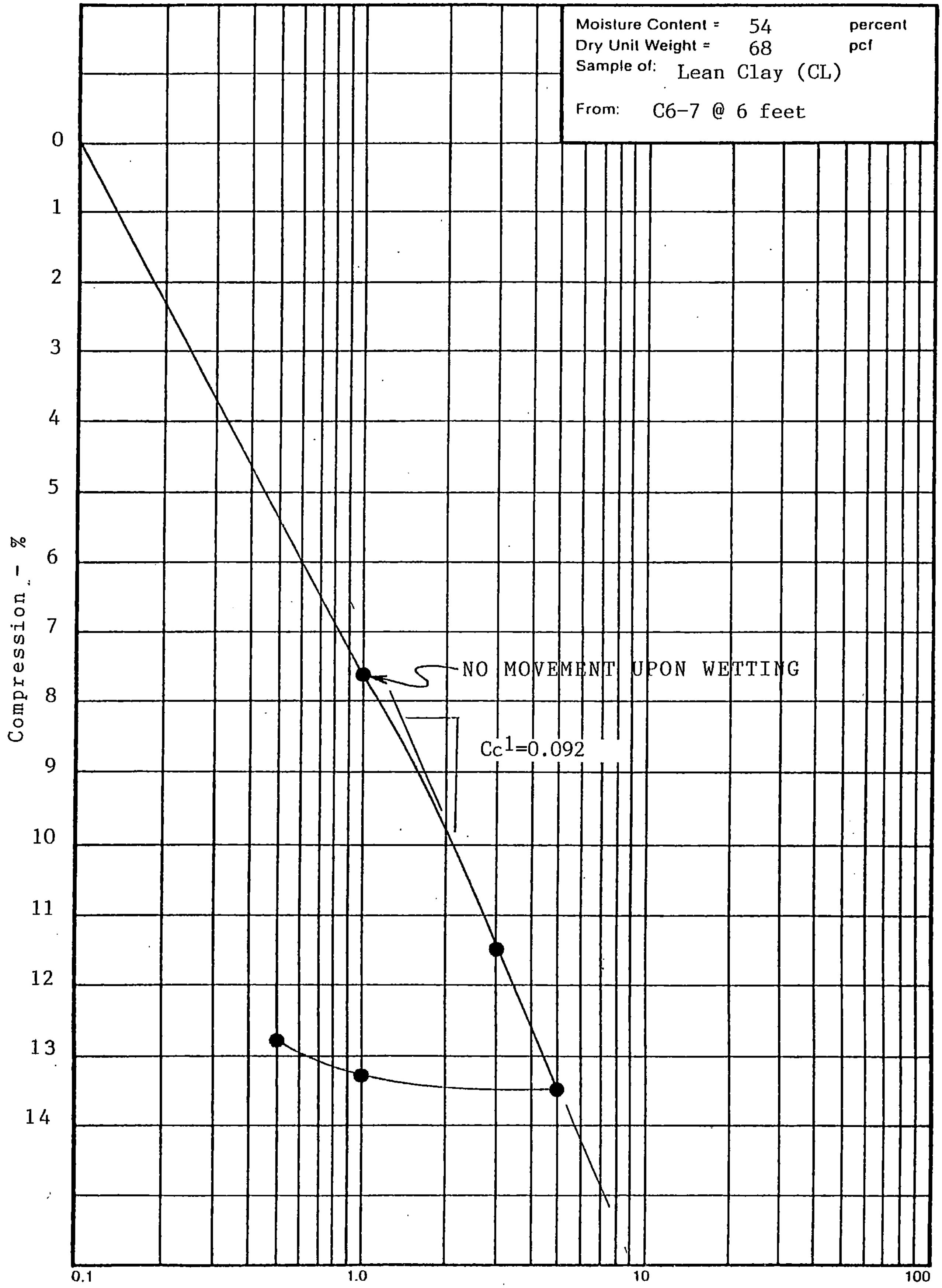


Job No. 11791

SWELL-CONSOLIDATION TEST RESULTS

Fig. A-2

Applied Geotechnical Engineering Consultants

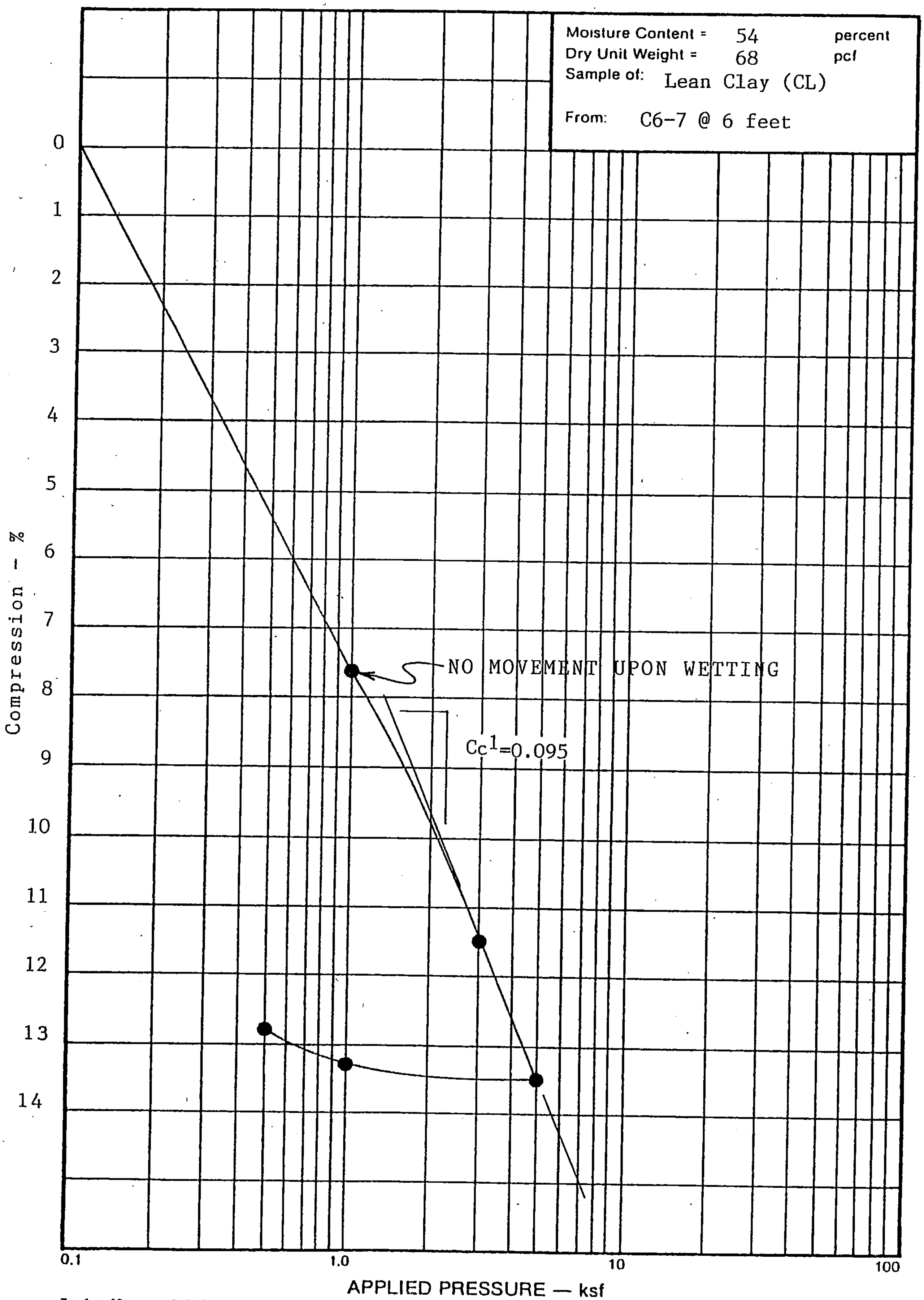


Job No. 11791

SWELL-CONSOLIDATION TEST RESULTS

Fig. A-3

Applied Geotechnical Engineering Consultants



Job No. 11791

SWELL-CONSOLIDATION TEST RESULTS

Fig. A-4

Project Number 11791

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

Boring	Depth (ft)	Water Content (%)	Dry Density (pcf)	Grain Size: Gravel (%)	Grain Size: Sand (%)	Grain Size: Clay/Silt (%)	Atterberg Limits: LL%	Atterberg Limits: PI%	Unconfined Compressive Strength (psf)	Description
C6-5	6	49	73			97			525	Lean Clay
	10	48	74			97			655	Lean Clay
	35	27	97			59	38	21		Sandy Ln Clay
C6-6	0	12	117			91	28	13		Lean Clay
	2	17	104			95				Lean Clay
	8	47	74			98	42	17	730	Lean Clay
	12	49	74			96			775	Lean Clay
	30	60	65			98			690	Lean Clay
C6-7	0	14	117			86				Lean Clay
	4	37	82			83			735	Lean Clay w/ Sand
	6	54	68			96				Lean Clay
	10	52	71			98			635	Lean Clay

APPENDIX B

PROPOSED LANDFILL

CELL PROFILES

AGEC
Applied GeoTech

PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/30/17 BY JRM
SUBJECT Landfill Cell Profiles SHEET 1 OF 11

Configuration

Size: each cell is approx. 800' x 800'

Slopes: interior 3H : 1V
exterior 2½H : 1V

Crest width: approx. 20'

Liner systems (top down)

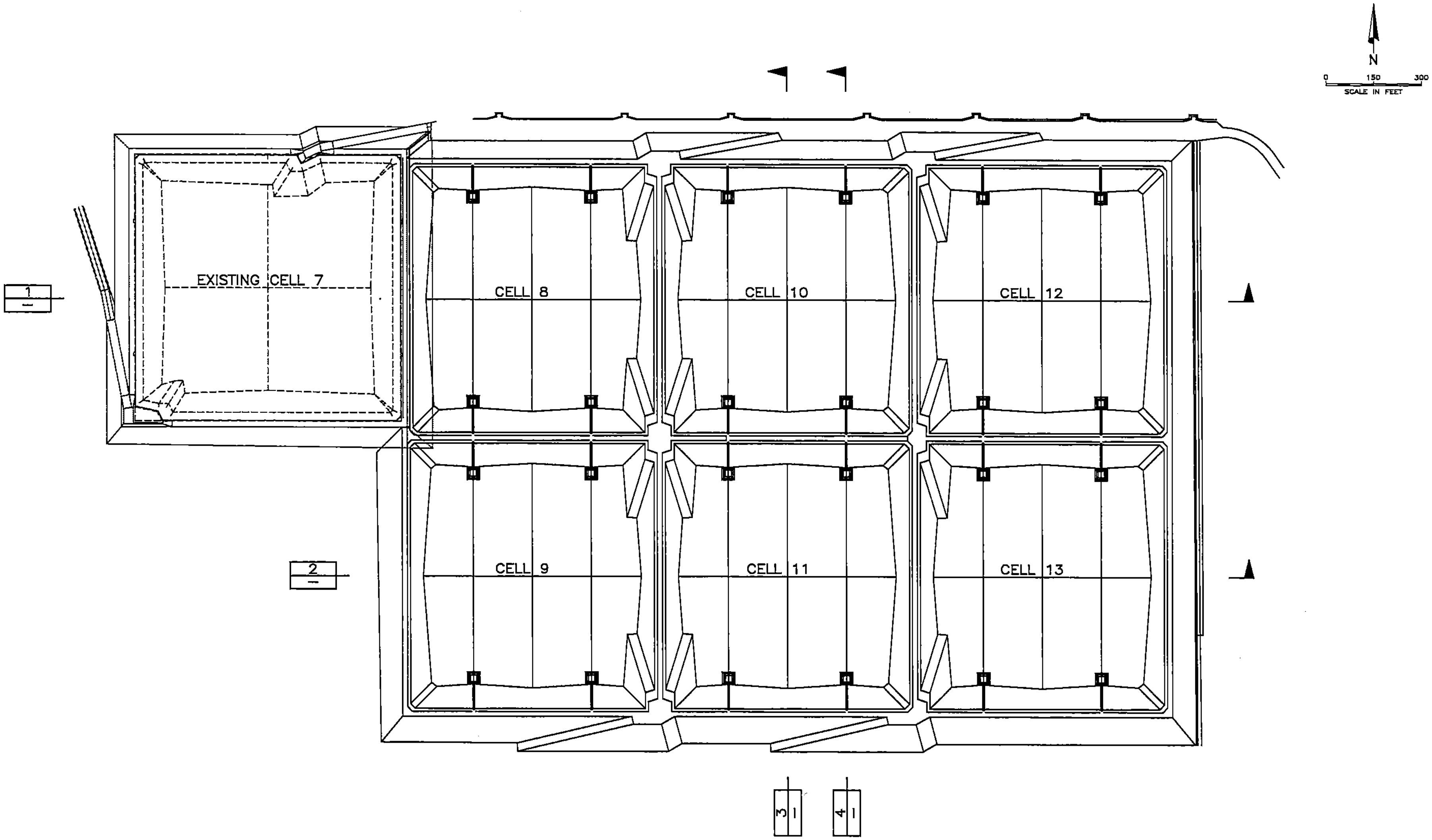
Cell Floor	Cell Floor to 10' up Slope	Upper Slope
2' soil cover	2' soil cover	2' soil cover
double-sided geocomposite	80 mil textured HDPE	80 mil textured HDPE
80 mil textured HDPE	GCL	GCL
GCL	80 mil textured HDPE	double-sided geocomp.
80 mil textured HDPE	double-sided geocomposite	60 mil textured HDPE
double-sided geocomposite	60 mil textured HDPE	3' compacted Clay Liner
60 mil textured HDPE	3' Compacted Clay Liner	
3' Compacted Clay Liner		

Cover Liner (top)
4" Stone mulch
2' Soil cover
double-sided drainage composit
60 mil HDPE textured liner
GCL
6" soil cushion

Cover Liner (perimeter)
(3H:1V. Slope)
4" Stone mulch
2' compacted Clay soil
60 mil HDPE textured liner
compacted clay cap

Elevations:

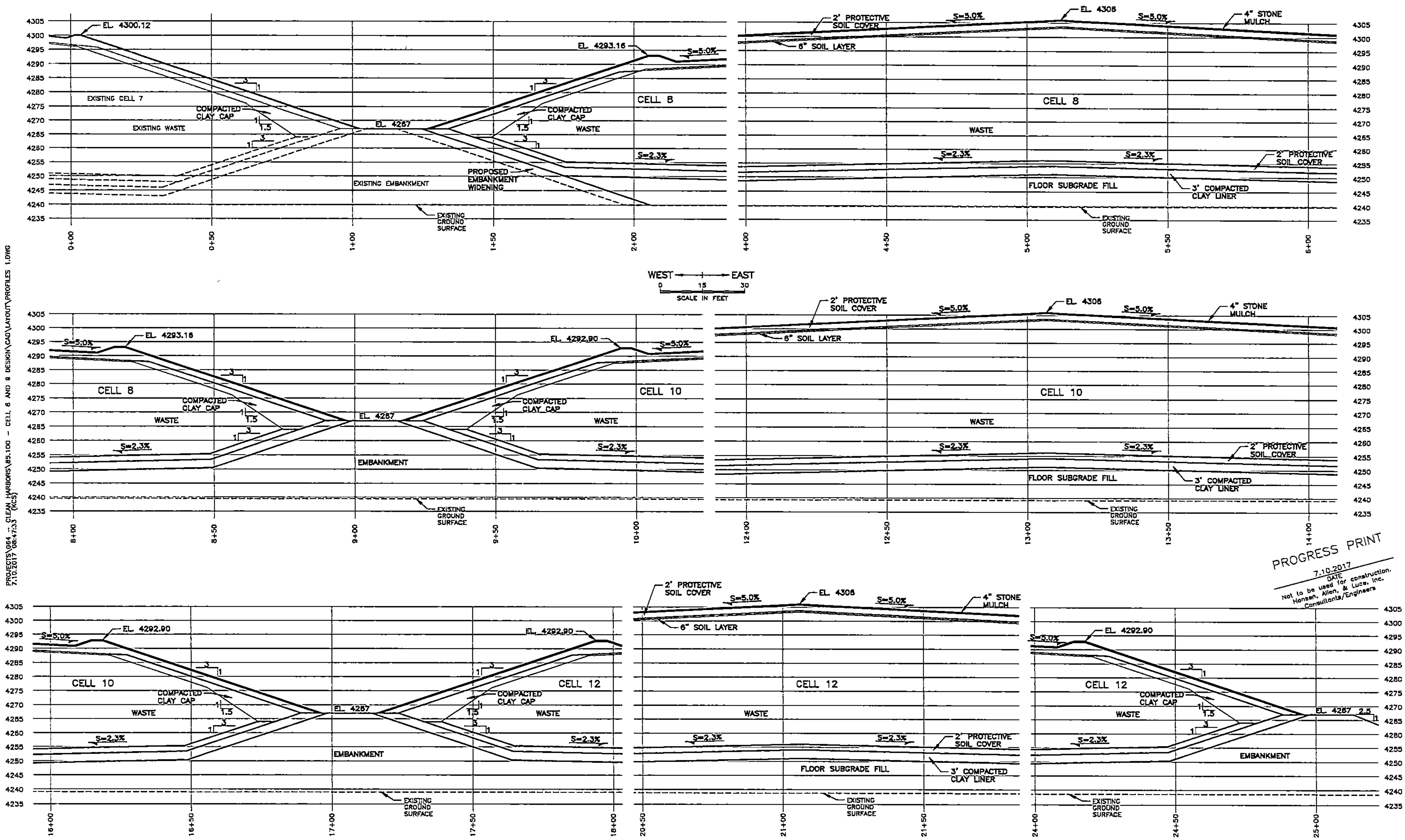
Existing Grade ~ 4239' to 4240'
Top of Embankment 4267'
Sump (top Clay Liner) ~4242'
Closure (peak) 4306'
(top 3:1 slope) ~4293'



PLAN VIEW

PROJECTS\084 – CLEAN HARBORS\85.100 -- CELL 8 AND 9 DESIGN\CAD\LAYOUT\PLAN VIEW.DWG
7.10.2017 08:43:39 (KCS)

PROGRESS PRINT
7.10.2017
DATE
Not to be used for construction.
Hansen, Allen, & Luce, Inc.
Consultants/Engineers



EL. 4300.12
EL. 4293.16
S=5.0%
EXISTING CELL 7
EXISTING WASTE
COMPACTED CLAY CAP
EL. 4267
EXISTING EMBANKMENT
PROPOSED EMBANKMENT WIDENING
EXISTING GROUND SURFACE
CELL 8
WASTE
S=2.3%
2' PROTECTIVE SOIL COVER
6" SOIL LAYER
EL. 4306
4" STONE MULCH
FLOOR SUBGRADE FILL
3' COMPACTED CLAY LINER
WEST
EAST
SCALE IN FEET
EL. 4292.90
CELL 10
EMBANKMENT
CELL 12
PROGRESS PRINT
7.10.2017
DATE
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Hansen, Allen, & Luce, Inc.
Consultants/Engineers
PROJECTS\084 -- CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\LAYOUT\PROFILES 1.DWG
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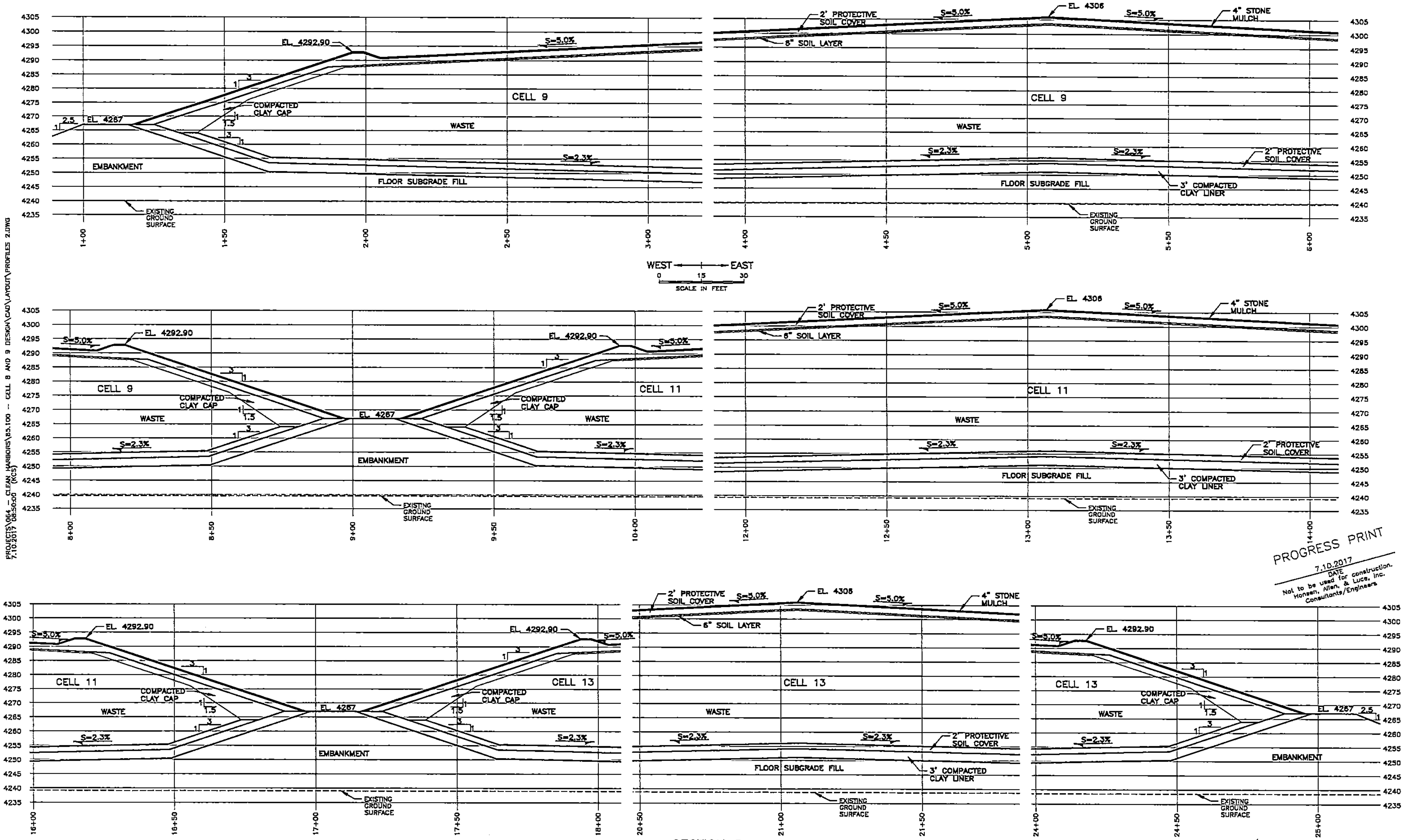
SECTION 1



CELL 9
CELL 11
CELL 13
WASTE
EMBANKMENT
FLOOR SUBGRADE FILL
COMPACTED CLAY CAP
EXISTING GROUND SURFACE
2' PROTECTIVE SOIL COVER
6" SOIL LAYER
4" STONE MULCH
3' COMPACTED CLAY LINER
EL. 4292.90
EL. 4267
EL. 4306
S=5.0%
S=2.3%
WEST EAST
0 15 30
SCALE IN FEET
PROGRESS PRINT
7.10.2017
DATE
Not to be used for construction.
Hansen, Allen, & Luce, Inc.
Consultants/Engineers
PROJECTS\064 -- CLEAN HARBORS\85.100 -- CELL 8 AND 9 DESIGN\CAD\LAYOUT\PROFILES 2.DWG
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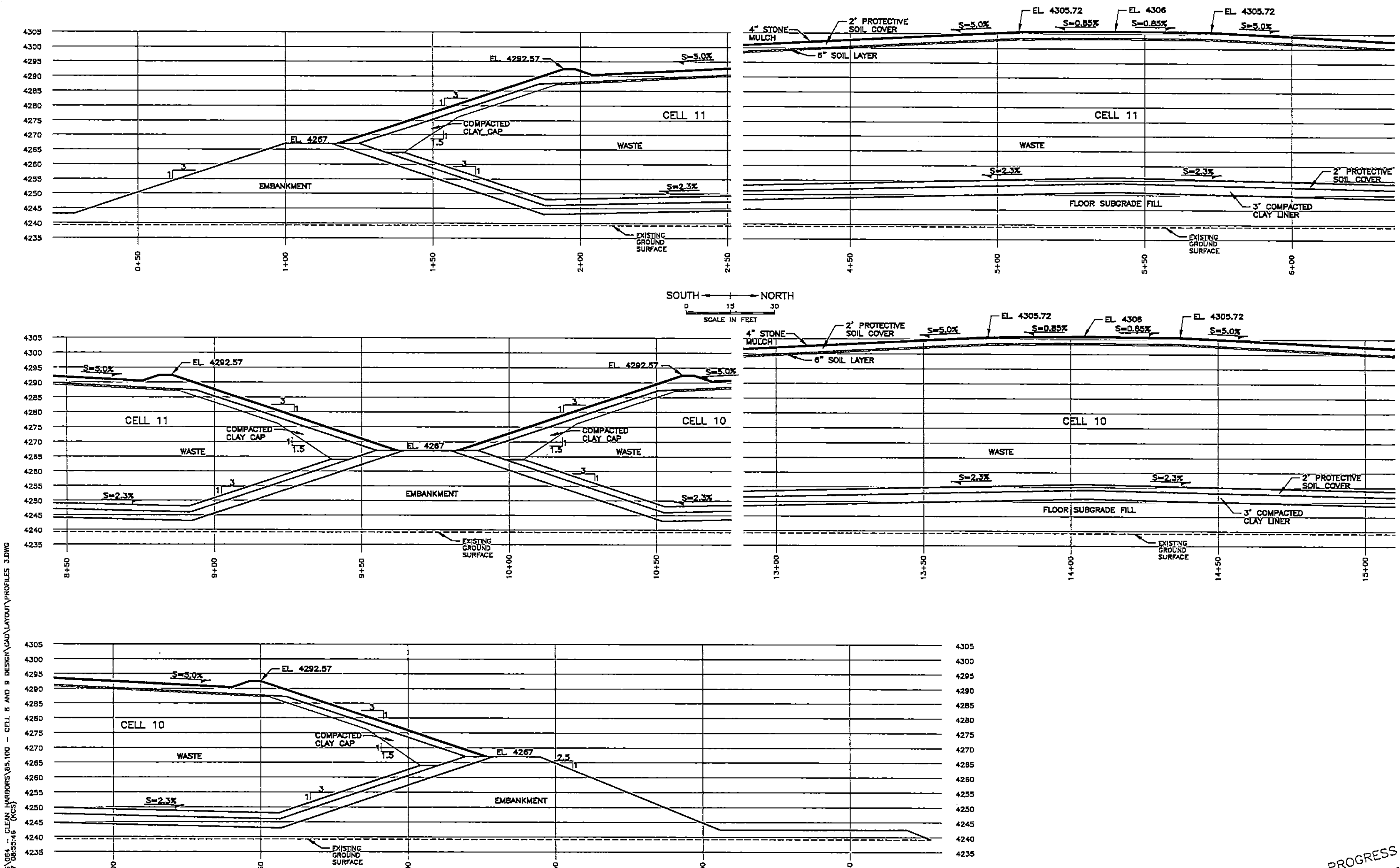
SECTION 2

4/n



SECTION 3

PROGRESS PRINT
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Not to be used for construction.
Hansen, Allen, & Luce, Inc.
Consultants/Engineers

PROJECTS\084 -- CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\LAYOUT\PROFILES 3.DWG
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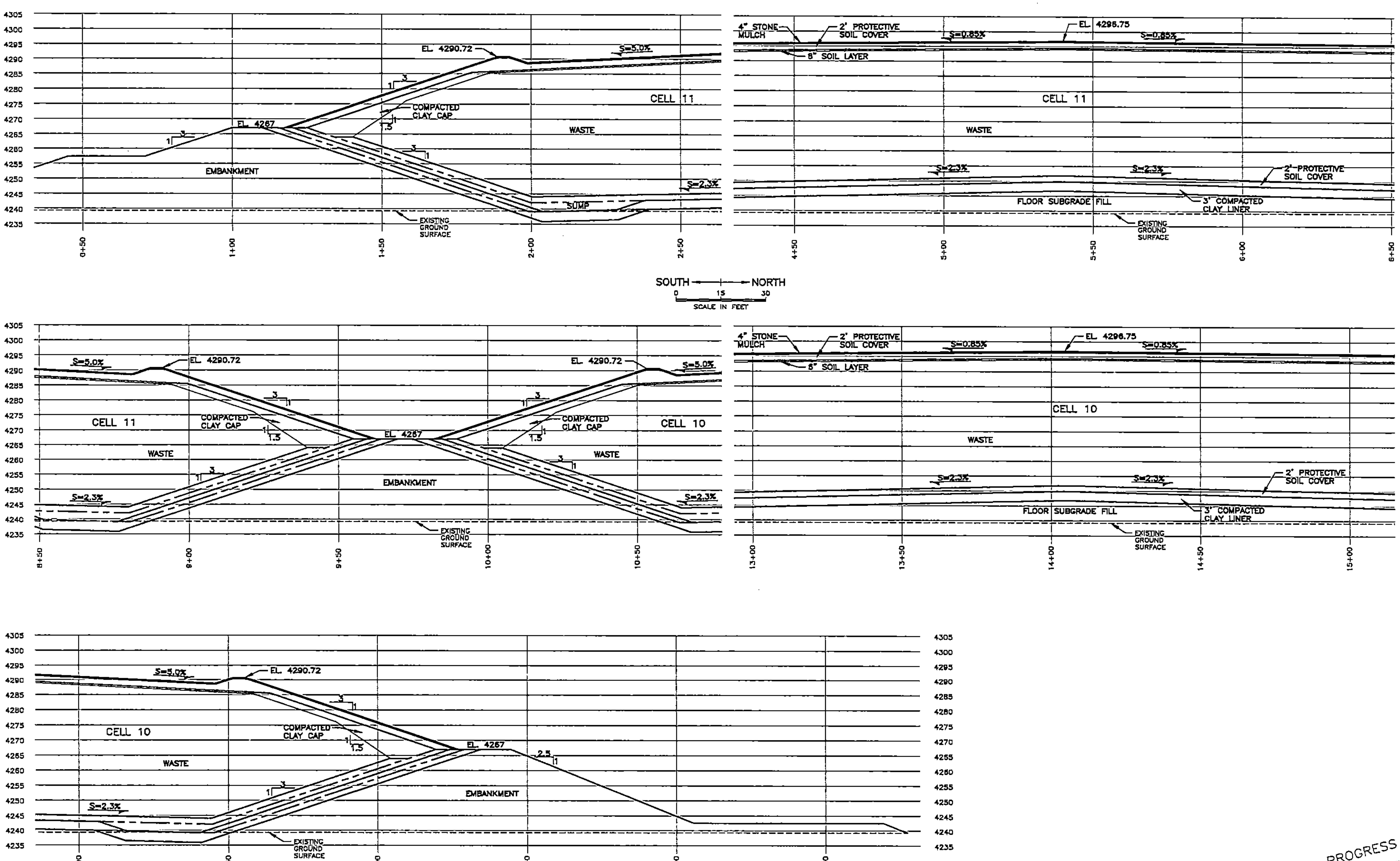
5/11



SECTION 4

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DATE
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Hansen, Allen, & Luce, Inc.
Consultants/Engineers

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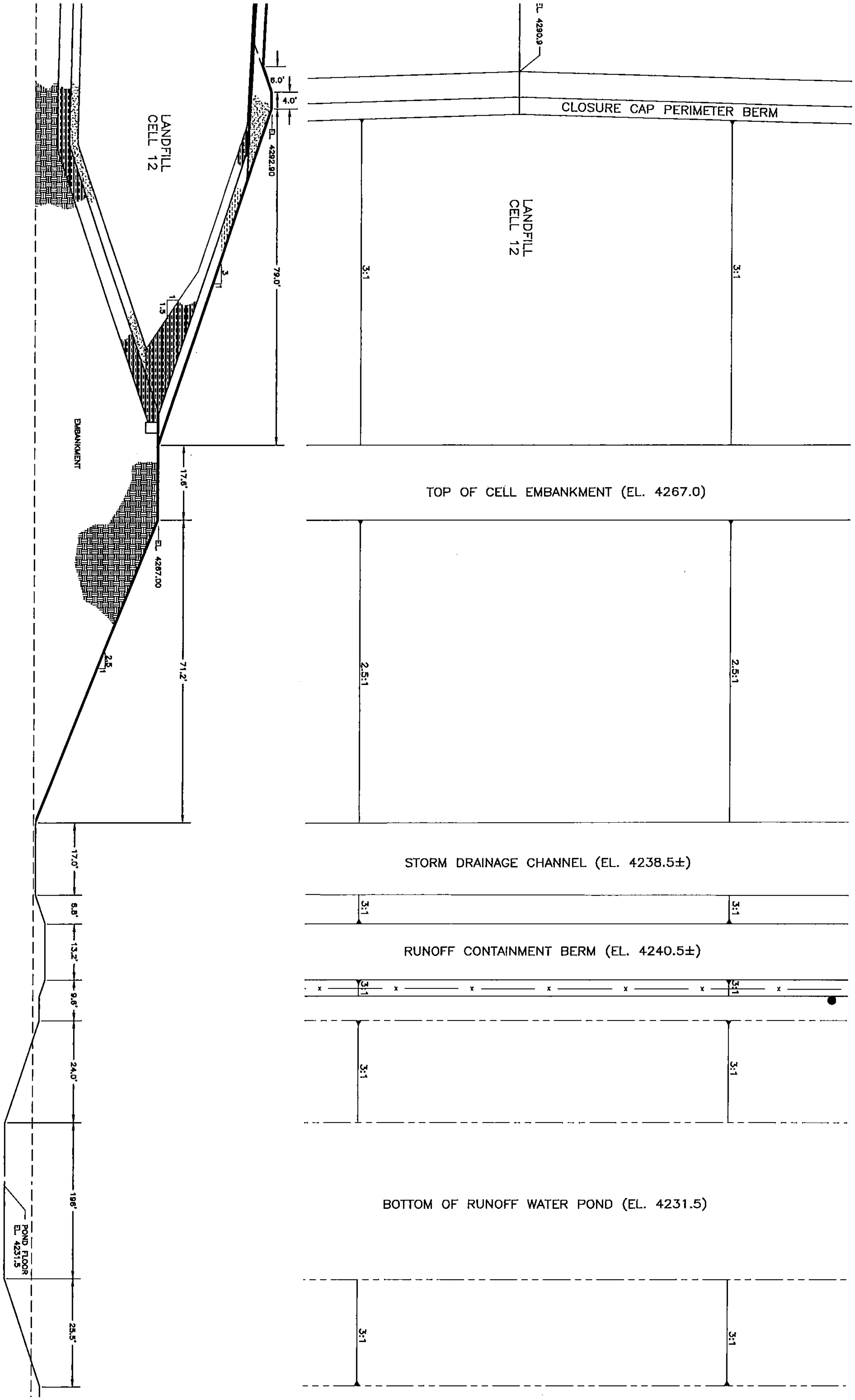
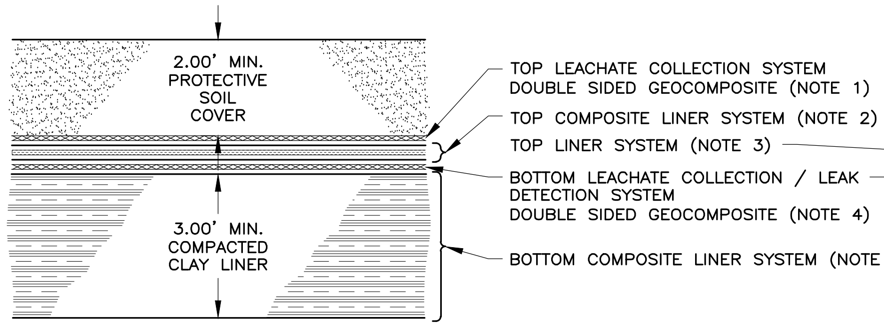
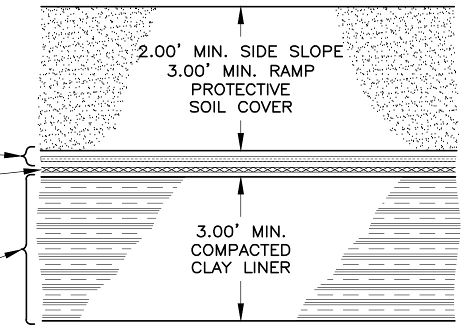


EL 4290.9
CLOSURE CAP PERIMETER BERM
LANDFILL CELL 12
3:1
3:1
TOP OF CELL EMBANKMENT (EL. 4267.0)
2.5:1
2.5:1
STORM DRAINAGE CHANNEL (EL. 4238.5±)
3:1
3:1
RUNOFF CONTAINMENT BERM (EL. 4240.5±)
3:1
3:1
3:1
3:1
BOTTOM OF RUNOFF WATER POND (EL. 4231.5)
3:1
3:1
LANDFILL CELL 12
6.0'
4.0'
EL 4292.90
79.0'
17.6'
EMBANKMENT
EL 4267.00
71.2'
17.0'
8.8'
13.2'
9.6'
24.0'
198'
POND FLOOR EL. 4231.5
25.5'

11/2



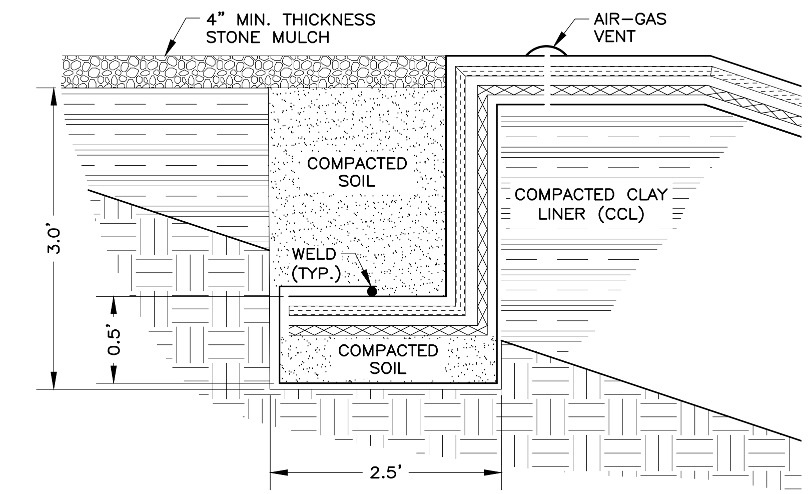
FLOOR LINER SYSTEM DETAIL A/– A/LF-8
N.T.S.



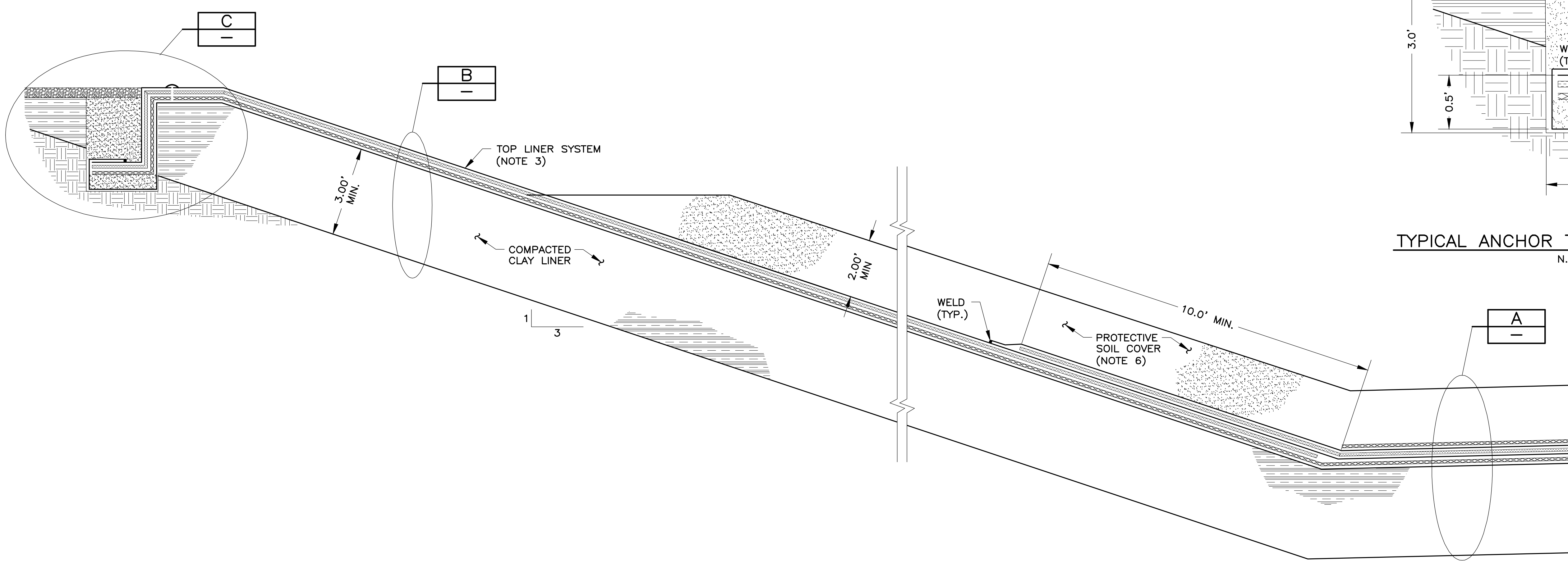
SIDESLOPE LINER SYSTEM DETAIL B/– B/LF-8
N.T.S.

NOTES:

1. TOP LEACHATE COLLECTION SYSTEM CONSISTS OF DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   8 OZ. NON-WOVEN GEOTEXTILE / GEONET / 8 OZ. NON-WOVEN GEOTEXTILE } MIN. GEOCOMPOSITE TRANSMISSIVITY OF 6.0×10^{-4} M^2/SEC, TYP.)
2. TOP COMPOSITE LINER SYSTEM ON THE FLOOR AND TO A DISTANCE OF 10 FEET UP THE INTERIOR SLOPES CONSISTS OF:
   80-MIL HDPE GEOMEMBRANE (TEXTURED)
   GEOSYNTHETIC CLAY LINER (GCL)
   80-MIL HDPE GEOMEMBRANE (TEXTURED)
3. TOP LINER SYSTEM ON THE INTERIOR SIDESLOPES FROM A DISTANCE OF 10 FEET UP THE SLOPES TO THE ANCHOR TRENCH AT THE TOP OF THE SLOPES CONSISTS OF:
   80-MIL HDPE GEOMEMBRANE (TEXTURED)
   GEOSYNTHETIC CLAY LINER (GCL)
4. BOTTOM LEACHATE COLLECTION / LEAK DETECTION SYSTEM CONSISTS OF DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   8 OZ. NON-WOVEN GEOTEXTILE / GEONET / 8 OZ. NON-WOVEN GEOTEXTILE } MIN. GEOCOMPOSITE TRANSMISSIVITY OF 2.7×10^{-4} M^2/SEC, TYP.)
5. BOTTOM COMPOSITE LINER SYSTEM CONSISTS OF:
   60-MIL HDPE GEOMEMBRANE (TEXTURED)
   COMPACTED CLAY LINER (CCL)
6. PROTECTIVE SOIL COVER PLACED ON THE INTERIOR SLOPES SHALL ONLY BE PLACED TO A VERTICAL HEIGHT OF 10-FEET ABOVE THE LEVEL OF THE COVER ON WASTE MATERIALS IN THE LANDFILL CELLS.
7. PROTECTIVE SOIL COVER ON RAMP TO CONSIST OF 18 INCHES OF COMPACTED SOIL (95% ASTM D-698) AND 18 INCHES OF ROAD BASE AGGREGATE AS SHOWN ON SHEET LF-8.
8. PROTECTIVE SOIL COVER ON FLOOR EXTENDING A DISTANCE OF 20 FEET FROM THE BASE OF THE RAMP TO CONSIST OF 12 INCHES OF COMPACTED SOIL (95% ASTM D-698) AND 12 INCHES OF ROAD BASE AGGREGATE AS SHOWN ON SHEET LF-8.



TYPICAL ANCHOR TRENCH DETAIL C/–
N.T.S.



TYPICAL SIDESLOPE LINER SYSTEM DETAILS 1/LF-2
N.T.S.

FILE NAME: PROJECTS\064 - CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\WORKING\LF-7 DETAILS.DWG
FILE DATE: 11.10.2017 11:32:25 (CAH)

10/07

HANSEN ALLEN & LUCE inc ENGINEERS

PROFESSIONAL ENGINEER GORDON L. JONES No. 5048470-2202 11/10/2017 STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE NOVEMBER 2017	NO.	DATE	REVISIONS	BY	APVD.

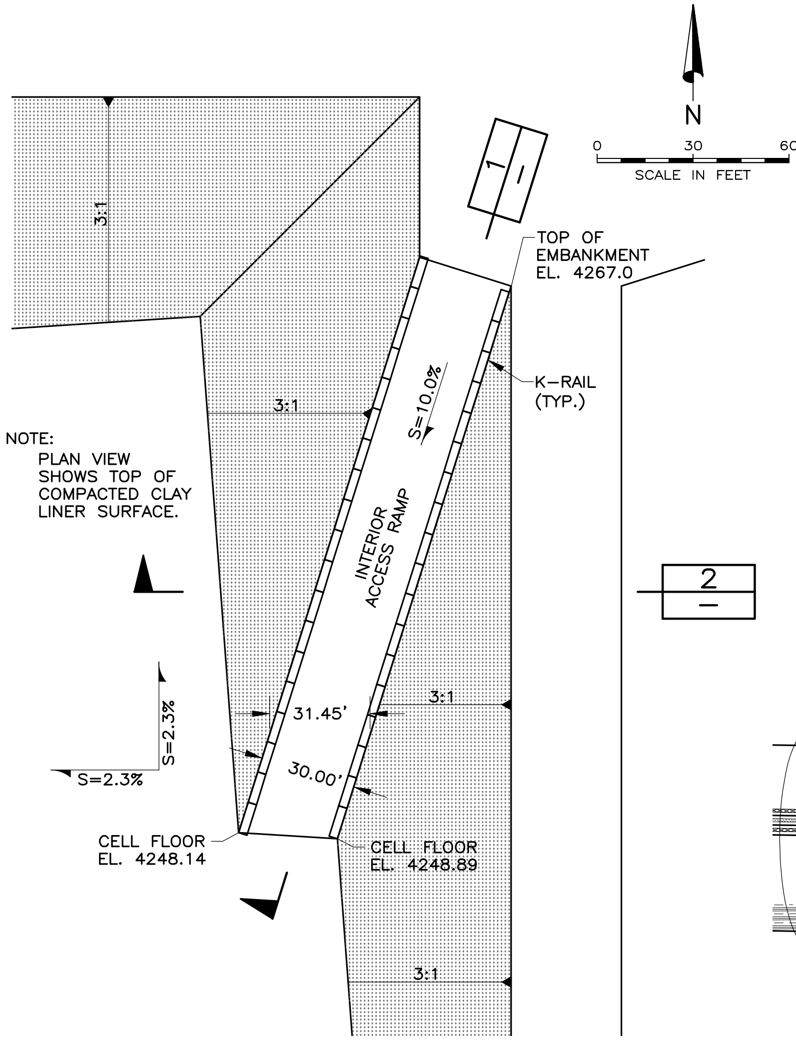
SCALE AS SHOWN

CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13
LANDFILL
DETAILS

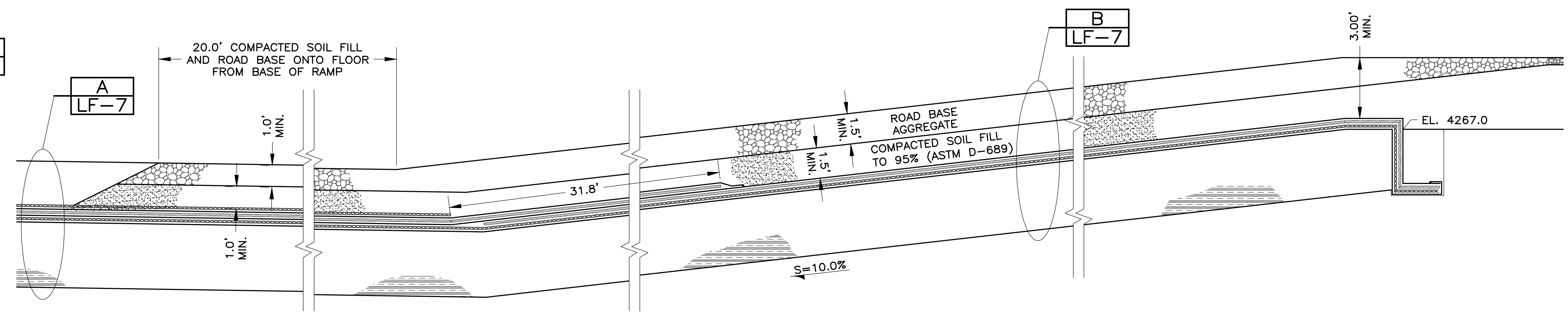
SHEET LF-7

064.85.100



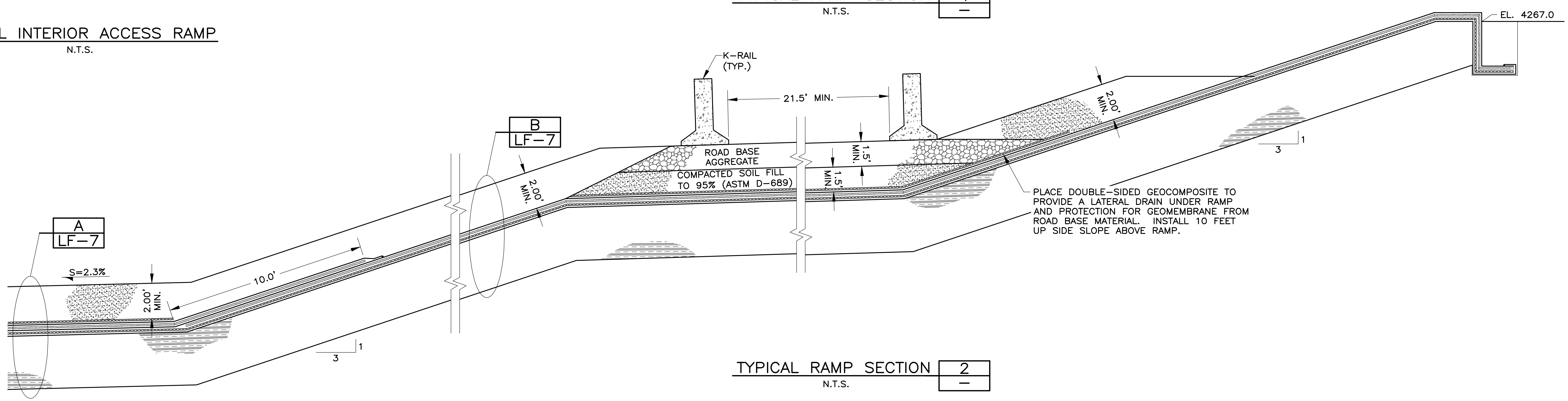
TYPICAL INTERIOR ACCESS RAMP

N.T.S.



TYPICAL RAMP SECTION 1

N.T.S.



TYPICAL RAMP SECTION 2

N.T.S.

FILE NAME: PROJECTS\064 - CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\WORKING\LF-8 RAMP SECTIONS.DWG
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HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER — GORDON L. JONES — No. 5048470-2202 — 11/10/2017 — STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED GLJ	1				
DATE NOVEMBER 2017	NO.	DATE	REVISIONS	BY	APVD.

SCALE: AS SHOWN

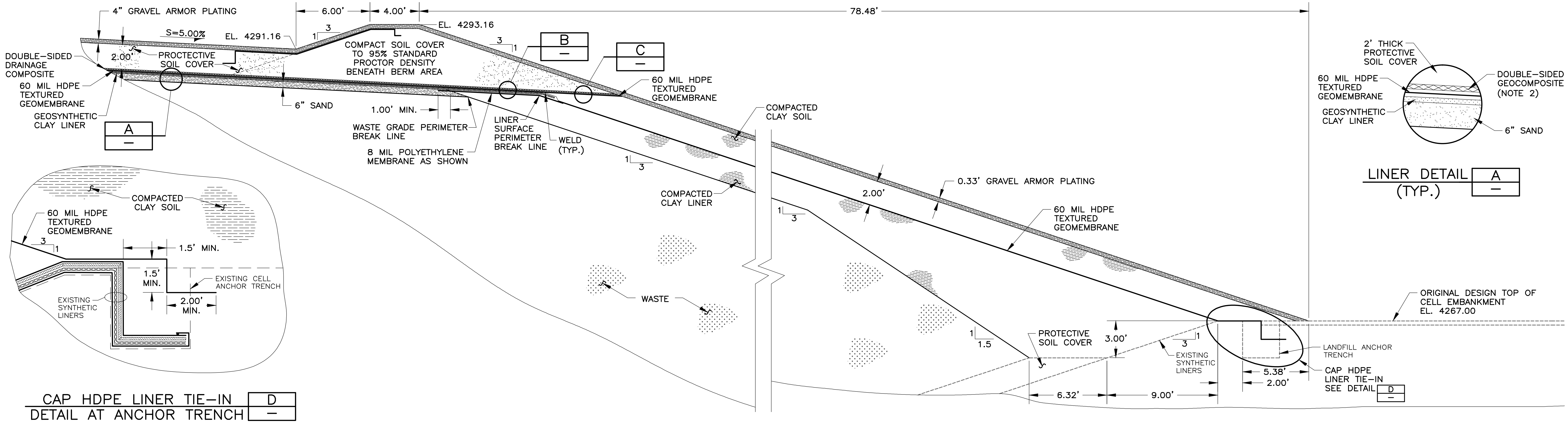
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13
LANDFILL
TYPICAL ACCESS RAMPS

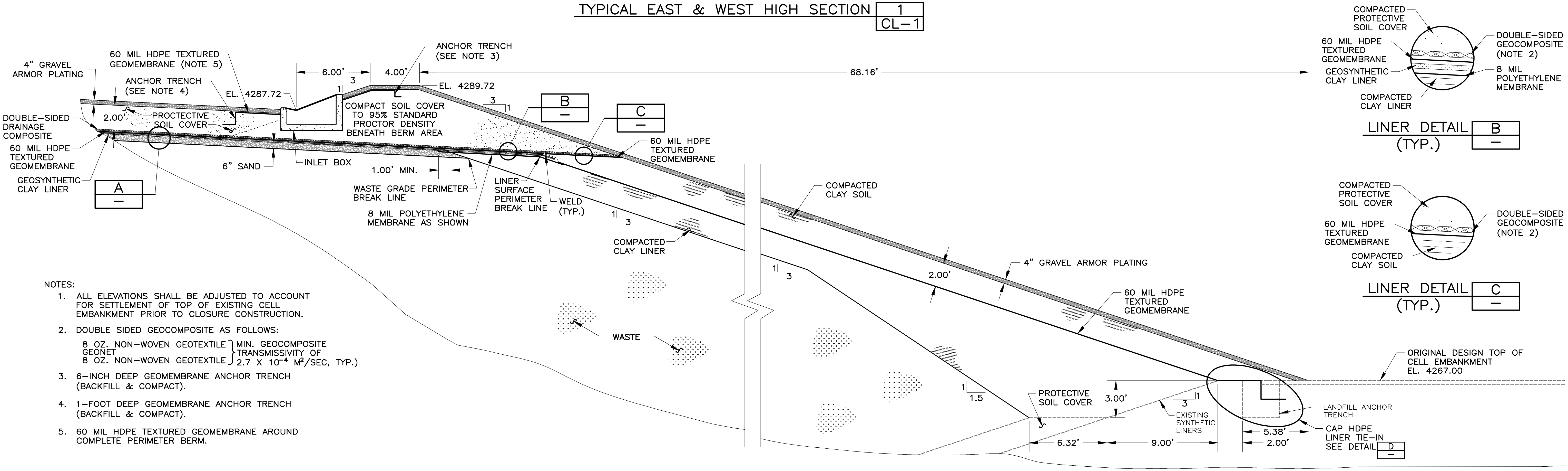
SHEET LF-8

064.85.100

10/07



TYPICAL EAST & WEST HIGH SECTION 1 CL–1



NOTES:

1. ALL ELEVATIONS SHALL BE ADJUSTED TO ACCOUNT FOR SETTLEMENT OF TOP OF EXISTING CELL EMBANKMENT PRIOR TO CLOSURE CONSTRUCTION.
2. DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   - 8 OZ. NON–WOVEN GEOTEXTILE
   - GEONET
   - 8 OZ. NON–WOVEN GEOTEXTILE

   MIN. GEOCOMPOSITE TRANSMISSIVITY OF 2.7×10^{-4} M^2/SEC, TYP.)
3. 6–INCH DEEP GEOMEMBRANE ANCHOR TRENCH (BACKFILL & COMPACT).
4. 1–FOOT DEEP GEOMEMBRANE ANCHOR TRENCH (BACKFILL & COMPACT).
5. 60 MIL HDPE TEXTURED GEOMEMBRANE AROUND COMPLETE PERIMETER BERM.

TYPICAL LOW SECTION 2 CL–1

FILE NAME: PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\WORKING\CL–7 HIGH LOW SECTIONS 8.DWG
FILE DATE: 11.10.2017 11:48:49 (CAH)

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER No. 5048470-2202 GORDON L. JONES 11/10/2017 STATE OF UTAH
PROJECT ENGINEER

DESIGNED	KCS	3			
DRAFTED	CAH	2			
CHECKED	GLJ	1			
DATE	NOVEMBER 2017	NO.	DATE	REVISIONS	BY / APVD.

SCALE: NOT TO SCALE

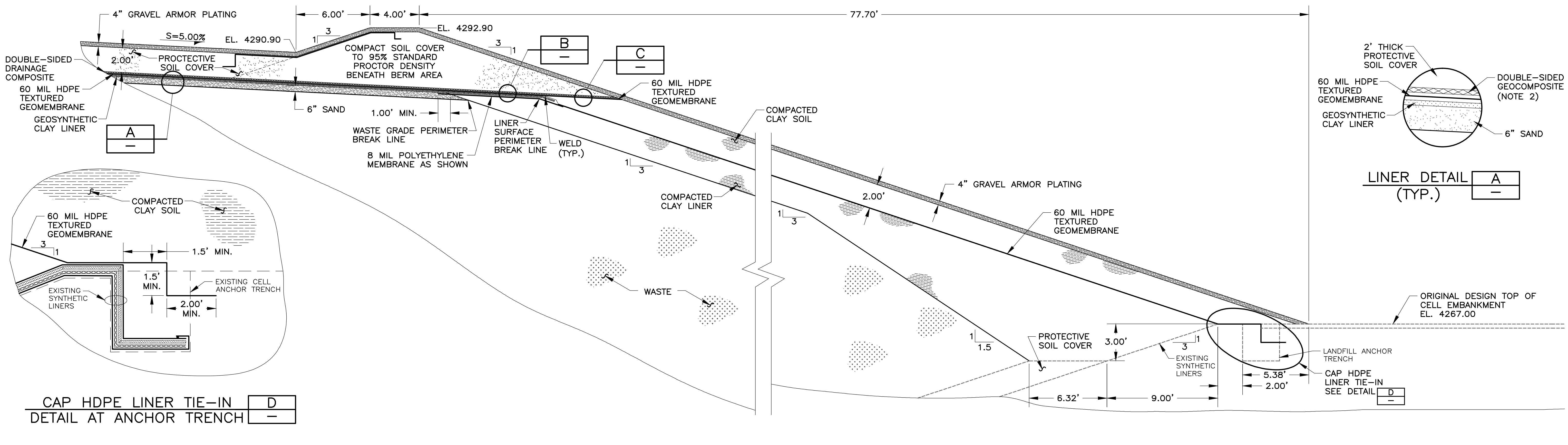
CleanHarbors® ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8–13 CLOSURE
HIGH–LOW SECTIONS CELL 8

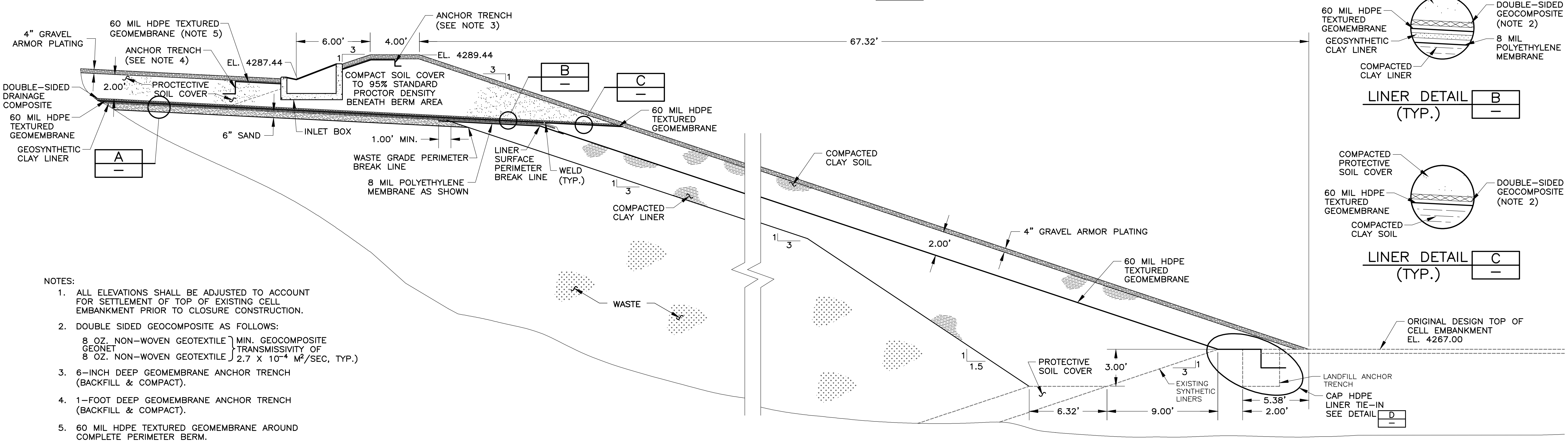
SHEET CL–7

064.85.100

10/07



TYPICAL EAST & WEST HIGH SECTION 1 CL-2



NOTES:

1. ALL ELEVATIONS SHALL BE ADJUSTED TO ACCOUNT FOR SETTLEMENT OF TOP OF EXISTING CELL EMBANKMENT PRIOR TO CLOSURE CONSTRUCTION.
2. DOUBLE SIDED GEOCOMPOSITE AS FOLLOWS:
   - 8 OZ. NON-WOVEN GEOTEXTILE
   - GEONET
   - 8 OZ. NON-WOVEN GEOTEXTILE

   MIN. GEOCOMPOSITE TRANSMISSIVITY OF 2.7×10^{-4} M^2/SEC, TYP.)
3. 6-INCH DEEP GEOMEMBRANE ANCHOR TRENCH (BACKFILL & COMPACT).
4. 1-FOOT DEEP GEOMEMBRANE ANCHOR TRENCH (BACKFILL & COMPACT).
5. 60 MIL HDPE TEXTURED GEOMEMBRANE AROUND COMPLETE PERIMETER BERM.

TYPICAL LOW SECTION 2 CL-2

FILE NAME: PROJECTS\064 - CLEAN HARBORS\85.100 - CELL 8 AND 9 DESIGN\CAD\WORKING\CL-8 HIGH LOW SECTIONS 9-13.DWG
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10/07

HANSEN ALLEN & LUCE INC ENGINEERS

PROFESSIONAL ENGINEER No. 5048470-2202 GORDON L. JONES STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3			
DRAFTED CAH	2			
CHECKED GLJ	1			
DATE NOVEMBER 2017	NO.	DATE	REVISIONS	BY APVD.

SCALE NOT TO SCALE

CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY CELLS 8-13 CLOSURE
HIGH-LOW SECTIONS CELLS 9-13

SHEET CL-8

064.85.100

APPENDIX C

SOIL STRENGTH PARAMETERS

Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
L-1	2	4249.2	0.240	40						5
4251.2	5	4246.2	0.600	18						5
	10	4241.2	1.200	13			4.5	4.5		2
	15	4236.2	1.800				1.3	1.3		2
	20	4231.2	2.350	3	0.19	0.15	0.2	0.2		1
	25	4226.2	2.638		0.23	0.2	0.9	0.9		1
	30	4221.2	2.926	5	0.24	0.21	1.7	1.7		1
	35	4216.2	3.214		0.27	0.24	0.7	0.7		3
	40	4211.2	3.502	4	0.19	0.15	0.4	0.4		3
	45	4206.2	3.790		0.15	0.11	0.8	0.8		3
	50	4201.2	4.078	23						6
	55	4196.2	4.366		0.55	0.69	2	2		1
	60	4191.2	4.654	21	0.27	0.24	0.5	0.5		2
	65	4186.2	4.942		0.23	0.2	0.5	0.5		2
	70	4181.2	5.230	10	0.18	0.15	0.4	0.4		1
	75	4176.2	5.518		0.31	0.3	0.8	0.8		1
	80.5	4170.7	5.835	8	0.27	0.24				1
	85.5	4165.7	6.123		0.36	0.37				3
	90.5	4160.7	6.411	31	0.14	0.11				2
	95.5	4155.7	6.699		0.14	0.11				6
	100.5	4150.7	6.987	152						6
L-2	2	4240.1	0.240	25	0.3	0.28				2
4242.1	5	4237.1	0.600	40	0.34	0.34				1
	10	4232.1	1.200		0.27	0.24	0.8	0.8		1
	20.5	4221.6	1.811	42						6
	30.5	4211.6	2.387				0.5	0.5		2
	40.5	4201.6	2.963	20	0.45	0.52	4.5	4.5		2
	50.5	4191.6	3.539		0.34	0.34	1.9	1.9		1
	60.5	4181.6	4.115	6	0.13	0.1	0.1	0.1		3
L-3	2	4237.1	0.240	66	0.35	0.35	4.5	4.5		1
4239.1	5	4234.1	0.600	7	0.36	0.37	1.7	1.7		1
	10	4229.1	1.019		0.27	0.24	0.7	0.7		1
	15	4224.1	1.307	4						3
	20	4219.1	1.595		0.18	0.15	0.3	0.3		3
	25	4214.1	1.883	2			0.3	0.3	0.188	3
	30	4209.1	2.171		0.33	0.33	1.6	1.6		1
	35	4204.1	2.459	11	0.3	0.28	0.9	0.9		1
	40	4199.1	2.747							4
	45	4194.1	3.035	12						2
	50	4189.1	3.323		0.47	0.55	1.7	1.7		1
	55	4184.1	3.611	11	0.43	0.48	2.2	2.2		3
	60	4179.1	3.899		0.46	0.53	1	1		1

Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
	65	4174.1	4.187	11	0.42	0.46	1	1		3
	70	4169.1	4.475							3
	75	4164.1	4.763	38						3
	80.5	4158.6	5.080		0.41	0.44	2	2		3
	85.5	4153.6	5.368	12			1	1	0.445	1
	90.5	4148.6	5.656				1	1		1
	95.5	4143.6	5.944	9	0.2	0.16	1.7	1.7		2
	100.5	4138.6	6.232		0.45	0.52	2.3	2.3		1
L-4	2	4244.4	0.240	10	0.6	0.78				2
4246.4	5	4241.4	0.600	11						2
	10	4236.4	1.200	8						2
	15.5	4230.9	1.791							2
	20.5	4225.9	2.079	2	0.19	0.15	0.5	0.5		1
	23	4223.4	2.223		0.21	0.17	0.8	0.8		1
	30.5	4215.9	2.655	5	0.08	0.05	0.1	0.1		2
	40.5	4205.9	3.231				0.1	0.1		6
	50.5	4195.9	3.807	13			0.7	0.7	0.575	1
	60.5	4185.9	4.383		0.13	0.1				2
L-6	2	4234.2	0.240	9	0.2	0.16	1	1		1
4236.2	5	4231.2	0.550		0.1	0.07	0.3	0.3		1
	10	4226.2	0.838	2	0.13	0.1	0.2	0.2		3
	20.5	4215.7	1.443		0.22	0.18	0.5	0.5		3
	30.5	4205.7	2.019	12						2
	40.5	4195.7	2.595		0.19	0.15	0.3	0.3		1
	50.5	4185.7	3.171	7			1	1		1
	60.5	4175.7	3.747		0.26	0.23	0.7	0.7		3
L-8	2	4237.9	0.240	58						1
4239.9	5	4234.9	0.600	11	0.16	0.12				1
	10	4229.9	1.069		0.23	0.2				1
	15	4224.9	1.357	3	0.26	0.23				1
	25	4214.9	1.933		0.14	0.1				3
	35	4204.9	2.509	16			4.5	4.5		3
	45	4194.9	3.085							5
	55	4184.9	3.661	5	0.21	0.17	1.2	1.2		1
	60	4179.9	3.949		0.31	0.3	1.1	1.1		1
L-10	2	4248.3	0.240	12			4.5	4.5		5
4250.3	5	4245.3	0.600	12						1
	10	4240.3	1.200	12	0.24	0.21				1
	15.5	4234.8	1.860	8	0.2	0.16				1
	20.5	4229.8	2.323		0.16	0.12	0.1	0.1		1

Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
	25.5	4224.8	2.611		0.16	0.12	0.4	0.4		1
	30.5	4219.8	2.899	2	0.24	0.21				3
	35.5	4214.8	3.187		0.22	0.18	0.3	0.3		3
	40.5	4209.8	3.475	5			0.5	0.5	0.410	3
	45.5	4204.8	3.763				0.2	0.2		3
	50.5	4199.8	4.051	90						6
	55.5	4194.8	4.339		0.33	0.33	1	1		1
	60.5	4189.8	4.627	2			0.6	0.6	0.450	1
L-12	2	4239.8	0.240	52	0.5	0.6	4.5	4.5		1
4241.8	5	4236.8	0.600	23			2.2	2.2		1
	10	4231.8	1.188		0.35	0.35	1.8	1.8		1
	20.5	4221.3	1.792	3	0.1	0.07	0.1	0.1		3
	30.5	4211.3	2.368		0.11	0.08	0.1	0.1		2
	40.5	4201.3	2.944	9	0.25	0.22	1.8	1.8		2
	50.5	4191.3	3.520							2
	60.5	4181.3	4.096	3			0.3	0.3	0.475	1
L-14	2	4238.6	0.240	50	0.55	0.69				1
4240.6	5	4235.6	0.600	19	0.38	0.4				1
	10	4230.6	1.113		0.22	0.18	1	1		1
	15	4225.6	1.401	2	0.28	0.26	0.8	0.8		1
	20	4220.6	1.689	34						6
	25	4215.6	1.977		0.076	0.05	0.1	0.1		3
	30	4210.6	2.265	4	0.14	0.11	0.5	0.5		3
	35	4205.6	2.553		0.036	0.02	0.1	0.1		3
	40	4200.6	2.841	6	0.11	0.08	1.7	1.7		3
	45	4195.6	3.129				0.8	0.8		4
	50	4190.6	3.417	8	0.52	0.63	0.9	0.9		1
	55	4185.6	3.705				0.9	0.9		1
	60	4180.6	3.993	7			0.8	0.8	0.510	1
	65	4175.6	4.281		0.45	0.52	1.3	1.3		1
	70	4170.6	4.569	8	0.32	0.31	1	1		3
	75	4165.6	4.857				1	1		6
	80.5	4160.1	5.173	45						6
	85.5	4155.1	5.461	10	0.43	0.48	1.5	1.5		1
	90.5	4150.1	5.749		0.45	0.52	1.5	1.5		3
	95.5	4145.1	6.037	15	0.56	0.7	1.8	1.8		1
	100.5	4140.1	6.325		0.14	0.11	2	2		1
L-15	2	4237.8	0.240	48	0.74	1.03	4.5	4.5		1
4239.8	5	4234.8	0.600	12	0.36	0.37	4.5	4.5		1
	10	4229.8	1.063		0.23	0.2	0.8	0.8		1
	20	4219.8	1.639	85						6

Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
	30	4209.8	2.215							1
	32	4207.8	2.330	6	0.24	0.21	0.6	0.6		3
	40	4199.8	2.791		0.28	0.26	1.1	1.1		2
	50	4189.8	3.367	9	0.44	0.5	1.2	1.2		1
	60	4179.8	3.943		0.26	0.23	0.6	0.6		3
L-17	2	4238.1	0.240	44	0.42	0.46	4.5	4.5		1
4240.1	5	4235.1	0.600	13	0.27	0.24	4.5	4.5		1
	8	4232.1	0.960		0.35	0.35	1.1	1.1		1
	15.5	4224.6	1.398	12	0.15	0.11	0.8	0.8		2
	25.5	4214.6	1.974		0.22	0.18	0.5	0.5		1
	35.5	4204.6	2.550	14			2.8	2.8	1.185	2
	45.5	4194.6	3.126		0.4	0.43	1.2	1.2		2
	55.5	4184.6	3.702	7			0.4	0.4	0.373	3
	60.5	4179.6	3.990		0.2	0.16	0.3	0.3		3
L-19	4	4236.4	0.480	55	0.56	0.7	4.5	4.5		1
4240.4	7	4233.4	0.840	3	0.32	0.31	0.8	0.8		1
	10	4230.4	1.100		0.17	0.13	0.5	0.5		1
	20	4220.4	1.676	101						6
	30	4210.4	2.252		0.07	0.04	0.1	0.1		3
	40	4200.4	2.828	4			0.1	0.1	0.238	2
	45	4195.4	3.116	3			0.5	0.5	0.210	2
	50	4190.4	3.404		0.3	0.28				1
	60	4180.4	3.980		0.41	0.44	1.2	1.2		1
L-21	2	4243.1	0.240	7			4	4		2
4245.1	5	4240.1	0.600	6			2.2	2.2		3
	10	4235.1	1.200	6	0.16	0.12	1.9	1.9		2
	12	4233.1	1.440		0.1	0.07				1
	14	4231.1	1.624							1
	20	4225.1	1.969	1			0.3	0.3	0.345	1
	30	4215.1	2.545		0.11	0.08	0.1	0.1		1
	40	4205.1	3.121	9	0.21	0.17	0.5	0.5		3
	50	4195.1	3.697							2
	60	4185.1	4.273	18						2
L-23	2	4234.8	0.240	9	0.38	0.4	1.7	1.7		1
4236.8	5	4231.8	0.588		0.42	0.47	1.3	1.3		1
	10	4226.8	0.876	1	0.28	0.26	0.6	0.6		1
	20	4216.8	1.452		0.03	0.02	0.1	0.1		3
	30	4206.8	2.028	10						3
	40	4196.8	2.604							4
	50	4186.8	3.180	7			0.6	0.6	0.628	1

Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
	60	4176.8	3.756		0.27	0.25	0.6	0.6		3
L-24	2	4242.2	0.240	20	0.41	0.44	4.5	4.5		1
4244.2	5	4239.2	0.600	12	0.37	0.38	4.5	4.5		1
	10	4234.2	1.200	8			4.5	4.5		1
	15	4229.2	1.625		0.28	0.26	0.6	0.6		1
	20	4224.2	1.913	1			0.6	0.6	0.388	1
	25	4219.2	2.201		0.15	0.11	0.1	0.1		1
	30	4214.2	2.489	2	0.2	0.16	0.4	0.4		1
	35	4209.2	2.777				0.6	0.6		1
	40	4204.2	3.065	11						3
	45	4199.2	3.353				0.8	0.8		3
	50	4194.2	3.641	8	0.5	0.6	0.7	0.7		2
	55	4189.2	3.929		0.52	0.63	1.5	1.5		3
	60	4184.2	4.217	12	0.39	0.42	0.3	0.3		2
	65	4179.2	4.505		0.36	0.37	0.8	0.8		1
	70	4174.2	4.793	10	0.4	0.43	0.5	0.5		1
	75	4169.2	5.081							6
	80.5	4163.7	5.398	12						3
	85.5	4158.7	5.686		0.24	0.21	4.5	4.5		3
	90.5	4153.7	5.974	44						3
	95.5	4148.7	6.262	14	0.47	0.55	1	1		1
	100.5	4143.7	6.550	43	0.68	0.92	4.5	4.5		2
L-26	2	4237.8	0.240	33	0.55	0.69	4.5	4.5		1
4239.8	5	4234.8	0.600	8	0.26	0.23	2.5	2.5		1
	10	4229.8	1.063		0.275	0.19	1	1		1
	15.5	4224.3	1.380	1			0.1	0.1	0.183	1
	20.5	4219.3	1.668							3
	25.5	4214.3	1.956	3			0.5	0.5		3
	30.5	4209.3	2.244							3
	35.5	4204.3	2.532		0.6	0.77				3
	40.5	4199.3	2.820	16						3
	45.5	4194.3	3.108		0.15	0.11	0.3	0.3		3
	50.5	4189.3	3.396	3						3
	55.5	4184.3	3.684				1	1		1
	60.5	4179.3	3.972	4			0.4	0.4	0.288	1
L-27	2	4235.5	0.240	8	0.5	0.6	3.3	3.3		1
4237.5	5	4232.5	0.600		0.42	0.46	2.2	2.2		1
	10	4227.5	0.919	1	0.18	0.15	0.2	0.2		1
	15	4222.5	1.207		0.5	0.6				3
	20	4217.5	1.495	1			0.6	0.6	0.460	3
	25	4212.5	1.783		0.31	0.3	0.6	0.6		3

Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
	30	4207.5	2.071	8						3
	35	4202.5	2.359		0.29	0.27	1.5	1.5		1
	40	4197.5	2.647	5					0.693	2
	45	4192.5	2.935		0.37	0.38	0.9	0.9		1
	50	4187.5	3.223	15	0.5	0.6	1.3	1.3		1
	55	4182.5	3.511				0.6	0.6		1
	60	4177.5	3.799	3	0.24	0.21	0.8	0.8		1
L-28	2	4237.7	0.240	16	0.37	0.38	4.5	4.5		1
4239.7	5	4234.7	0.600		0.3	0.28	4	4		1
	10	4229.7	1.056	1	0.17	0.13	0.5	0.5		1
	15	4224.7	1.344		0.3	0.28	1	1		1
	20	4219.7	1.632	6	0.2	0.16	0.3	0.3		3
	25	4214.7	1.920		0.05	0.03	0.1	0.1		3
	30	4209.7	2.208	4			0.1	0.1		2
	35	4204.7	2.496		0.39	0.42	0.6	0.6		3
	40	4199.7	2.784	4			0.6	0.6		2
	45	4194.7	3.072				0.8	0.8		2
	50	4189.7	3.360	9						2
	55	4184.7	3.648		0.39	0.42	0.8	0.8		1
	60	4179.7	3.936	7	0.22	0.18	0.6	0.6		1
L-29	2	4234.8	0.240	7	0.37	0.38	4.5	4.5		1
4236.8	5	4231.8	0.588		0.32	0.31	0.8	0.8		1
	10	4226.8	0.876	2	0.17	0.13	0.3	0.3		1
	15.5	4221.3	1.192		0.3	0.28	0.7	0.7		3
	20.5	4216.3	1.480	2			0.5	0.5	0.248	3
	25.5	4211.3	1.768		0.11	0.08	0.2	0.2		2
	30.5	4206.3	2.056	12						6
	35.5	4201.3	2.344				0.2	0.2		2
	40.5	4196.3	2.632	6	0.2	0.16	0.7	0.7		2
	45.5	4191.3	2.920		0.37	0.39	0.8	0.8		1
	50.5	4186.3	3.208	7	0.32	0.31	0.8	0.8		1
	55.5	4181.3	3.496		0.58	0.73	1.2	1.2		1
	60.5	4176.3	3.784	4	0.21	0.17	1.2	1.2		3
L-30	2	4235.6	0.240	24	0.4	0.43	4.5	4.5		1
4237.6	5	4232.6	0.600	5	0.27	0.24	4.5	4.5		1
	10	4227.6	0.925		0.24	0.21	0.4	0.4		1
	15	4222.6	1.213	5	0.14	0.11	0.1	0.1		3
	20	4217.6	1.501		0.17	0.13	0.1	0.1		1
	25	4212.6	1.789	2	0.14	0.11	0.5	0.5		1
	30	4207.6	2.077		0.13	0.09	0.1	0.1		3
	35	4202.6	2.365	5			0.7	0.7	0.315	3

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Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
	40	4197.6	2.653							2
	45	4192.6	2.941	14	0.74	1.03	2.6	2.6		2
	50	4187.6	3.229		0.3	0.28	3.5	3.5		1
	55	4182.6	3.517	8						3
	60	4177.6	3.805		0.33	0.33	0.7	0.7		1
	65	4172.6	4.093	7	0.2	0.16	0.8	0.8		1
	70	4167.6	4.381		0.24	0.21	0.7	0.7		3
	75	4162.6	4.669	49						6
	80.5	4157.1	4.986		0.32	0.31	1.2	1.2		3
	85.5	4152.1	5.274	20	0.66	0.88	1	1		3
	90.5	4147.1	5.562		0.34	0.34	1.5	1.5		1
	95.5	4142.1	5.850	8	0.42	0.46	1	1		1
	100.5	4137.1	6.138				4.5	4.5		2
B-1A	0	4244.8	0.000	13			4.5	4.5		1
4244.8	2	4242.8	0.240	7			3.7	3.7		1
	4	4240.8	0.480	4			2.4	2.4		1
	9	4235.8	1.080	1			1.5	1.5	0.158	1
	14	4230.8	1.605	0			0.5	0.5	0.168	1
	19	4225.8	1.893	0			0.6	0.6		1
	24	4220.8	2.181	1			0.6	0.6		1
	29	4215.8	2.469	1			0.7	0.7		1
	34	4210.8	2.757	1			0.6	0.6		1
	39	4205.8	3.045	1			0.3	0.3		1
B-2A	0	4242.5	0.000	9			4.5	4.5		1
4242.5	2	4240.5	0.240	5			2.1	2.1		1
	4	4238.5	0.480	5						1
	9	4233.5	1.080	2			1.1	1.1		1
	14	4228.5	1.462	1			0.3	0.3		1
	19	4223.5	1.750	1			0.2	0.2		1
	24	4218.5	2.038	0			0.7	0.7		1
	29	4213.5	2.326	1			0.3	0.3		1
	34	4208.5	2.614	1			0.3	0.3		3
	39	4203.5	2.902	25						6
B-3A	0	4243.2	0.000	11			4.5	4.5		1
4243.2	2	4241.2	0.240	13			4.5	4.5		1
	4	4239.2	0.480	5						1
	9	4234.2	1.080	1			0.6	0.6		1
	14	4229.2	1.505	1			0.6	0.6		1
	19	4224.2	1.793	1			0.8	0.8		1
	24	4219.2	2.081							3
	29	4214.2	2.369	0			0.3	0.3		1

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Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
	34	4209.2	2.657	0			0.2	0.2		3
	39	4204.2	2.945	0			0.6	0.6		3
	44	4199.2	3.233	0						1
	49	4194.2	3.521	1			0.9	0.9		1
	54	4189.2	3.809	2			1.2	1.2		1
	59	4184.2	4.097	0			0.7	0.7		1
	64	4179.2	4.385	0			0.7	0.7		1
	69	4174.2	4.673	7			0.9	0.9		3
	74	4169.2	4.961	26						6
	79	4164.2	5.249	8			1.3	1.3		3
	84	4159.2	5.537	32			3	3		6
	89	4154.2	5.825	22			3.6	3.6		1
	94	4149.2	6.113	1			1.1	1.1		1
	99	4144.2	6.401	12			4.5	4.5		1
B-1B	0	4238.2	0.000	28			4.5	4.5		1
4238.2	2	4236.2	0.240	17			3	3		1
	4	4234.2	0.480	6			3.3	3.3		1
	9	4229.2	0.905	0			0.9	0.9		1
	14	4224.2	1.193	0			0.3	0.3		1
	19	4219.2	1.481				0.5	0.5		1
	24	4214.2	1.769	1			0.5	0.5		1
	29	4209.2	2.057	0			0.6	0.6		1
	34	4204.2	2.345	5			1.4	1.4		3
	39	4199.2	2.633	0			0.7	0.7		1
	44	4194.2	2.921	0			0.8	0.8		1
	49	4189.2	3.209	0			1.2	1.2		1
	54	4184.2	3.497	0			0.9	0.9		1
	59	4179.2	3.785	1			0.7	0.7		1
	64	4174.2	4.073	5			0.7	0.7		1
	69	4169.2	4.361	2			0.8	0.8		1
	74	4164.2	4.649	14			2.7	2.7		1
	79	4159.2	4.937	25						6
	84	4154.2	5.225	0			1.7	1.7		1
	89	4149.2	5.513	5			2.2	2.2		1
	94	4144.2	5.801	3			1.2	1.2		1
	99	4139.2	6.089	2			0.9	0.9		1
B-2B	0	4237.5	0.000	22			4.5	4.5		1
4237.5	2	4235.5	0.240	7			4.5	4.5		1
	4	4233.5	0.480	1			0.8	0.8		1
	9	4228.5	0.862	0			0.7	0.7		1
	14	4223.5	1.150				0.7	0.7		1
	19	4218.5	1.438	5			0.4	0.4		1

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
	24	4213.5	1.726	0			0.2	0.2		2
	29	4208.5	2.014	1			0.4	0.4		2
	34	4203.5	2.302	1			1.8	1.8		2
	39	4198.5	2.590	0			0.8	0.8		2
	44	4193.5	2.878	2			1.6	1.6		1
	49	4188.5	3.166	0			1.3	1.3		1
	54	4183.5	3.454	5			3.5	3.5		3
	59	4178.5	3.742	7			0.6	0.6		3
	64	4173.5	4.030	4			0.8	0.8		3
	69	4168.5	4.318	2						3
	74	4163.5	4.606	10						6
	79	4158.5	4.894	16			1.6	1.6		1
	84	4153.5	5.182	0			1.7	1.7		1
	89	4148.5	5.470	0			2.3	2.3		1
	94	4143.5	5.758	1			1.1	1.1		1
	99	4138.5	6.046	5			2.8	2.8		1
B-3B	0	4239.9	0.000	13			4.5	4.5		1
4239.9	2	4237.9	0.240	13			4.5	4.5		1
	4	4235.9	0.480	6			1.5	1.5		1
	9	4230.9	1.011				0.8	0.8		1
	11	4228.9	1.127				0.7	0.7		1
	19	4220.9	1.587	1						3
	24	4215.9	1.875	1			0.4	0.4		3
	29	4210.9	2.163	0			0.3	0.3		3
	34	4205.9	2.451	1			0.3	0.3		1
	39	4200.9	2.739	10			1.8	1.8		2
	44	4195.9	3.027	4			2.8	2.8		2
	49	4190.9	3.315	4			2	2		2
	54	4185.9	3.603	1			1.1	1.1		1
	59	4180.9	3.891	2			0.7	0.7		1
	64	4175.9	4.179	1			0.8	0.8		1
	69	4170.9	4.467	15			0.8	0.8		1
	74	4165.9	4.755	6			0.7	0.7		1
	79	4160.9	5.043	25			2.5	2.5		1
	84	4155.9	5.331	28						6
	89	4150.9	5.619	31						6
	94	4145.9	5.907	7			0.9	0.9		1
	99	4140.9	6.195	7			1.7	1.7		1
B-4B	0	4237.3	0.000	20			4.5	4.5		1
4237.3	2	4235.3	0.240	5			1.8	1.8		1
	4	4233.3	0.480				1.1	1.1		1
	9	4228.3	0.849	0			0.6	0.6		1

10/26

Clean Harbors Landfill Cells 8 to 13
Project No. 1160276
Field & Lab Data
Water 4232 assumed

Soil	1	2	3	4	5	6
Soil	CL	CL.ML	CL/S	ML	SM/ML	SM

Boring	Depth (ft)	Elev (ft)	Eff. Stress (ksf)	N	Torvane (ksf)	Ct (ksf)	Pocket Pen (tsf)	Cp (ksf)	Cuc (ksf)	Material
	14	4223.3	1.137	1			0.2	0.2		1
	19	4218.3	1.425	3			0.3	0.3		1
	24	4213.3	1.713	0			0.3	0.3		1
	29	4208.3	2.001	0			0.3	0.3		1
	34	4203.3	2.289	0			0.8	0.8		3
	39	4198.3	2.577	7						3
	44	4193.3	2.865	5			2.2	2.2		1
	49	4188.3	3.153	0			0.8	0.8		1
	54	4183.3	3.441	11				0		6
	59	4178.3	3.729	10			0.4	0.4		6
	64	4173.3	4.017	4						6
	69	4168.3	4.305	4			1.1	1.1		3
	74	4163.3	4.593	9			1.2	1.2		3
	79	4158.3	4.881	12			1.7	1.7		3
	84	4153.3	5.169	14						6
	89	4148.3	5.457	4			2.6	2.6		1
	94	4143.3	5.745	3			1.3	1.3		1
	99	4138.3	6.033	4			2.8	2.8		1

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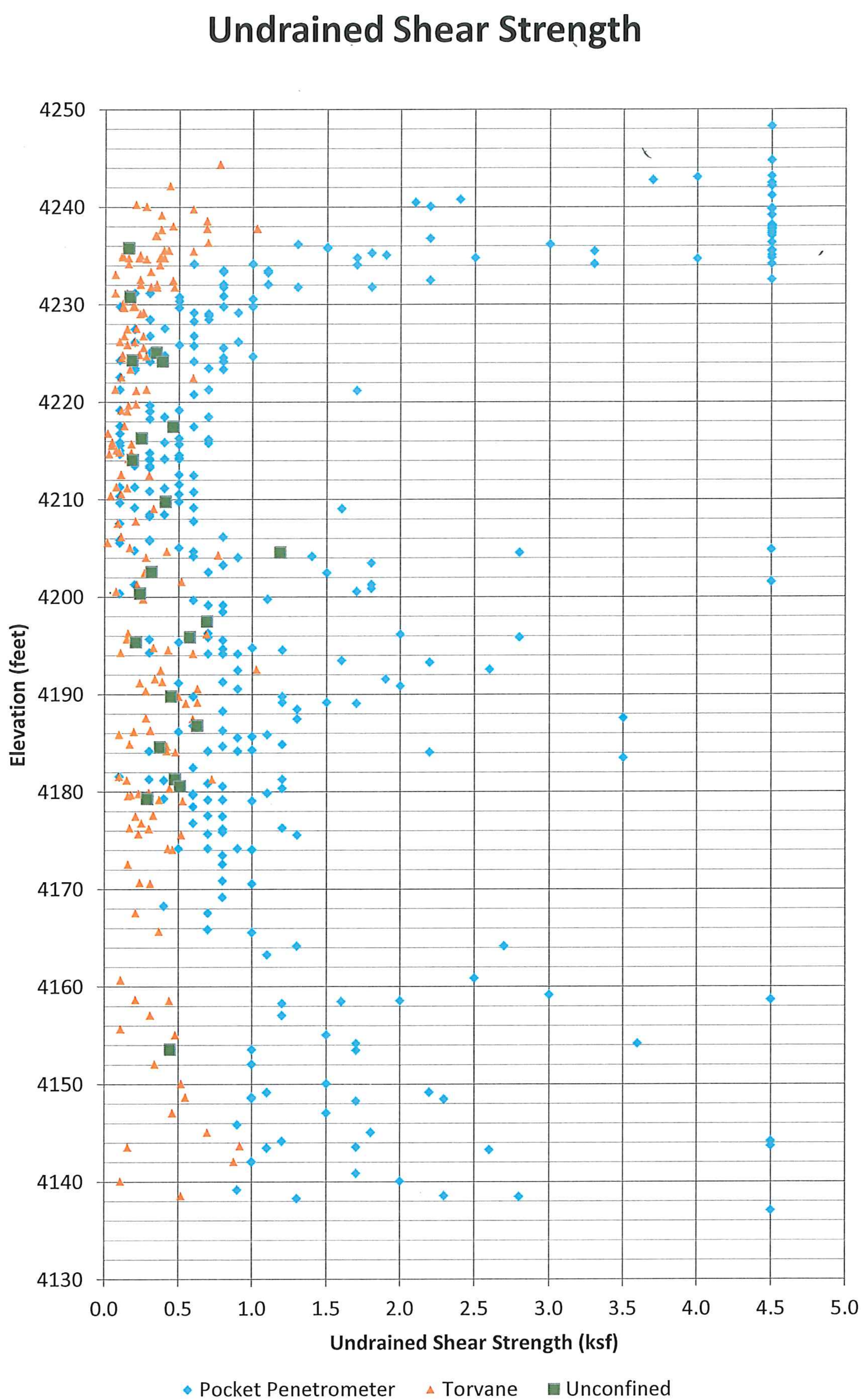
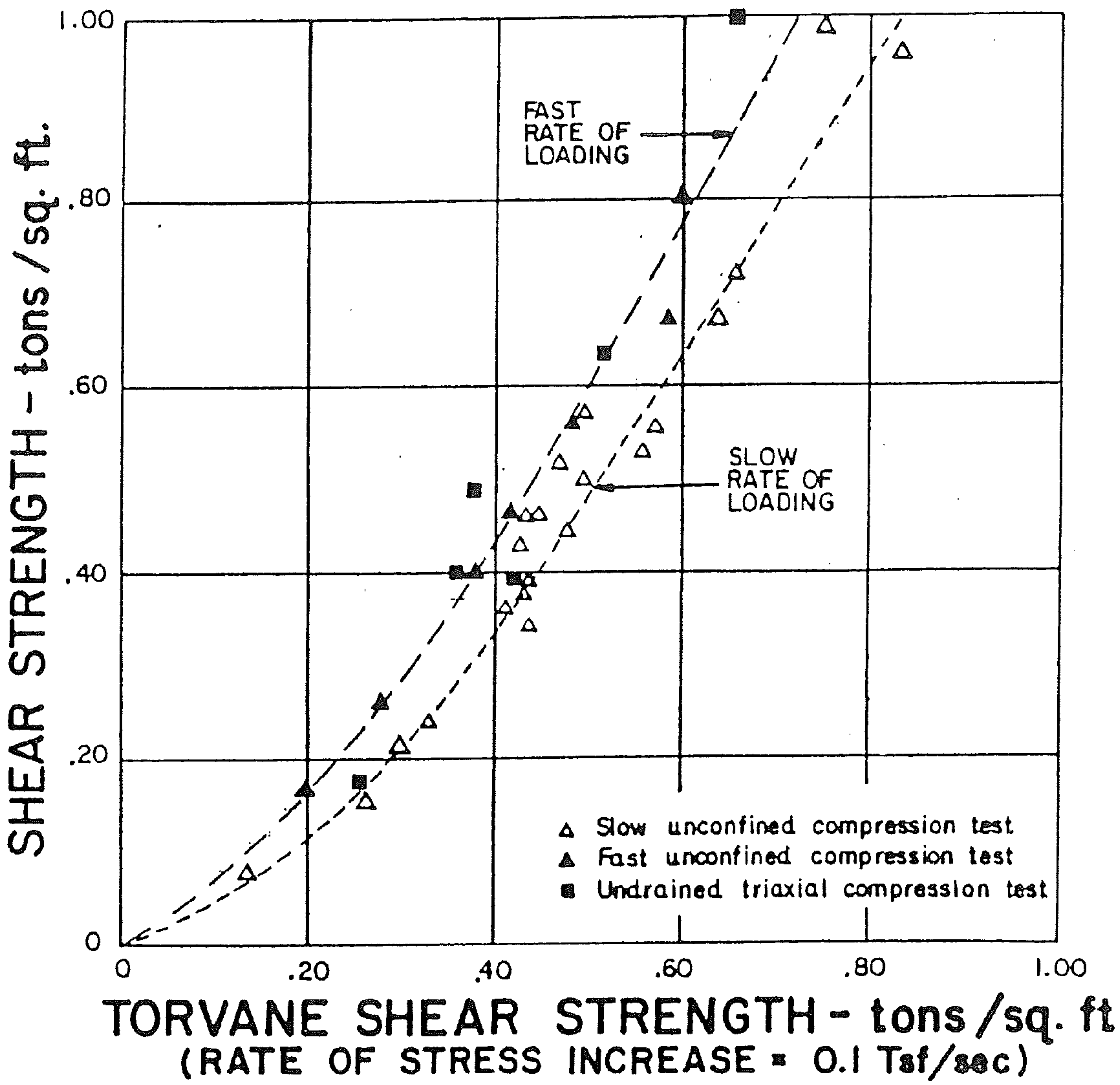

Undrained Shear Strength
4250
4240
4230
4220
4210
4200
4190
4180
4170
4160
4150
4140
4130
Elevation (feet)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Undrained Shear Strength (ksf)
Pocket Penetrometer
Torvane
Unconfined

STRENGTH CORRELATION



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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JRM

SUBJECT Correlation of strength of clay with CPT data SHEET 13 OF 26

$q_c = C_u N_K + \sigma_0$ Robertson & Campanella

q_c = Tip resistance

C_u = undrained shear strength

N_K = cone factor 11-19 with 15 ave
for $P_I = 18 \rightarrow N_K = 18$

σ_0 = in-situ total stress

Check correlation of N_K with UC test results

CL3 was CPT near NEC of site
water assumed at 4232 feet (~7' depth)

at 63 ft q_c = 11 TSF or 22 ksf

$\sigma_0 = (130)(7) + (56)(120) = 7630$ psf

$C_u = \frac{q_c - \sigma_0}{N_K} = \frac{22 - 7.63}{18} = \underline{0.798 \text{ ksf}}$

at 25 ft q_c = 5.4 Tsf or 10.8 ksf

$\sigma_0 = (130)(7) + (18)(120) = 3070$ psf

$C_u = \frac{10.8 - 3.07}{18} = \underline{0.429 \text{ ksf}}$

at 84 ft q_c = 13.4 Tsf or 26.8 ksf

$\sigma_0 = (130)(7) + (77)(120) = 10.15$ ksf

$C_u = \frac{27.0 - 10.15}{18} = \underline{0.936 \text{ ksf}}$

Check correlation of N_K with UC test results

Boring	Depth, ft	Correlated CPT #	Resulting N_K
L-3	25	CL-3	22 *
L-3	85.5	CL-3	25 *
L-4	50.5	CL-1	20.5
L-10	40.5	CL-7	16
L-10	60.5	CL-7	14
L-12	60	CL-13	16
L-14	60	CL-14	16
L-17	35.5	CL-9	16
L-17	55.5	CL-9	34 *
L-19	40	CL-14	34 *
L-19	45	CL-14	35 *
L-21	20	CL-24	20
L-23	50	CL-30	19
L-24	20	CL-24	18
L-26	15.5	CL-25	26 *
L-26	60.5	CL-26	18
L-27	20	CL-26	15.5
L-27	40	CL-26	11 *
L-29	20.5	CL-30	42 *
L-30	35	CL-30	25.5 *

average 22
non * test average 17

CPT data correlates well with lab UC results

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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JRu

SUBJECT Correlate CPT data with Sand ϕ SHEET 15 OF 26

Lowest q_c for upper sand is CL-26

$q_c = 32.4$ TSF at 6.55 m (21.5 ft)

$\sigma_o' = (130)(8) + (120-62.4)(13.5) = 1818$ psf

1 bar = 2088.6 psf

$\sigma_o' = \frac{1818}{2088.6} = 0.87$ bars $\qquad q_c = 31$ bars

from Fig 5.5 $\quad \phi = 36°$

16/26

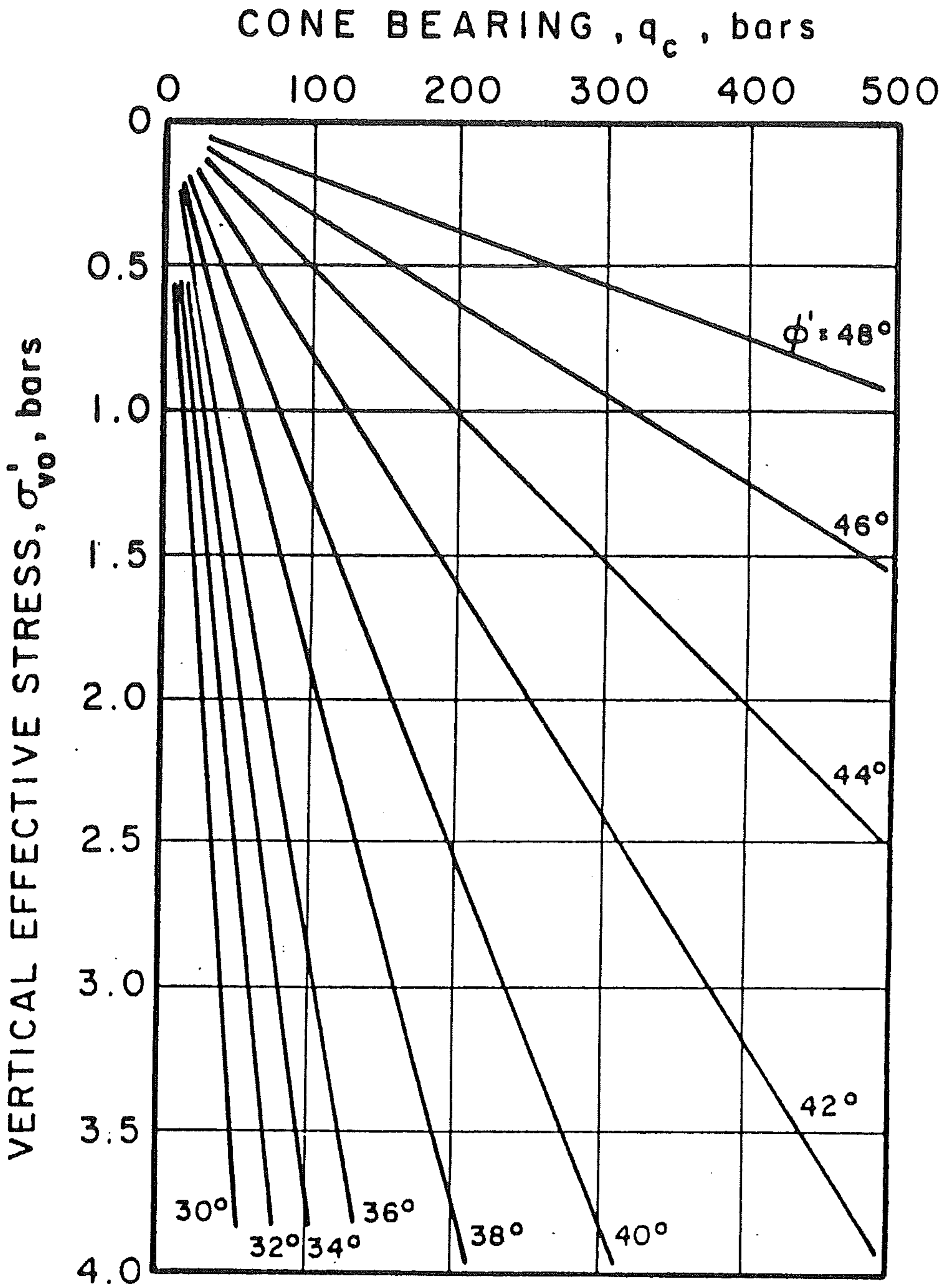

Fig. 5.5. Proposed Correlation between Cone Bearing and Peak Friction Angle for Uncemented, Quartz Sands (After Robertson and Campanella, 1983)

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SUBJECT Soil Strength Testing and Summary SHEET 17 OF 26

Additional testing

Triaxial shear - multistage

TH-21 @ 4' $\overline{CIU}$ — $\bar{\phi} = 34.9°$, $\bar{c} = 0.16$ Ksf; $\phi = 32.1°$, $c = 0.10$ Ksf
-200 = 77% wc = 17.6% LL = 28% PI = 13% N = 13/12

TH-15 @ 11' $\overline{CIU}$ — $\bar{\phi} = 33.5°$, $\bar{c} = 0.2$ Ksf; $\phi = 20.5°$, $c = 0.2$ Ksf
-200 = 99% wc = 55.7% LL = 47% PI = 23% N = 4/12

C6-7 @ 0' — $\bar{\phi} = 42°$, $\bar{c} = 20$ psf; $\phi = 38°$, $c = 0$
-200 ≈ 86% wc = 14% N = 42/12

L-2 @ 30½' — $\bar{\phi} = 26°$, $\bar{c} = 100$ psf; $\phi = 13°$, $c = 240$ psf
-200 = 100% wc = 65% LL = 66% PI = 40%

L-4 @ 23' — $\bar{\phi} = 25°$, $\bar{c} = 460$ psf; $\phi = 12°$, $c = 610$ psf
-200 = 99% wc = 48% LL = 46% PI = 25%

L-6 @ 20½' — $\bar{\phi} = 32°$, $\bar{c} = 230$ psf; $\phi = 17°$, $c = 150$ psf
-200 = 100% wc = 58% LL = 46% PI = 19%

L-8 @ 60' — $\bar{\phi} = 22°$, $\bar{c} = 750$ psf; $\phi = 12°$, $c = 870$ psf
-200 = 100% wc = 59% LL = 63% PI = 36%

L-14 @ 45' — $\bar{\phi} = 35°$, $\bar{c} = 110$ psf; $\phi = 20°$, $c = 120$ psf
-200 = 81% wc = 33% LL = 29% PI = 11%

L-17 @ 8' — $\bar{\phi} = 43°$, $\bar{c} = 150$ psf; $\phi = 10°$, $c = 840$ psf
wc = 59%

L-17 @ 25' — $\bar{\phi} = 41°$, $\bar{c} = 340$ psf; $\phi = 19°$, $c = 270$ psf
-200 = 89% wc = 52% LL = 49% PI = 25%

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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JRM

SUBJECT Soil Strength Testing and Summary SHEET 18 OF 26

Additional testing (cont)

Triaxial Shear

L-19 @ 50½' $\bar{\phi} = 33^\circ$ $\bar{c} = 410$ psf
$\phi = 22^\circ$ $c = 420$ psf

-200 = 100% wc = 31% LL = 45% PI = 25%

L-24 @ 35' $\bar{\phi} = 24^\circ$ $\bar{c} = 100$ psf
$\phi = 12^\circ$ $c = 270$ psf

-200 = 100% wc = 67% LL = 68% PI = 42%

Direct Shear

L-1 @ 50' $\phi_p = 34.3^\circ$ $c = 0$

L-10 @ 50½' $\phi_p = 31.3^\circ$ $c = 0$

L-14 @ 20' $\phi_p = 37.6^\circ$ $c = 0$

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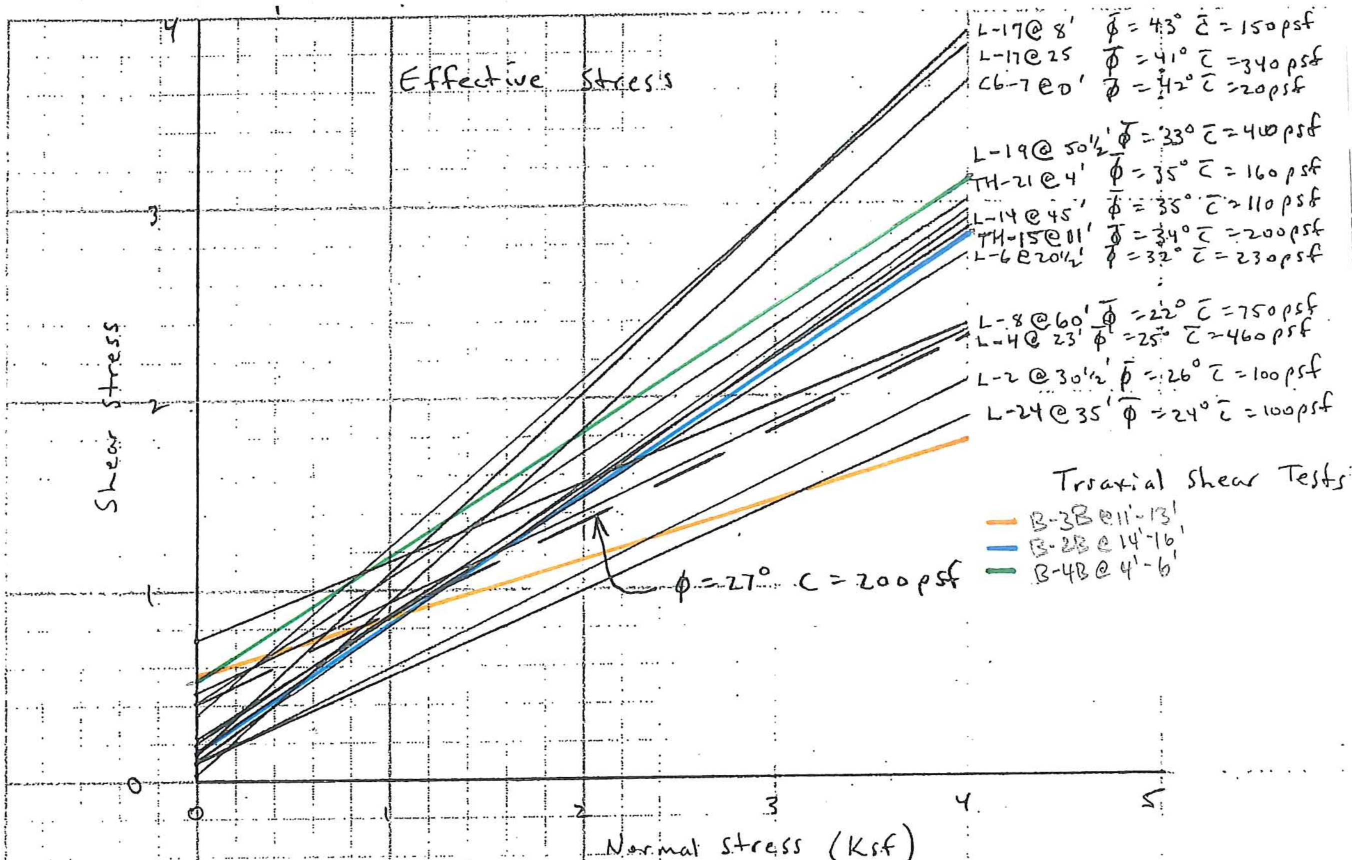
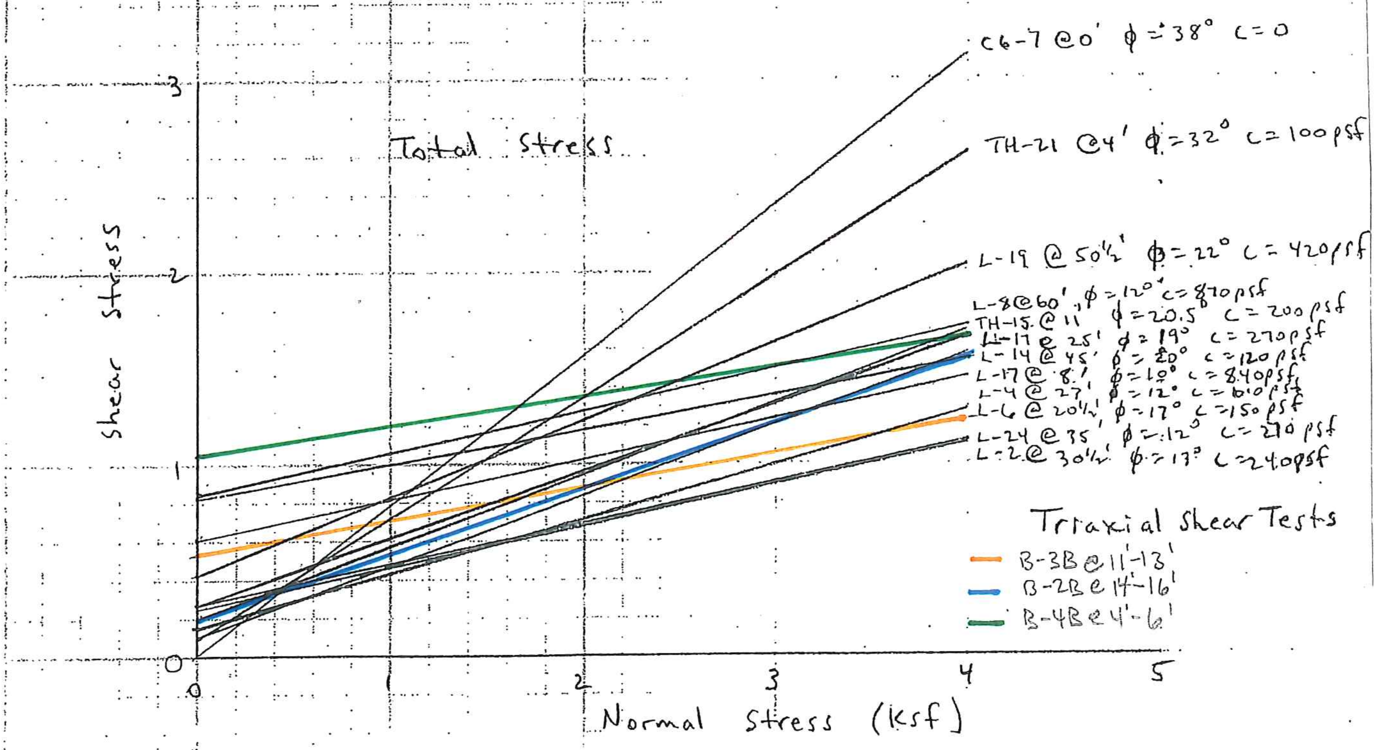
PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JRM

SUBJECT Soil Strength Testing Summary SHEET 19 OF 26





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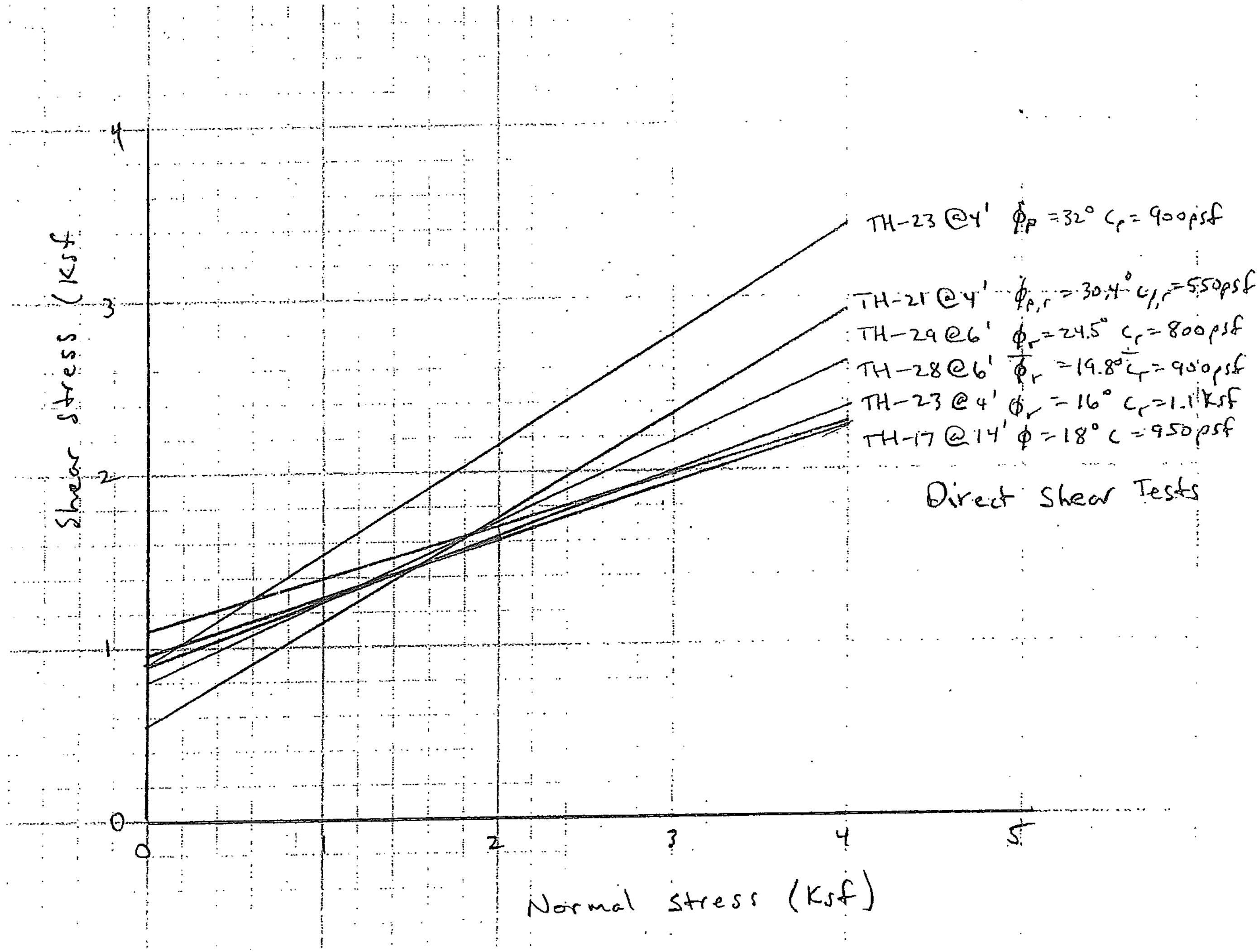
PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JTR

SUBJECT Soil Strength Testing and Summary SHEET 20 OF 26



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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JRM
SUBJECT Soil Strength Testing and Summary SHEET 21 OF 26

Undrained Conditions
A. Embankment Fill
Unconfined Compression
c = 435 to 7750 psf
ave = 2656 psf
Direct Shear - remolded
ϕ = 32° c = 1600 psf
Direct Shear undisturbed
σ_N = 1.0 Ksf τ = 1.1 Ksf
σ_N = 2.0 Ksf τ = 1.9 Ksf
} Cell 1

B. Upper Stiff Clay
Unconfined Compression
c = 4 to 7.75 Ksf — Cell 1
ave = 5.6 Ksf
c = 1.195 to 2.37 Ksf — Cell 2
ave = 1.78 Ksf
c = 0.585 to 4.475 Ksf — Cell 3
ave = 2.73 Ksf
c = 0.84 to 8.425 Ksf — Cell X
ave = 3.967 Ksf
c = 0.785 to 11.7 Ksf — Cell Y
ave = 5.68 Ksf
c = 0.840 to 5.30 Ksf — Cell Z
ave = 3.54 Ksf
c = 0.945 to 4.995 Ksf — Cell 4
ave = 2.29 Ksf
c = 0.13 to 11.6 Ksf — Cell 5
ave = 4.88 Ksf
c = 0.368 to 0.865 Ksf — Cell 6
ave = 0.58 Ksf
Pocket Penetrometer
1.1 to > 4.5 Ksf — all cells
ave > 4.5 Ksf
Direct Shear - CU
ϕ = 32° c = 0.94 Ksf — Cell 3
Triaxial Shear - Multistage - $\overline{CU}$
ϕ = 32.1° c = 0.10 Ksf — Cell 3
ϕ = 38° c = 0 — Cell 6
$\overline{\phi}$ = 22° $\overline{c}$ = 0.75 Ksf — LTU

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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JRM

SUBJECT Soil Strength Testing and Summary SHEET 22 OF 26

C. Soft Clay

Unconfined Compression

c = 145 psf	Cell 1
c = 220 to 850 psf	Cell 2
ave = 550 psf	
c = 225 to 2215 psf	Cell 3
ave = 1040 psf	
c = 235 to 1040 psf	Cell X
ave = 535 psf	
c = 235 psf	Cell Y
c = 235 psf to 488 psf	Cell Z
ave = 370 psf	
c = 195 psf	Cell 4
c = 325 to 333 psf	Cell 5
ave = 329 psf	
c = 263 to 525 psf	Cell 6
ave = 724 psf	
c = 183 to 460 psf	LTU
ave = 354 psf	

Pocket Penetrometer

< 100 to 2500 psf	Cell 1
< 100 to 700 psf	2
< 100 to 4300 psf	3
100 to 900 psf	X
< 100 to 1200 psf	Y
< 100 to 1500 psf	4
200 to 700 psf	Z
< 100 to 700 psf	5
250 to 550 psf	6

Direct Shear

Test Type	σ_N	τ	ϕ	c	Cell
CU	2.0 Ksf	1.5 Ksf			1
UU			38.7°	170 psf	2
UU			31.7°	260 psf	2
CU			30.4°	550 psf	3
CD			22.7°	940 psf	3
CU			45°	600 psf	3
UU			18°	950 psf	X

Triaxial Shear – multistage – $\overline{CIU}$

$\phi = 20.5°$	c = 0.2 Ksf	Cell 2
$\phi = 33.5°$	$\bar{c}$ = 0.2 Ksf	Cell 2
$\bar{\phi} = 26°$	$\bar{c}$ = 0.1 Ksf	LTU
$\bar{\phi} = 25°$	$\bar{c}$ = 0.46 Ksf	LTU
$\phi = 32°$	c = 0.23 Ksf	LTU
$\bar{\phi} = 41°$	$\bar{c}$ = 0.34 Ksf	LTU
$\phi = 33°$	c = 0.41 Ksf	LTU

D. Clay and Silty Sand
Unconfined Compression
C = 200 to 400 psf Cell 1
ave = 300 psf
C = 150 to 710 psf Cell X
ave = 430 psf
C = 1040 psf Cell Y
C = 150 to 1650 psf Cell Z
ave = 720 psf
C = 320 to 1075 psf Cell 5
ave = 541 psf
C = 300 to 1650 psf Cell 6
ave = 765 psf
C = 188 to 1185 psf LTU
ave = 471 psf
Triaxial Shear
$\bar{\phi} = 22°$ $\bar{c} = 0.75$ ksf LTU
$\bar{\phi} = 35°$ $\bar{c} = 0.11$ ksf LTU
$\bar{\phi} = 24°$ $\bar{c} = 0.10$ ksf LTU
Direct Shear on Sand
$\phi_p = 34.3°$ c = 0 LTU L-1 @ 50'
$\phi_p = 31.3°$ c = 0 LTU L-10 @ 50½'
$\phi_p = 37.6°$ c = 0 LTU L-14 @ 20'
$\phi_p = 30.4°$ c = 0 LTU L-14 @ 20'

Strength Parameter for Stability Analysis
A. End of Construction - during placement of embankment and clay liner - prior to synthetic liner placement
1. Embankment Material
- with controlled placement of fill, use a drained strength for construction and long term conditions
- based on cell 1 embankment material tests | $\bar{\phi} = 34°$ $\bar{c} = 400$ psf |
- ϕ is increased 2° above direct shear results
- c is less than test results (drilling for monitor wells through the embankment indicates very dense and hard materials)
- assuming a 35' high embankment, the shear strength calculates as: 35 ft (130 pcf) tan 34° + 400 psf = 3469 psf. The calculated value is greater than the average (2656) undrained strength obtained from UC tests and direct shear tests. The average shear strength used in the analysis $\frac{35}{2}(130)\tan 34° + 400 = 1935$ psf is less than the average test values.

2. Clay liner material
- Classifies as CL, CL-ML and ML materials with LL = 22 to 49 PI = 5 to 25 -200 = 85 to 100

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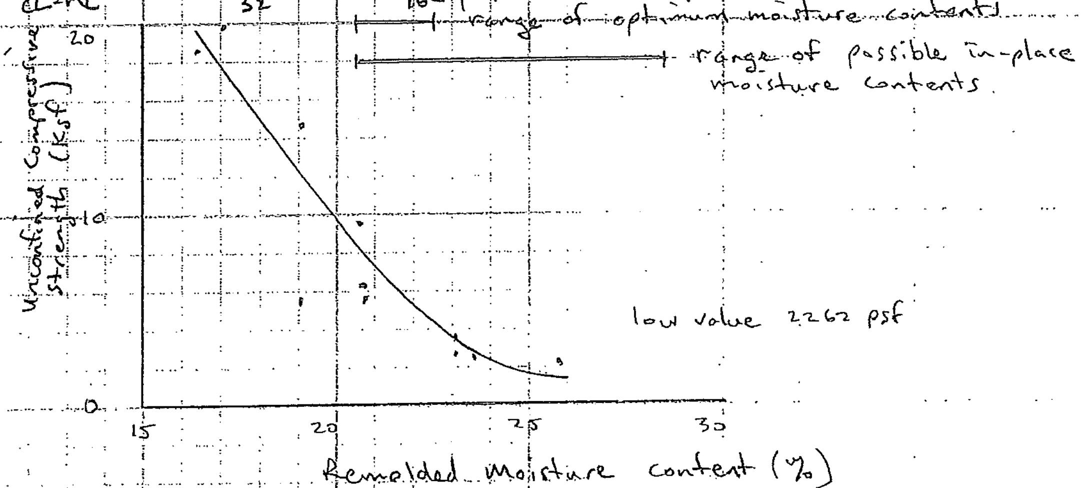
PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JRM.

SUBJECT Soil Strength Testing and Summary SHEET 24 OF 26

- NAVFAC DM-7 (1986) pg 7.2-39, Table I gives typical properties

Soil Type	$\bar{\phi}$ (sat)	$\bar{c}$ (sat)	c (as compacted)
CL	28°	270 psf	1800 psf
ML	32°	190 psf	1400 psf
CL-ML	32°	460 psf	1350 psf



- Based on tests and typical properties

Undrained strength - to allow for moisture contents up to 27%. c = 750 psf

Drained strength - following typical properties
$\bar{\phi} = 28°$ $\bar{c} = 270$ psf

The drained parameters will be used in the stability analysis for the landfill. The undrained strength will be used for traffic loading on the clay.

3. Sand Cover and Synthetic liner
For overall stability assume no strength in the synthetic materials and $\phi = 28°$ c = 100 psf for silt/clay/sand cover materials.

4. Stiff Clay, transitioning to soft clay - based on lab & field tests

Elev.	cohesion
38 - 36	3700 psf
36 - 34	1900 psf
34 - 32	500 psf
32 - 30	200 psf

Field and lab tests indicate c will vary in the upper stiff clay from 585 psf to 11700 psf.

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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JTRM

SUBJECT Soil Strength Testing and Summary SHEET 25 OF 26

5. Clay and Silty Sand
- The sand occurs as thin to medium thick layers
- UC results range from 150 to 1650 psf
- Direct Shear tests indicate $\sigma_N = 2.0$ ksf $\tau = 1.0$ ksf
  - ∴ if $\phi = 0 \Rightarrow c = 1000$ psf
  - $\phi = 18^\circ \Rightarrow c = 950$ psf
  - $\phi = 26^\circ \Rightarrow c = 0$
  - Tests on sand $\phi_p = 34.3^\circ, 31.3^\circ, 37.6^\circ$
- Penetration resistance indicates $\phi = 28-32^\circ$ ave. 30°
- Cone penetration Test correlation give $\phi' = 36^\circ$ min.
- Use a combination of ϕ and c

$\phi = 30^\circ$ c = 200 psf

B. Long Term Conditions
- Pore Pressure monitoring in the upper soils of Cell 2 indicate a fairly rapid decrease in pore pressure during construction
- NAVFAC DM-7 (1971) Fig 3.7 indicates that for PI ranging from 8 to 20 the ϕ may range from 22° to 27°
- Patton & Hendron indicate a residual shear strength of $12^\circ-14^\circ$

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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/30/17 BY JRM
SUBJECT Subsurface Profile & Strength Parameters SHEET 26 OF 26

Elev. Top (ft)	Soil	End of Construction		Long Term		γ (pcf)
		φ (deg)	c (psf)	φ (deg)	c (psf)	
varies	Landfill	–	–	25	100	120
varies	Soil Cover	–	–	28	100	120
varies	clay	28	270	28	270	110
varies	Embankment	34	400	34	400	130
4239-4240	clay	0	3700	30	200	130
4236	clay	0	1900	30	200	120
4234	clay	0	500	30	200	110
4232	clay	0	200	30	200	110
4230	clay	0	200	27	200	110
4220	SM/CL	26	200	30	200	110
4218	clay	0	200	27	200	110
4208	SM/ML/CL	26	200	30	200	110
4197	clay	0	200	27	200	110
4191	SM/CL	26	200	30	200	110
4185	clay	0	200	27	200	110
4175	SM/CL	26	200	30	200	110
4169	clay	0	200	27	200	110
4165	SM/CL	26	200	30	200	110
4153	clay	0	200	27	200	110
4149	SM/CL	26	200	30	200	110
4140	clay	0	200	27	200	110
4119	SM/CL	26	200	30	200	110
4104	clay	0	200	27	200	110
4093	SM/CL	26	200	30	200	110

APPENDIX D

POTENTIAL FOR

TENSION CRACKS

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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JRW
SUBJECT Tension Cracking SHEET 1 OF 2

Determine critical height of embankment for tension cracking

H_T = height of embankment when tension cracking begins

$$H_T = \frac{S_{us}}{\gamma_E} N_T$$

S_{us} = undrained shear strength of foundation at surface

highest case of S_{us} = 3700 psf

ave. for upper 20' = $\frac{3(3700) + 2(1900) + 2(500) + 12(200)}{19}$

= 963 psf

γ_E = 130. pcf (embankment)

N_T is function of $\frac{\text{Embank. modulus}}{\text{Found. modulus}} = \frac{K_E}{K_F}$

and $\frac{\text{Embank. width}}{\text{depth of influence}} = \frac{W}{D}$

K_E could range from 30 - 750

K_F could range from 390 - 970

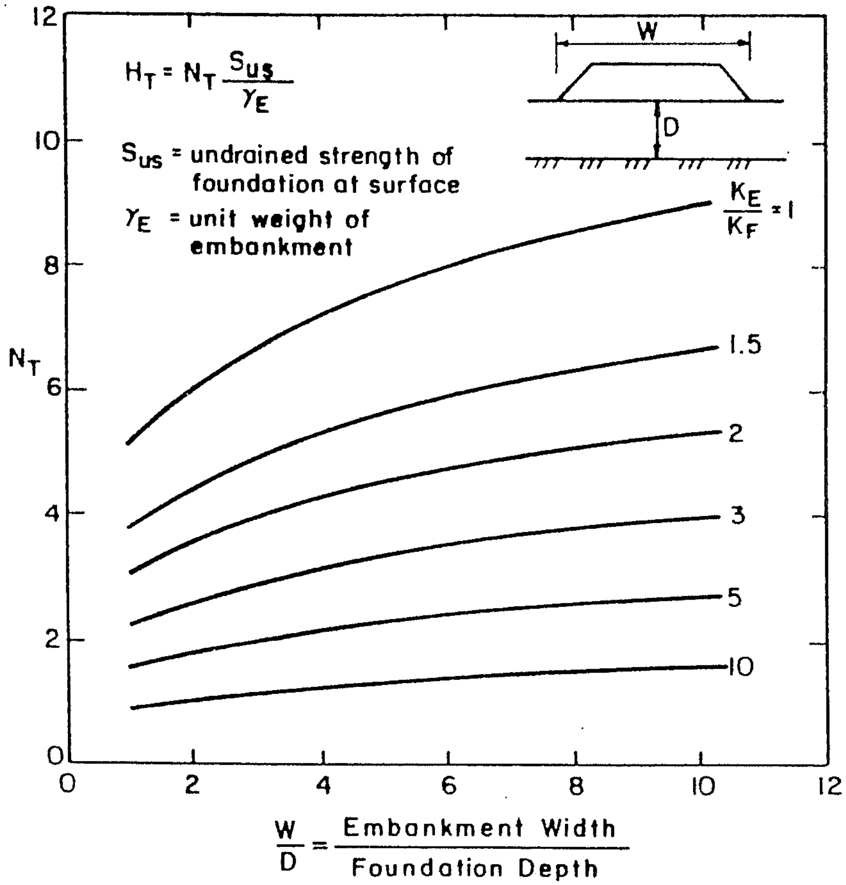
$\frac{W}{D} = \frac{174}{19} = 9$ max

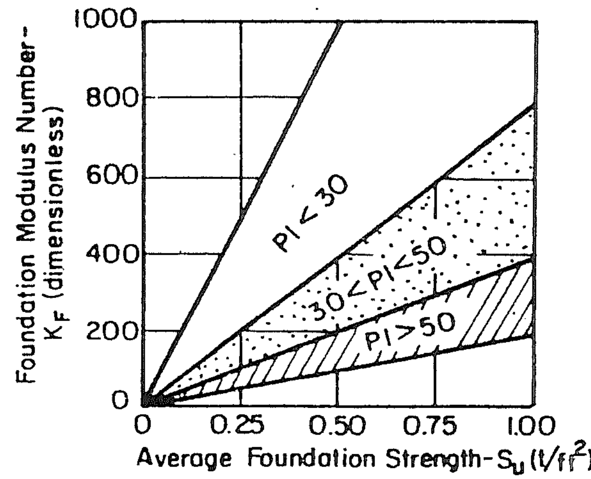
Assume D is limited to dominant sand @ 31'

$\frac{W}{D} = \frac{174}{31} = 5.6$ $\frac{K_E}{K_F} = \frac{750}{390} = 1.92$

$N_T = 4.85$ $H_T = \frac{963}{130}(4.85) = 36'$

with max embank. height 28', cracking due to tension is not expected





Typical values of K_E for compacted fills

Unified Class.	Compaction Water Content		
	Optimum - 3%	Optimum	Optimum + 3%
GC	300 - 1200	200-500	75 - 300
SP	400 - 1000	400-1000	400-1000
SM	300 - 750	300-750	300-750
SC	250 - 1000	150-600	50-250
ML	250-1000	150-600	50-250
CL	250-1000	100-400	30-200
CH	100 - 400	50-200	20-100

Values shown apply to fill materials compacted to dry densities from 90% to 95% of the Std. AASHO maximum. In general, the value of K_E increases with increasing dry density at a given water content.

Fig. 4 CHART FOR ESTIMATING H_T = HEIGHT OF EMBANKMENT WHEN CRACKING WILL BEGIN. (after Chirapuntu and Duncan, 1975.) An Engineering manual for Slope Stability Studies by Duncan and Buchignani, 1975; Univ. of CA. Berkeley

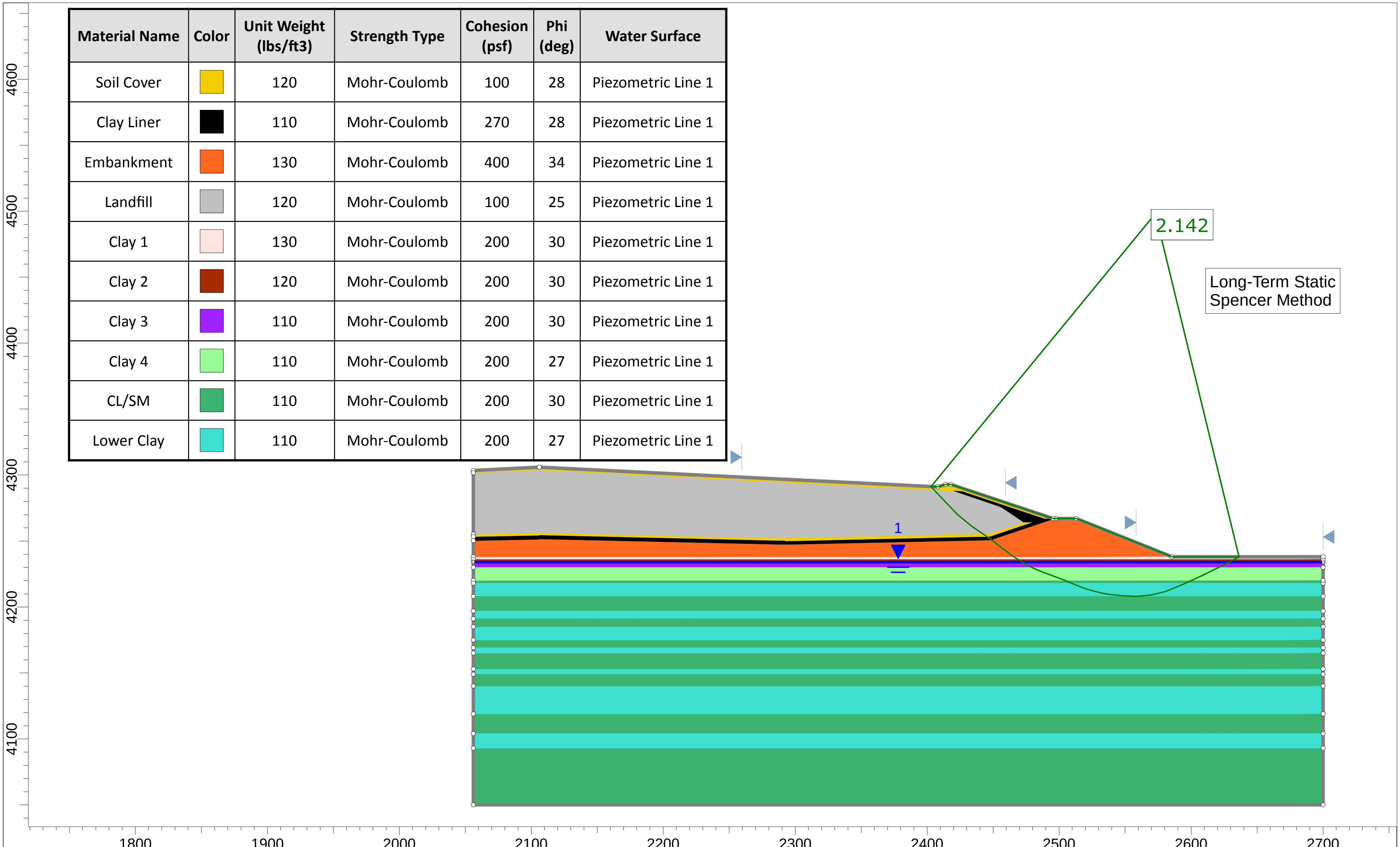
2/2

APPENDIX E-1

SLOPE STABILITY

LONG TERM STATIC

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Soil Cover		120	Mohr-Coulomb	100	28	Piezometric Line 1
Clay Liner		110	Mohr-Coulomb	270	28	Piezometric Line 1
Embankment		130	Mohr-Coulomb	400	34	Piezometric Line 1
Landfill		120	Mohr-Coulomb	100	25	Piezometric Line 1
Clay 1		130	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 2		120	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 3		110	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 4		110	Mohr-Coulomb	200	27	Piezometric Line 1
CL/SM		110	Mohr-Coulomb	200	30	Piezometric Line 1
Lower Clay		110	Mohr-Coulomb	200	27	Piezometric Line 1



Project	SLIDE - An Interactive Slope Stability Program
Analysis Description	Cells 8 to 13 - Long Term Static
Drawn By	JRM
Scale	1:1208
Company	AGEC
Date	9/8/2017
File Name	1160276 Cell 8 to 13 long term static.slim

SLIDEINTERPRET 7.013

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	1160276 Cell 8 to 13 long term static
Last saved with Slide version:	7.013
Project Title:	SLIDE - An Interactive Slope Stability Program
Analysis:	Cells 8 to 13 - Long Term Static
Author:	JRM
Company:	AGEC
Date Created:	9/8/2017

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Soil Cover	Clay Liner	Embankment	Landfill	Clay 1	Clay 2	Clay 3	Clay 4
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	130	120	130	120	110	110
Cohesion [psf]	100	270	400	100	200	200	200	200
Friction Angle [deg]	28	28	34	25	30	30	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1	1	1	1	1	1	1

Property	CL/SM	Lower Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	110	110
Cohesion [psf]	200	200
Friction Angle [deg]	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1

List Of Coordinates

Piezoline

X	Y
2056	4234
2700	4234

External Boundary

X	Y
2056	4303.5
2056	4301.77
2056	4255.2
2056	4253.2
2056	4250.2
2056	4238
2056	4236
2056	4234
2056	4230
2056	4220
2056	4218
2056	4208
2056	4197
2056	4191
2056	4185
2056	4175
2056	4169
2056	4165
2056	4153
2056	4149
2056	4140
2056	4119
2056	4104
2056	4093
2056	4050
2700	4050
2700	4093
2700	4104
2700	4119
2700	4140
2700	4149
2700	4153
2700	4165
2700	4169
2700	4175
2700	4185
2700	4191
2700	4197
2700	4208
2700	4218
2700	4220
2700	4230
2700	4234
2700	4236
2700	4238
2585.5	4238
2513	4267
2497.5	4267
2495.5	4267
2418	4292.9
2414	4292.9
2408	4291
2106	4306

Material Boundary

X	Y
2056	4301.77
2106	4304
2420	4288
2426.5	4287.5
2488	4267
2495.5	4267

Material Boundary

X	Y
2420	4288
2455	4276
2473	4264
2479	4264
2488	4267

Material Boundary

X	Y
2056	4255.2
2106	4256.3
2292.5	4252
2447.5	4255.5
2473	4264

Material Boundary

X	Y
2056	4253.2
2106	4254.3
2292.5	4250
2447.5	4253.5
2479	4264

Material Boundary

X	Y
2056	4250.2
2106	4251.3
2292.5	4247
2448	4250.5
2497.5	4267

Material Boundary

X	Y
2056	4238
2585.5	4238

Material Boundary

X	Y
2056	4236
2700	4236

Material Boundary

X	Y
2056	4234
2700	4234

Material Boundary

X	Y
2056	4230
2700	4230

Material Boundary

X	Y
2056	4220
2700	4220

Material Boundary

X	Y
2056	4218
2700	4218

Material Boundary

X	Y
2056	4208
2700	4208

Material Boundary

X	Y
2056	4197
2700	4197

Material Boundary

X	Y
2056	4191
2700	4191

Material Boundary

X	Y
2056	4185
2700	4185

Material Boundary

X	Y
2056	4175
2700	4175

Material Boundary

X	Y
2056	4169
2700	4169

Material Boundary

X	Y
2056	4165
2700	4165

Material Boundary

X	Y
2056	4153
2700	4153

Material Boundary

X	Y
2056	4149
2700	4149

Material Boundary

X	Y
2056	4140
2700	4140

Material Boundary

X	Y
2056	4119
2700	4119

Material Boundary

X	Y
2056	4104
2700	4104

Material Boundary

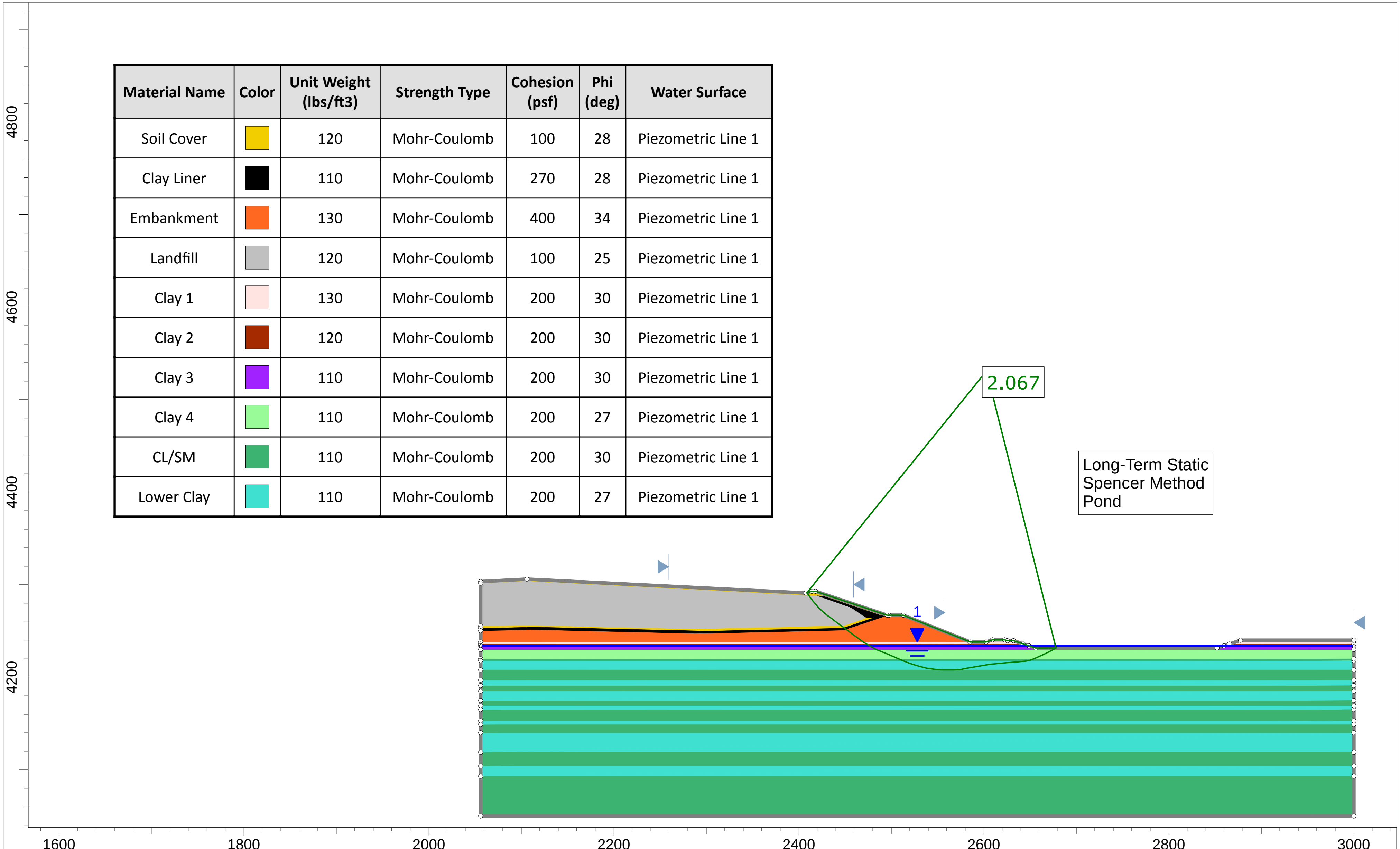
X	Y
2056	4093
2700	4093

APPENDIX E-2

SLOPE STABILITY - NEAR POND

LONG TERM STATIC

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Soil Cover		120	Mohr-Coulomb	100	28	Piezometric Line 1
Clay Liner		110	Mohr-Coulomb	270	28	Piezometric Line 1
Embankment		130	Mohr-Coulomb	400	34	Piezometric Line 1
Landfill		120	Mohr-Coulomb	100	25	Piezometric Line 1
Clay 1		130	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 2		120	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 3		110	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 4		110	Mohr-Coulomb	200	27	Piezometric Line 1
CL/SM		110	Mohr-Coulomb	200	30	Piezometric Line 1
Lower Clay		110	Mohr-Coulomb	200	27	Piezometric Line 1



Project	SLIDE - An Interactive Slope Stability Program
Analysis Description	Cells 8 to 13 - Long Term Static - Pond
Drawn By JRM	*Scale* 1:1723
Company	AGEC
Date 9/8/2017	*File Name* 1160276 Cell 8 to 13 long term static pond.slim

SLIDEINTERPRET 7.013

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	1160276 Cell 8 to 13 long term static pond
Last saved with Slide version:	7.013
Project Title:	SLIDE - An Interactive Slope Stability Program
Analysis:	Cells 8 to 13 - Long Term Static - Pond
Author:	JRM
Company:	AGEC
Date Created:	9/8/2017

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Soil Cover	Clay Liner	Embankment	Landfill	Clay 1	Clay 2	Clay 3	Clay 4
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	130	120	130	120	110	110
Cohesion [psf]	100	270	400	100	200	200	200	200
Friction Angle [deg]	28	28	34	25	30	30	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1	1	1	1	1	1	1

Property	CL/SM	Lower Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	110	110
Cohesion [psf]	200	200
Friction Angle [deg]	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1

List Of Coordinates

Piezoline

X	Y
2056	4234
3000	4234

External Boundary

X	Y
2056	4303.5
2056	4301.77
2056	4255.2
2056	4253.2
2056	4250.2
2056	4238
2056	4236
2056	4234
2056	4230

2056	4220
2056	4218
2056	4208
2056	4197
2056	4191
2056	4185
2056	4175
2056	4169
2056	4165
2056	4153
2056	4149
2056	4140
2056	4119
2056	4104
2056	4093
2056	4050
3000	4050
3000	4093
3000	4104
3000	4119
3000	4140
3000	4149
3000	4153
3000	4165
3000	4169
3000	4175
3000	4185
3000	4191
3000	4197
3000	4208
3000	4218
3000	4220
3000	4230
3000	4234
3000	4236
3000	4240
2877.6	4240
2865.6	4236
2859.6	4234
2852.1	4231.5
2656.1	4231.5
2648.6	4234
2642.6	4236
2632.1	4239.5
2625.5	4239.5
2622.5	4240.5
2609.3	4240.5
2602.5	4238
2585.5	4238
2513	4267
2497.5	4267
2495.5	4267
2418	4292.9
2414	4292.9
2408	4291
2106	4306

Material Boundary

X	Y
2056	4301.77
2106	4304
2420	4288
2426.5	4287.5
2488	4267
2495.5	4267

Material Boundary

X	Y
2420	4288
2455	4276
2473	4264
2479	4264
2488	4267

Material Boundary

X	Y
2056	4255.2
2106	4256.3
2292.5	4252
2447.5	4255.5
2473	4264

Material Boundary

X	Y
2056	4253.2
2106	4254.3
2292.5	4250
2447.5	4253.5
2479	4264

Material Boundary

X	Y
2056	4250.2
2106	4251.3
2292.5	4247
2448	4250.5
2497.5	4267

Material Boundary

X	Y
2056	4238
2585.5	4238

Material Boundary

X	Y
2056	4236
2642.6	4236

Material Boundary

X	Y
2056	4234
2648.6	4234

Material Boundary

X	Y
2056	4230
3000	4230

Material Boundary

X	Y
2056	4220
3000	4220

Material Boundary

X	Y
2056	4218
3000	4218

Material Boundary

X	Y
2056	4208
3000	4208

Material Boundary

X	Y
2056	4197
3000	4197

Material Boundary

X	Y
2056	4191
3000	4191

Material Boundary

X	Y
2056	4185
3000	4185

Material Boundary

X	Y
2056	4175
3000	4175

Material Boundary

X	Y
2056	4169
3000	4169

Material Boundary

X	Y
2056	4165
3000	4165

Material Boundary

X	Y
2056	4153
3000	4153

Material Boundary

X	Y
2056	4149
3000	4149

Material Boundary

X	Y
2056	4140
3000	4140

Material Boundary

X	Y
2056	4119
3000	4119

Material Boundary

X	Y
2056	4104
3000	4104

Material Boundary

X	Y
2056	4093
3000	4093

Material Boundary

X	Y
2859.6	4234
3000	4234

Material Boundary

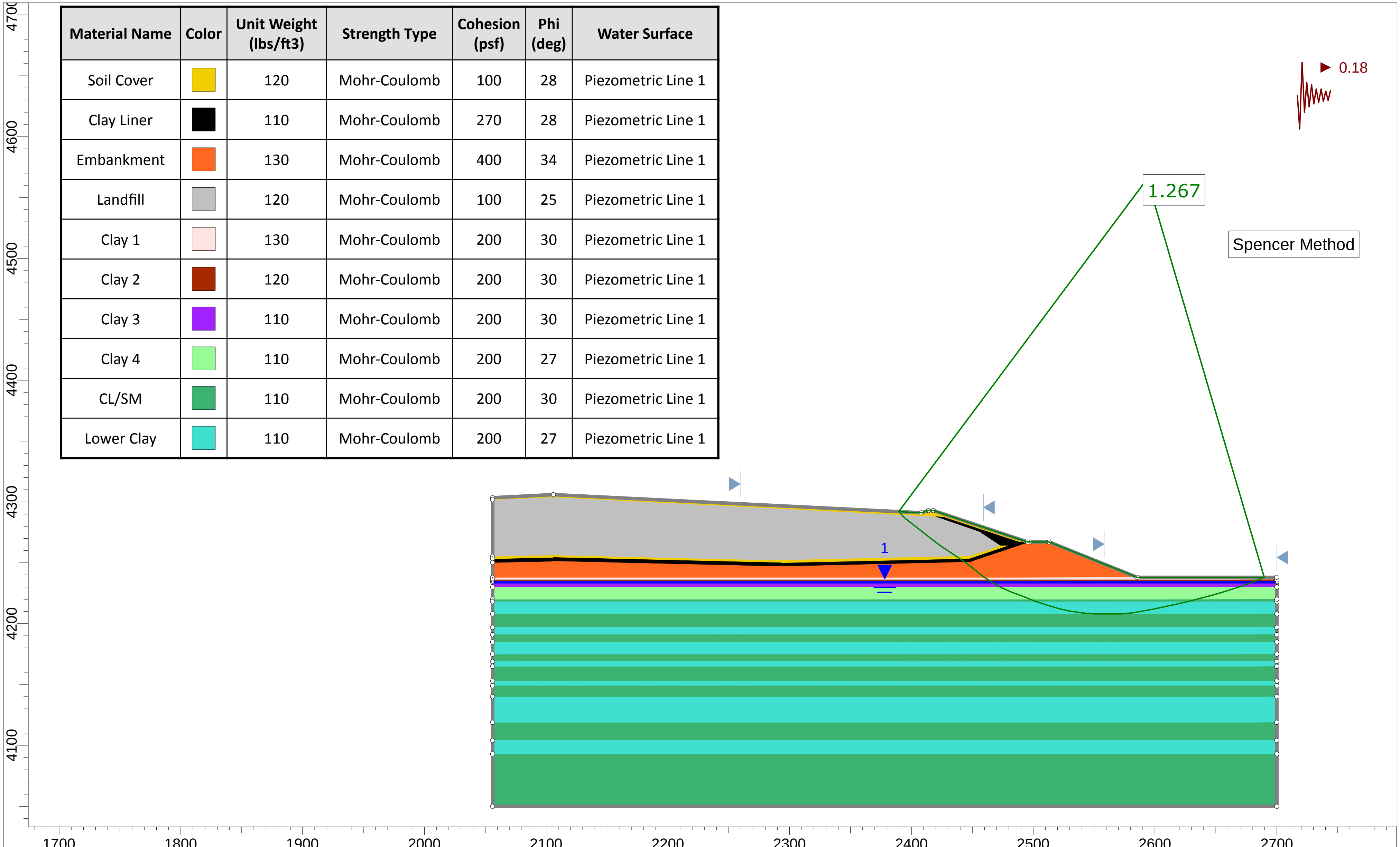
X	Y
2865.6	4236
3000	4236

APPENDIX E-3

SLOPE STABILITY

LONG TERM SEISMIC

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Soil Cover		120	Mohr-Coulomb	100	28	Piezometric Line 1
Clay Liner		110	Mohr-Coulomb	270	28	Piezometric Line 1
Embankment		130	Mohr-Coulomb	400	34	Piezometric Line 1
Landfill		120	Mohr-Coulomb	100	25	Piezometric Line 1
Clay 1		130	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 2		120	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 3		110	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 4		110	Mohr-Coulomb	200	27	Piezometric Line 1
CL/SM		110	Mohr-Coulomb	200	30	Piezometric Line 1
Lower Clay		110	Mohr-Coulomb	200	27	Piezometric Line 1



Project	SLIDE - An Interactive Slope Stability Program
Analysis Description	Cells 8 to 13 - Long Term Seismic
Drawn By	JRM
Scale	1:1308
Company	AGEC
Date	9/8/2017
File Name	1160276 Cell 8 to 13 long term seismic.slim

SLIDEINTERPRET 7.013

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	1160276 Cell 8 to 13 long term seismic
Last saved with Slide version:	7.013
Project Title:	SLIDE - An Interactive Slope Stability Program
Analysis:	Cells 8 to 13 - Long Term Seismic
Author:	JRM
Company:	AGEC
Date Created:	9/8/2017

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.18

Material Properties

Property	Soil Cover	Clay Liner	Embankment	Landfill	Clay 1	Clay 2	Clay 3	Clay 4
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	130	120	130	120	110	110
Cohesion [psf]	100	270	400	100	200	200	200	200
Friction Angle [deg]	28	28	34	25	30	30	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1	1	1	1	1	1	1

Property	CL/SM	Lower Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	110	110
Cohesion [psf]	200	200
Friction Angle [deg]	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1

List Of Coordinates

Piezoline

X	Y
2056	4234
2700	4234

External Boundary

X	Y
2056	4303.5
2056	4301.77
2056	4255.2
2056	4253.2
2056	4250.2
2056	4238
2056	4236
2056	4234
2056	4230
2056	4220
2056	4218
2056	4208
2056	4197
2056	4191
2056	4185
2056	4175
2056	4169
2056	4165
2056	4153
2056	4149
2056	4140
2056	4119
2056	4104
2056	4093
2056	4050
2700	4050
2700	4093
2700	4104
2700	4119
2700	4140
2700	4149
2700	4153
2700	4165
2700	4169
2700	4175
2700	4185
2700	4191
2700	4197
2700	4208
2700	4218
2700	4220
2700	4230
2700	4234
2700	4236
2700	4238
2585.5	4238
2513	4267
2497.5	4267
2495.5	4267
2418	4292.9
2414	4292.9
2408	4291
2106	4306

Material Boundary

X	Y
2056	4301.77
2106	4304
2420	4288
2426.5	4287.5
2488	4267
2495.5	4267

Material Boundary

X	Y
2420	4288
2455	4276
2473	4264
2479	4264
2488	4267

Material Boundary

X	Y
2056	4255.2
2106	4256.3
2292.5	4252
2447.5	4255.5
2473	4264

Material Boundary

X	Y
2056	4253.2
2106	4254.3
2292.5	4250
2447.5	4253.5
2479	4264

Material Boundary

X	Y
2056	4250.2
2106	4251.3
2292.5	4247
2448	4250.5
2497.5	4267

Material Boundary

X	Y
2056	4238
2585.5	4238

Material Boundary

X	Y
2056	4236
2700	4236

Material Boundary

X	Y
2056	4234
2700	4234

Material Boundary

X	Y
2056	4230
2700	4230

Material Boundary

X	Y
2056	4220
2700	4220

Material Boundary

X	Y
2056	4218
2700	4218

Material Boundary

X	Y
2056	4208
2700	4208

Material Boundary

X	Y
2056	4197
2700	4197

Material Boundary

X	Y
2056	4191
2700	4191

Material Boundary

X	Y
2056	4185
2700	4185

Material Boundary

X	Y
2056	4175
2700	4175

Material Boundary

X	Y
2056	4169
2700	4169

Material Boundary

X	Y
2056	4165
2700	4165

Material Boundary

X	Y
2056	4153
2700	4153

Material Boundary

X	Y
2056	4149
2700	4149

Material Boundary

X	Y
2056	4140
2700	4140

Material Boundary

X	Y
2056	4119
2700	4119

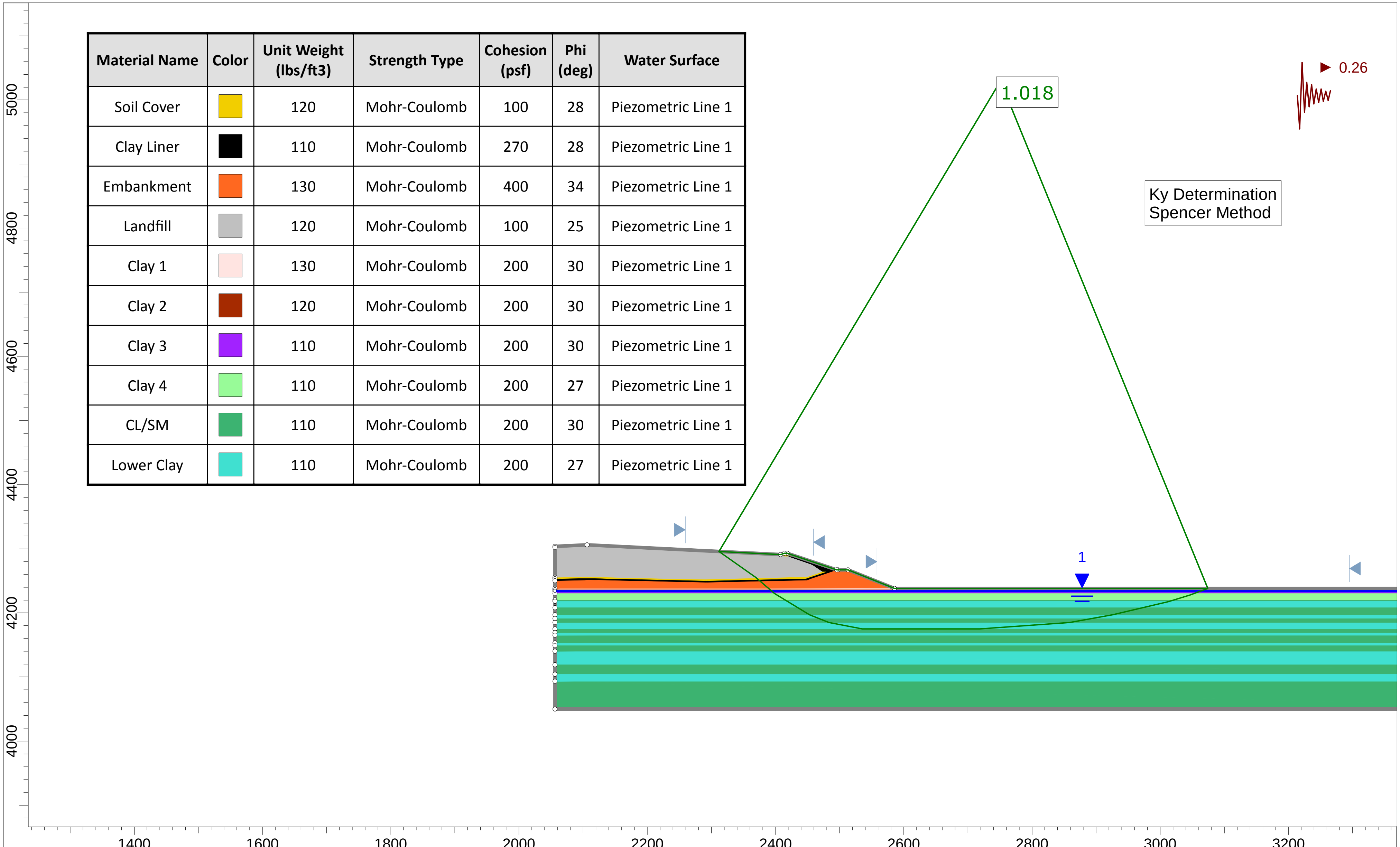
Material Boundary

X	Y
2056	4104
2700	4104

Material Boundary

X	Y
2056	4093
2700	4093

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Soil Cover		120	Mohr-Coulomb	100	28	Piezometric Line 1
Clay Liner		110	Mohr-Coulomb	270	28	Piezometric Line 1
Embankment		130	Mohr-Coulomb	400	34	Piezometric Line 1
Landfill		120	Mohr-Coulomb	100	25	Piezometric Line 1
Clay 1		130	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 2		120	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 3		110	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 4		110	Mohr-Coulomb	200	27	Piezometric Line 1
CL/SM		110	Mohr-Coulomb	200	30	Piezometric Line 1
Lower Clay		110	Mohr-Coulomb	200	27	Piezometric Line 1



Project	SLIDE - An Interactive Slope Stability Program
Analysis Description	Cells 8 to 13 - Long Term Seismic
Drawn By	JRM
Scale	1:2485
Company	AGEC
Date	9/8/2017
File Name	1160276 Cell 8 to 13 long term - determine Ky enlarged.slim

SLIDEINTERPRET 7.013

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	1160276 Cell 8 to 13 long term - determine Ky enlarged
Last saved with Slide version:	7.013
Project Title:	SLIDE - An Interactive Slope Stability Program
Analysis:	Cells 8 to 13 - Long Term Seismic
Author:	JRM
Company:	AGEC
Date Created:	9/8/2017

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.26

Material Properties

Property	Soil Cover	Clay Liner	Embankment	Landfill	Clay 1	Clay 2	Clay 3	Clay 4
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	130	120	130	120	110	110
Cohesion [psf]	100	270	400	100	200	200	200	200
Friction Angle [deg]	28	28	34	25	30	30	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1	1	1	1	1	1	1

Property	CL/SM	Lower Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	110	110
Cohesion [psf]	200	200
Friction Angle [deg]	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1

List Of Coordinates

Piezoline

X	Y
2056	4234
3700	4234

External Boundary

X	Y
2056	4303.5
2056	4301.77
2056	4255.2
2056	4253.2
2056	4250.2
2056	4238
2056	4236
2056	4234
2056	4230
2056	4220
2056	4218
2056	4208
2056	4197
2056	4191
2056	4185
2056	4175
2056	4169
2056	4165
2056	4153
2056	4149
2056	4140
2056	4119
2056	4104
2056	4093
2056	4050
3700	4050
3700	4093
3700	4104
3700	4119
3700	4140
3700	4149
3700	4153
3700	4165
3700	4169
3700	4175
3700	4185
3700	4191
3700	4197
3700	4208
3700	4218
3700	4220
3700	4230
3700	4234
3700	4236
3700	4238
2585.5	4238
2513	4267
2497.5	4267
2495.5	4267
2418	4292.9
2414	4292.9
2408	4291
2106	4306

Material Boundary

X	Y
2056	4301.77
2106	4304
2420	4288
2426.5	4287.5
2488	4267
2495.5	4267

Material Boundary

X	Y
2420	4288
2455	4276
2473	4264
2479	4264
2488	4267

Material Boundary

X	Y
2056	4255.2
2106	4256.3
2292.5	4252
2447.5	4255.5
2473	4264

Material Boundary

X	Y
2056	4253.2
2106	4254.3
2292.5	4250
2447.5	4253.5
2479	4264

Material Boundary

X	Y
2056	4250.2
2106	4251.3
2292.5	4247
2448	4250.5
2497.5	4267

Material Boundary

X	Y
2056	4238
2585.5	4238

Material Boundary

X	Y
2056	4236
3700	4236

Material Boundary

X	Y
2056	4234
3700	4234

Material Boundary

X	Y
2056	4230
3700	4230

Material Boundary

X	Y
2056	4220
3700	4220

Material Boundary

X	Y
2056	4218
3700	4218

Material Boundary

X	Y
2056	4208
3700	4208

Material Boundary

X	Y
2056	4197
3700	4197

Material Boundary

X	Y
2056	4191
3700	4191

Material Boundary

X	Y
2056	4185
3700	4185

Material Boundary

X	Y
2056	4175
3700	4175

Material Boundary

X	Y
2056	4169
3700	4169

Material Boundary

X	Y
2056	4165
3700	4165

Material Boundary

X	Y
2056	4153
3700	4153

Material Boundary

X	Y
2056	4149
3700	4149

Material Boundary

X	Y
2056	4140
3700	4140

Material Boundary

X	Y
2056	4119
3700	4119

Material Boundary

X	Y
2056	4104
3700	4104

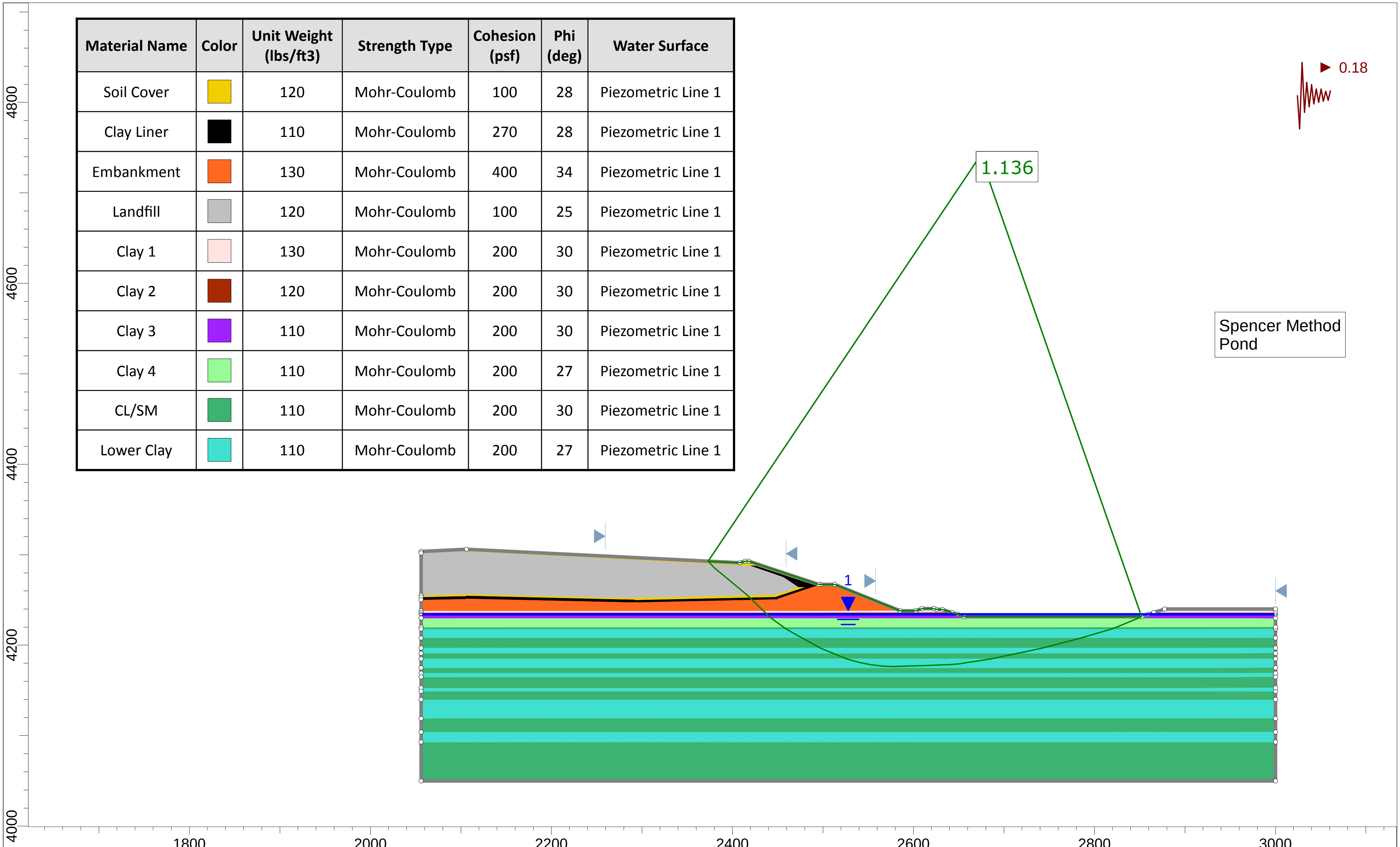
Material Boundary

X	Y
2056	4093
3700	4093

APPENDIX E-4

SLOPE STABILITY - NEAR POND

LONG TERM SEISMIC



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Soil Cover		120	Mohr-Coulomb	100	28	Piezometric Line 1
Clay Liner		110	Mohr-Coulomb	270	28	Piezometric Line 1
Embankment		130	Mohr-Coulomb	400	34	Piezometric Line 1
Landfill		120	Mohr-Coulomb	100	25	Piezometric Line 1
Clay 1		130	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 2		120	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 3		110	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 4		110	Mohr-Coulomb	200	27	Piezometric Line 1
CL/SM		110	Mohr-Coulomb	200	30	Piezometric Line 1
Lower Clay		110	Mohr-Coulomb	200	27	Piezometric Line 1

SLIDEINTERPRET 7.013

Project	SLIDE - An Interactive Slope Stability Program
Analysis Description	Cells 8 to 13 - Long Term Seismic - Pond
Drawn By	JRM
Scale	1:1761
Company	AGEC
Date	9/8/2017
File Name	1160276 Cell 8 to 13 long term seismic pond.slim

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	1160276 Cell 8 to 13 long term seismic pond
Slide Modeler Version:	7.013
Project Title:	SLIDE - An Interactive Slope Stability Program
Analysis:	Cells 8 to 13 - Long Term Seismic - Pond
Author:	JRM
Company:	AGEC
Date Created:	9/8/2017

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.18

Material Properties

Property	Soil Cover	Clay Liner	Embankment	Landfill	Clay 1	Clay 2	Clay 3	Clay 4
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	130	120	130	120	110	110
Cohesion [psf]	100	270	400	100	200	200	200	200
Friction Angle [deg]	28	28	34	25	30	30	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1	1	1	1	1	1	1

Property	CL/SM	Lower Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	110	110
Cohesion [psf]	200	200
Friction Angle [deg]	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1

Global Minimums

Method: spencer

FS	1.135850
Axis Location:	2673.843, 4741.095
Left Slip Surface Endpoint:	2373.121, 4292.732
Right Slip Surface Endpoint:	2852.100, 4231.500
Resisting Moment:	4.942e+008 lb-ft
Driving Moment:	4.35091e+008 lb-ft
Resisting Horizontal Force:	819105 lb
Driving Horizontal Force:	721135 lb
Total Slice Area:	21947.4 ft2
Surface Horizontal Width:	478.979 ft
Surface Average Height:	45.8212 ft

Global Minimum Coordinates

Method: spencer

X	Y
2373.12	4292.73
2379.68	4285.77
2393.88	4273.88
2405.48	4264.3
2417.08	4254.72
2429.59	4242.39
2442.31	4230.07
2459.31	4218.06
2468.28	4212.76
2496.88	4197.04
2512.81	4190.4
2527.36	4184.34
2540.56	4180.76
2553.39	4178.27
2565.66	4176.83
2577.45	4176.34
2616	4177.69
2641.48	4178.59
2650.16	4179.39
2662.31	4181.17
2667.73	4182.03
2686.33	4185.02
2701.16	4188.13
2715.58	4191.16
2729.39	4194.06
2742.79	4196.98
2781.44	4206.91
2785.27	4207.97
2819.14	4218.03
2825.12	4220.03
2852.1	4231.5

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 1476
Number of Invalid Surfaces: 3025

Error Codes:

Error Code -105 reported for 291 surfaces
Error Code -112 reported for 368 surfaces
Error Code -113 reported for 2348 surfaces
Error Code -116 reported for 17 surfaces
Error Code -1000 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-113 = Surface intersects outside slope limits.
-116 = Not enough slices to analyze the surface Increase the number of slices in the job control in the modeler.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.13585

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.31924	326.547	-46.7084	Soil Cover	100	28	105.939	120.331	38.2368	-3588.09	38.2368
2	4.24172	2286.75	-46.7084	Landfill	100	25	202.053	229.502	277.717	-3370.8	277.717
3	14.2015	20839.3	-39.9259	Landfill	100	25	470.589	534.518	931.829	-2859.51	931.829
4	11.596	31061.2	-39.5701	Landfill	100	25	802.153	911.126	1739.47	-2189.7	1739.47
5	11.483	44708.2	-39.5701	Landfill	100	25	1132.61	1286.47	2544.39	-1594.64	2544.39
6	0.112974	517.007	-39.5701	Soil Cover	100	28	1459.22	1657.46	2929.15	-1295.66	2929.15
7	1.88956	8850.23	-44.5701	Soil Cover	100	28	1387.37	1575.84	2775.65	-1234.67	2775.65
8	2.98644	14533.5	-44.5701	Clay Liner	270	28	1555.94	1767.32	2816.04	-1084.8	2816.04
9	7.63529	40411.3	-44.5701	Embankment	400	34	2046.16	2324.13	2852.64	-758.342	2852.64
10	4.53417	26390.6	-44.0883	Embankment	400	34	2241.77	2546.32	3182.05	-386.635	3182.05
11	2.06468	12602.8	-44.0883	Clay 1	200	30	1981.61	2250.81	3552.1	-187.2	3552.1
12	2.06468	12948.5	-44.0883	Clay 2	200	30	2032.25	2308.33	3651.73	-62.4	3651.73
13	4.0595	26327.1	-44.0883	Clay 3	200	30	2048.79	2327.12	3806.97	122.689	3684.28
14	14.2511	98276.9	-35.2393	Clay 4	200	27	2077.18	2359.37	4797.48	559.489	4238
15	2.751	19889.6	-35.2393	CL/SM	200	30	2244.54	2549.46	5003.64	934.235	4069.41
16	8.96459	66275.6	-30.5583	Lower Clay	200	27	2134.23	2424.16	5525.16	1160.01	4365.15
17	8.66491	65841.4	-28.8008	Lower Clay	200	27	2127.97	2417.06	5824.99	1473.77	4351.22
18	19.9357	159461	-28.8008	CL/SM	200	30	2287.86	2598.67	6118.99	1964.35	4154.64
19	0.095796	798.362	-22.616	CL/SM	200	30	2479.35	2816.17	6838.88	2307.55	4531.33
20	14.4027	124871	-22.616	Lower Clay	200	27	2269.26	2577.54	7162.18	2496	4666.18
21	1.43289	12943	-22.616	CL/SM	200	30	2578.9	2929.24	7429.01	2701.82	4727.19
22	12.9698	117189	-22.616	CL/SM	200	30	2491.72	2830.22	7444.7	2889.02	4555.68
23	1.58581	14257.4	-22.616	Lower Clay	200	27	2141.51	2432.43	7459.61	3078.21	4381.4
24	13.1914	116609	-15.1944	Lower Clay	200	27	2263.22	2570.68	7863.34	3210.6	4652.74
25	12.8371	109074	-10.9589	Lower Clay	200	27	2176.4	2472.06	7859.09	3399.93	4459.16
26	12.2713	98906.5	-6.70049	Lower Clay	200	27	2070.23	2351.47	7744.97	3522.47	4222.5
27	11.7817	88846.4	-2.39821	Lower Clay	200	27	1945.36	2209.64	7526.99	3582.84	3944.15
28	19.2782	132888	2.01703	Lower Clay	200	27	1779.43	2021.16	7151.27	3577.06	3574.21
29	19.2782	133045	2.01703	Lower Clay	200	27	1805.25	2050.49	7166.46	3534.69	3631.77
30	25.4793	173394	2.01711	Lower Clay	200	27	1782.93	2025.14	7067.56	3485.51	3582.05
31	8.67627	53469.5	5.28622	Lower Clay	200	27	1587.21	1802.83	6578.19	3432.46	3145.73
32	12.1484	69092.3	8.30829	Lower Clay	200	27	1470.56	1670.34	6237.77	3352.07	2885.7
33	5.42382	29773.3	8.98565	Lower Clay	200	27	1428.02	1622.02	6060.84	3269.96	2790.88
34	18.5022	97665.3	9.13252	Lower Clay	200	27	1382.5	1570.31	5839.79	3150.4	2689.39
35	0.0957966	489.918	9.13252	CL/SM	200	30	1541.72	1751.16	5743.81	3057.12	2686.69
36	14.8313	73294.7	11.8682	CL/SM	200	30	1594.52	1811.14	5749.97	2959.39	2790.58
37	13.6459	62945	11.8682	CL/SM	200	30	1496.86	1700.21	5371.12	2772.67	2598.45
38	0.778011	3459.04	11.8682	Lower Clay	200	27	1256.8	1427.54	5087.28	2678.1	2409.18
39	13.8049	59049.8	11.8682	Lower Clay	200	27	1214.29	1379.25	4896.89	2582.48	2314.41
40	13.3988	53029.9	12.2563	Lower Clay	200	27	1143.37	1298.7	4557.46	2401.15	2156.31
41	0.0957999	363.69	14.421	Lower Clay	200	27	1157.33	1314.55	4497	2309.57	2187.43
42	38.5538	125289	14.421	CL/SM	200	30	1163.84	1321.95	3942.74	1999.48	1943.26
43	3.83544	10149.7	15.4149	CL/SM	200	30	997.56	1133.08	3273.32	1657.17	1616.15
44	0.0958202	247.845	16.5378	CL/SM	200	30	1007.45	1144.31	3258.87	1623.29	1635.58
45	33.6777	68534.2	16.5378	Lower Clay	200	27	719.012	816.69	2520.72	1310.4	1210.32
46	0.0957965	142.108	16.5378	CL/SM	200	30	636.627	723.113	1903.57	997.513	906.061
47	5.88541	8083.23	18.5204	CL/SM	200	30	631.936	717.784	1831.94	935.113	896.829
48	0.0958562	121.089	18.5204	Clay 4	200	27	524.268	595.49	1648.79	872.598	776.193
49	23.4486	16724.3	23.0301	Clay 4	200	27	401.525	456.072	1063.17	560.598	502.57
50	3.52862	291.111	23.0301	Clay 3	200	30	190.523	216.406	231.216	202.8	28.4163

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.13585

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2373.12	4292.73	0	0	0
2	2375.44	4290.27	-92.7861	-22.9376	13.8857
3	2379.68	4285.77	712.209	176.065	13.8857
4	2393.88	4273.88	8855.21	2189.09	13.8857
5	2405.48	4264.3	21813.6	5392.52	13.8856
6	2416.96	4254.81	41000.4	10135.7	13.8857
7	2417.08	4254.72	41202	10185.5	13.8856
8	2418.97	4252.86	45340.2	11208.5	13.8856
9	2421.95	4249.91	51594.3	12754.6	13.8857
10	2429.59	4242.39	64701.7	15994.9	13.8857
11	2434.12	4238	73263.4	18111.4	13.8857
12	2436.19	4236	78544.8	19417	13.8857
13	2438.25	4234	83983	20761.4	13.8857
14	2442.31	4230.07	95375.1	23577.6	13.8856
15	2456.56	4220	131763	32573	13.8856
16	2459.31	4218.06	138892	34335.5	13.8857
17	2468.28	4212.76	160933	39784.2	13.8857
18	2476.94	4208	182095	45015.6	13.8857
19	2496.88	4197.04	232252	57415	13.8857
20	2496.97	4197	232431	57459.3	13.8857
21	2511.38	4191	265198	65559.4	13.8857
22	2512.81	4190.4	268267	66318.1	13.8857
23	2525.78	4185	297268	73487.5	13.8857
24	2527.36	4184.34	301366	74500.7	13.8857
25	2540.56	4180.76	320673	79273.3	13.8856
26	2553.39	4178.27	331903	82049.6	13.8857
27	2565.66	4176.83	335467	82930.8	13.8857
28	2577.45	4176.34	332254	82136.4	13.8857
29	2596.72	4177.01	317015	78369.1	13.8857
30	2616	4177.69	301296	74483.1	13.8856
31	2641.48	4178.59	280737	69400.8	13.8857
32	2650.16	4179.39	271309	67070.3	13.8857
33	2662.31	4181.17	254815	62992.7	13.8857
34	2667.73	4182.03	247231	61117.8	13.8857
35	2686.23	4185	221862	54846.4	13.8857
36	2686.33	4185.02	221714	54809.8	13.8857
37	2701.16	4188.13	193336	47794.6	13.8857
38	2714.81	4191	168837	41738.2	13.8857
39	2715.58	4191.16	167650	41444.8	13.8857
40	2729.39	4194.06	147310	36416.4	13.8857
41	2742.79	4196.98	128270	31709.5	13.8856
42	2742.88	4197	128114	31670.9	13.8856
43	2781.44	4206.91	66707	16490.6	13.8857
44	2785.27	4207.97	61246.3	15140.7	13.8857
45	2785.37	4208	61101.6	15104.9	13.8857
46	2819.05	4218	24016	5936.98	13.8857
47	2819.14	4218.03	23926.4	5914.84	13.8857
48	2825.03	4220	18050.4	4462.24	13.8857
49	2825.12	4220.03	17969	4442.12	13.8857
50	2848.57	4230	966.707	238.979	13.8857
51	2852.1	4231.5	0	0	0

List Of Coordinates

Piezoline

X	Y
2056	4234
3000	4234

External Boundary

X	Y
2056	4303.5
2056	4301.77
2056	4255.2
2056	4253.2
2056	4250.2
2056	4238
2056	4236
2056	4234
2056	4230
2056	4220
2056	4218
2056	4208
2056	4197
2056	4191
2056	4185
2056	4175
2056	4169
2056	4165
2056	4153
2056	4149
2056	4140
2056	4119
2056	4104
2056	4093
2056	4050
3000	4050
3000	4093
3000	4104
3000	4119
3000	4140
3000	4149
3000	4153
3000	4165
3000	4169
3000	4175
3000	4185
3000	4191
3000	4197
3000	4208
3000	4218
3000	4220
3000	4230
3000	4234
3000	4236
3000	4240
2877.6	4240
2865.6	4236
2859.6	4234
2852.1	4231.5
2656.1	4231.5
2648.6	4234
2642.6	4236
2632.1	4239.5
2625.5	4239.5
2622.5	4240.5
2609.3	4240.5
2602.5	4238
2585.5	4238
2513	4267
2497.5	4267

2495.5	4267
2418	4292.9
2414	4292.9
2408	4291
2106	4306

Material Boundary

X	Y
2056	4301.77
2106	4304
2420	4288
2426.5	4287.5
2488	4267
2495.5	4267

Material Boundary

X	Y
2420	4288
2455	4276
2473	4264
2479	4264
2488	4267

Material Boundary

X	Y
2056	4255.2
2106	4256.3
2292.5	4252
2447.5	4255.5
2473	4264

Material Boundary

X	Y
2056	4253.2
2106	4254.3
2292.5	4250
2447.5	4253.5
2479	4264

Material Boundary

X	Y
2056	4250.2
2106	4251.3
2292.5	4247
2448	4250.5
2497.5	4267

Material Boundary

X	Y
2056	4238
2585.5	4238

Material Boundary

X	Y
2056	4236
2642.6	4236

Material Boundary

X	Y
2056	4234
2648.6	4234

Material Boundary

X	Y
2056	4230
3000	4230

Material Boundary

X	Y
2056	4220
3000	4220

Material Boundary

X	Y
2056	4218
3000	4218

Material Boundary

X	Y
2056	4208
3000	4208

Material Boundary

X	Y
2056	4197
3000	4197

Material Boundary

X	Y
2056	4191
3000	4191

Material Boundary

X	Y
2056	4185
3000	4185

Material Boundary

X	Y
2056	4175
3000	4175

Material Boundary

X	Y
2056	4169
3000	4169

Material Boundary

X	Y
2056	4165
3000	4165

Material Boundary

X	Y
2056	4153
3000	4153

Material Boundary

X	Y
2056	4149
3000	4149

Material Boundary

X	Y
2056	4140
3000	4140

Material Boundary

X	Y
2056	4119
3000	4119

Material Boundary

X	Y
2056	4104
3000	4104

Material Boundary

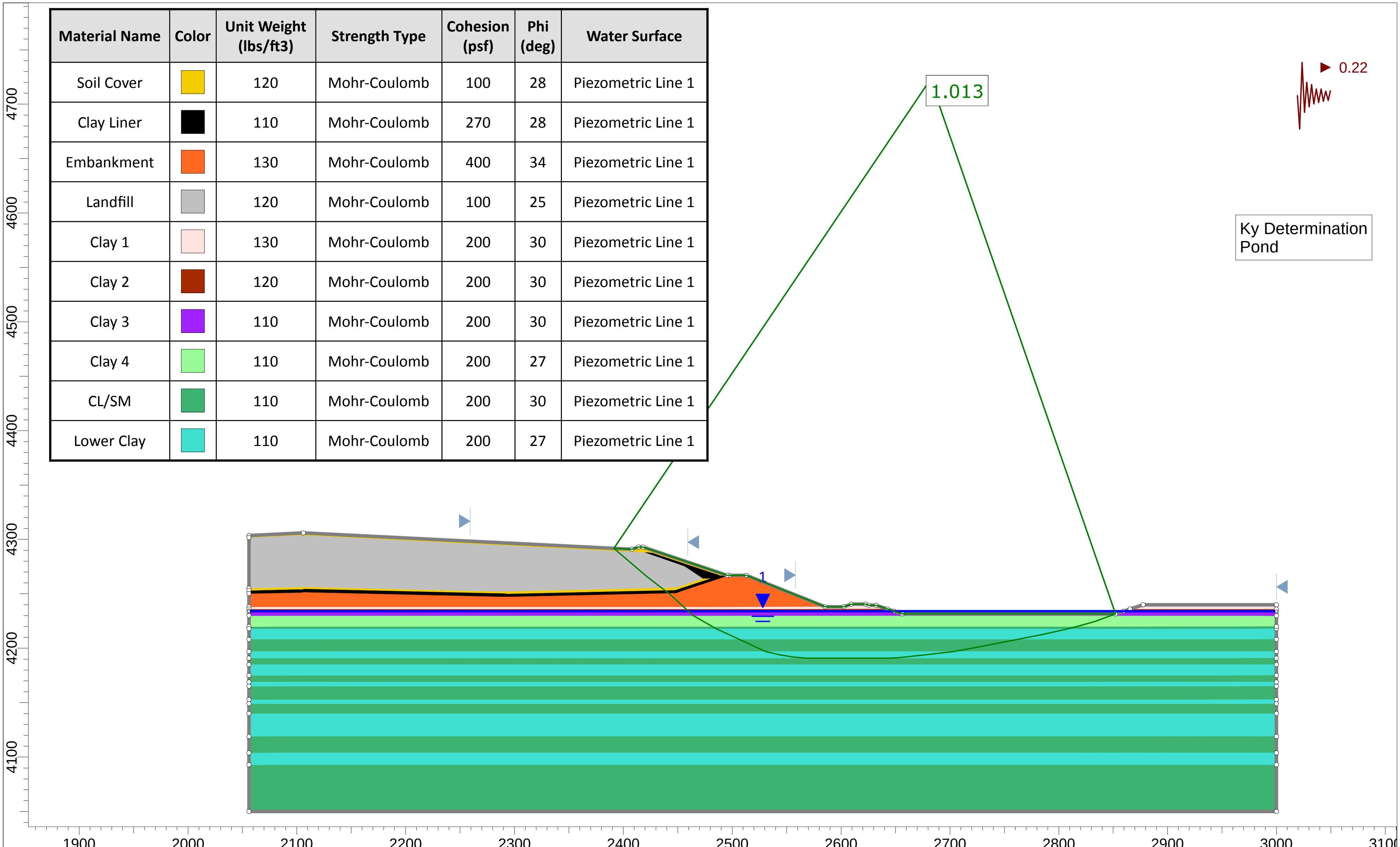
X	Y
2056	4093
3000	4093

Material Boundary

X	Y
2859.6	4234
3000	4234

Material Boundary

X	Y
2865.6	4236
3000	4236



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Soil Cover		120	Mohr-Coulomb	100	28	Piezometric Line 1
Clay Liner		110	Mohr-Coulomb	270	28	Piezometric Line 1
Embankment		130	Mohr-Coulomb	400	34	Piezometric Line 1
Landfill		120	Mohr-Coulomb	100	25	Piezometric Line 1
Clay 1		130	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 2		120	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 3		110	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 4		110	Mohr-Coulomb	200	27	Piezometric Line 1
CL/SM		110	Mohr-Coulomb	200	30	Piezometric Line 1
Lower Clay		110	Mohr-Coulomb	200	27	Piezometric Line 1

rocscience

SLIDEINTERPRET 7.013

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	Cells 8 to 13 - Determine Ky - Pond		
Drawn By	JRM	*Scale* 1:1464	*Company* AGEC
Date	9/8/2017	*File Name*	1160276 Cell 8 to 13 Determine Ky pond.slim

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	1160276 Cell 8 to 13 Determine Ky pond
Slide Modeler Version:	7.013
Project Title:	SLIDE - An Interactive Slope Stability Program
Analysis:	Cells 8 to 13 - Determine Ky - Pond
Author:	JRM
Company:	AGEC
Date Created:	9/8/2017

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.22

Material Properties

Property	Soil Cover	Clay Liner	Embankment	Landfill	Clay 1	Clay 2	Clay 3	Clay 4
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	130	120	130	120	110	110
Cohesion [psf]	100	270	400	100	200	200	200	200
Friction Angle [deg]	28	28	34	25	30	30	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1	1	1	1	1	1	1

Property	CL/SM	Lower Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	110	110
Cohesion [psf]	200	200
Friction Angle [deg]	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1

Global Minimums

Method: spencer

FS	1.013340
Axis Location:	2681.986, 4722.564
Left Slip Surface Endpoint:	2391.203, 4291.834
Right Slip Surface Endpoint:	2852.100, 4231.500
Resisting Moment:	3.67337e+008 lb-ft
Driving Moment:	3.62503e+008 lb-ft
Resisting Horizontal Force:	644465 lb
Driving Horizontal Force:	635983 lb
Total Slice Area:	16691.5 ft2
Surface Horizontal Width:	460.897 ft
Surface Average Height:	36.2153 ft

Global Minimum Coordinates

Method: spencer

X	Y
2391.2	4291.83
2421.96	4265.55
2441.93	4250.29
2464.23	4230.05
2485.1	4218.04
2507.83	4207.54
2530.45	4197.02
2543.47	4193.92
2555.99	4191.94
2567.99	4191
2620.11	4191
2645.43	4191
2652.77	4191.38
2677.43	4193.93
2703.84	4197.01
2727.94	4201.4
2743.83	4204.45
2785.27	4212.68
2803.51	4216.71
2816.85	4220.02
2832.75	4224.52
2852.1	4231.5

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 1431
Number of Invalid Surfaces: 3070

Error Codes:

Error Code -105 reported for 292 surfaces
Error Code -112 reported for 371 surfaces
Error Code -113 reported for 2388 surfaces
Error Code -116 reported for 16 surfaces
Error Code -1000 reported for 3 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-113 = Surface intersects outside slope limits.
-116 = Not enough slices to analyze the surface Increase the number of slices in the job control in the modeler.
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.01334

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.94518	418.93	-40.5178	Soil Cover	100	28	124.799	126.464	49.7717	-3530.33	49.7717
2	9.26896	6786.25	-40.5178	Landfill	100	25	291.701	295.592	419.449	-3204.65	419.449
3	9.26896	15567.7	-40.5178	Landfill	100	25	563.996	571.52	1011.18	-2710.35	1011.18
4	9.26896	25660.4	-40.5178	Landfill	100	25	876.954	888.653	1691.27	-2216.06	1691.27
5	13.5098	46690.8	-37.3888	Landfill	100	25	1122.8	1137.78	2225.52	-1646.78	2225.52
6	2.54185	9830.7	-37.3888	Soil Cover	100	28	1379.58	1397.98	2441.14	-1264.03	2441.14
7	3.91873	15747.6	-37.3888	Clay Liner	270	28	1568.87	1589.8	2482.18	-1109.98	2482.18
8	13.5442	62833.8	-42.2223	Embankment	400	34	2030.32	2057.4	2457.19	-633.071	2457.19
9	2.20397	11610.1	-42.2223	Clay 1	200	30	1902.41	1927.79	2992.62	-187.2	2992.62
10	2.20397	11966.3	-42.2223	Clay 2	200	30	1956.07	1982.16	3086.79	-62.4	3086.79
11	4.34948	24509.8	-42.2223	Clay 3	200	30	1969.8	1996.08	3234.05	123.145	3110.91
12	8.73593	51247.3	-29.9155	Clay 4	200	27	2109.86	2138.01	4206.69	403.118	3803.57
13	8.73593	53281.4	-29.9155	Clay 4	200	27	2054.08	2081.48	4409.39	716.773	3692.62
14	3.40195	21410.4	-29.9155	CL/SM	200	30	2239.66	2269.54	4519.23	934.672	3584.56
15	10.8731	70166.2	-24.788	Lower Clay	200	27	2142	2170.57	5019.88	1152.41	3867.47
16	10.8731	74514.3	-24.788	Lower Clay	200	27	2150.99	2179.68	5351.08	1465.74	3885.34
17	0.986582	7059.05	-24.788	CL/SM	200	30	2430.86	2463.29	5556.74	1636.62	3920.12
18	11.3065	83473.4	-24.9538	CL/SM	200	30	2430.09	2462.51	5733.76	1814.98	3918.78
19	11.3065	84063.3	-24.9538	CL/SM	200	30	2281.75	2312.19	5801.69	2143.28	3658.41
20	13.0262	94601.7	-13.4063	Lower Clay	200	27	2245.61	2275.57	6477.82	2404.3	4073.52
21	12.5167	86084.9	-8.95791	Lower Clay	200	27	2143.39	2171.98	6432.96	2562.73	3870.23
22	12.0036	76829.6	-4.49747	Lower Clay	200	27	2017.76	2044.68	6274.14	2653.74	3620.4
23	10.4237	61180	2.08968e-009	Lower Clay	200	27	1882.09	1907.2	6033.78	2683.2	3350.58
24	10.4237	55820.2	2.02969e-009	Lower Clay	200	27	1599.89	1621.23	5472.53	2683.2	2789.33
25	10.4237	54515.7	2.08968e-009	Lower Clay	200	27	1531.2	1551.63	5335.92	2683.2	2652.72
26	10.4237	55746.7	2.08968e-009	Lower Clay	200	27	1596.02	1617.31	5464.82	2683.2	2781.62
27	10.4237	57903.4	2.08968e-009	Lower Clay	200	27	1709.57	1732.38	5690.66	2683.2	3007.46
28	12.6588	69170	-1.71082e-008	Lower Clay	200	27	1659.72	1681.86	5591.52	2683.2	2908.32
29	12.6588	64847.9	-1.71123e-008	Lower Clay	200	27	1472.34	1491.98	5218.85	2683.2	2535.65
30	7.3433	34461.4	2.97996	Lower Clay	200	27	1325.36	1343.04	4914.61	2671.27	2243.34
31	12.3292	53748.8	5.88865	Lower Clay	200	27	1244.52	1261.12	4702.24	2619.67	2082.57
32	12.3292	51821.2	5.88865	Lower Clay	200	27	1199.56	1215.56	4533.47	2540.32	1993.15
33	8.80323	35887.5	6.66322	Lower Clay	200	27	1189.32	1205.19	4441.35	2468.56	1972.79
34	8.80323	34891.6	6.66322	Lower Clay	200	27	1160.47	1175.95	4319.8	2404.39	1915.41
35	8.80323	33895.7	6.66322	Lower Clay	200	27	1131.62	1146.72	4198.25	2340.21	1858.04
36	12.0507	44263.8	10.3205	CL/SM	200	30	1369.15	1387.41	4296.31	2239.66	2056.65
37	12.0507	41354.9	10.3205	CL/SM	200	30	1289.01	1306.21	4018.74	2102.73	1916.01
38	15.8847	49926.5	10.8832	CL/SM	200	30	1212.14	1228.31	3720.06	1938.97	1781.09
39	8.92923	25694.4	11.2314	CL/SM	200	30	1133.61	1148.73	3431.61	1788.36	1643.25
40	8.92923	23952.8	11.2314	CL/SM	200	30	1067.09	1081.33	3204.23	1677.72	1526.51
41	11.7934	28966.9	11.2314	Lower Clay	200	27	865.135	876.676	2877.39	1549.33	1328.06
42	11.7934	25928.9	11.2314	Lower Clay	200	27	791.116	801.669	2584.04	1403.2	1180.84
43	9.12076	17867.8	12.4507	Lower Clay	200	27	744.464	754.395	2355.36	1267.3	1088.06
44	9.12076	15847.4	12.4507	Lower Clay	200	27	678.639	687.692	2098.79	1141.64	957.149
45	5.19154	8077.4	13.9404	Lower Clay	200	27	648.48	657.131	1935.77	1038.61	897.159
46	8.05728	11078.8	13.9404	CL/SM	200	30	670	678.938	1765.55	936	829.547
47	0.0925293	116.933	13.9404	Clay 4	200	27	557.922	565.365	1589.95	872.883	717.072
48	15.891	16131.9	15.8	Clay 4	200	27	503.873	510.595	1341.45	731.87	609.577
49	15.1953	7087.38	19.8323	Clay 4	200	27	358.726	363.511	741.492	420.586	320.906
50	4.15905	343.122	19.8323	Clay 3	200	30	219.826	222.759	242.219	202.8	39.4194

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.01334

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2391.2	4291.83	0	0	0
2	2394.15	4289.32	-150.117	-41.7766	15.5515
3	2403.42	4281.4	1961.71	545.931	15.5515
4	2412.69	4273.47	8168.88	2273.34	15.5515
5	2421.96	4265.55	19082.9	5310.65	15.5515
6	2435.46	4255.23	37164.2	10342.5	15.5515
7	2438.01	4253.29	40562.4	11288.3	15.5516
8	2441.93	4250.29	45312.8	12610.2	15.5515
9	2455.47	4238	61837.9	17209.1	15.5516
10	2457.67	4236	66184.5	18418.7	15.5515
11	2459.88	4234	70679.5	19669.6	15.5515
12	2464.23	4230.05	80268.7	22338.2	15.5515
13	2472.96	4225.03	94256.4	26230.9	15.5515
14	2481.7	4220	110198	30667.3	15.5515
15	2485.1	4218.04	116135	32319.6	15.5515
16	2495.97	4213.02	133488	37148.7	15.5515
17	2506.85	4208	153362	42679.6	15.5515
18	2507.83	4207.54	155049	43149	15.5515
19	2519.14	4202.28	176103	49008.4	15.5516
20	2530.45	4197.02	199323	55470.1	15.5515
21	2543.47	4193.92	210995	58718.6	15.5516
22	2555.99	4191.94	215798	60055.2	15.5515
23	2567.99	4191	214404	59667.2	15.5515
24	2578.42	4191	208245	57953.2	15.5515
25	2588.84	4191	203849	56729.8	15.5515
26	2599.26	4191	199882	55625.7	15.5515
27	2609.69	4191	195510	54409	15.5515
28	2620.11	4191	190428	52994.9	15.5515
29	2632.77	4191	184635	51382.8	15.5516
30	2645.43	4191	180264	50166.2	15.5515
31	2652.77	4191.38	176234	49044.8	15.5515
32	2665.1	4192.65	166735	46401.3	15.5515
33	2677.43	4193.93	157581	43853.9	15.5516
34	2686.23	4194.95	150439	41866.2	15.5515
35	2695.04	4195.98	143457	39923.1	15.5515
36	2703.84	4197.01	136635	38024.5	15.5515
37	2715.89	4199.21	120445	33519.1	15.5516
38	2727.94	4201.4	105191	29273.9	15.5515
39	2743.83	4204.45	85558.7	23810.4	15.5515
40	2752.76	4206.23	75004.6	20873.3	15.5515
41	2761.68	4208	65064.4	18107	15.5515
42	2773.48	4210.34	54495.7	15165.8	15.5515
43	2785.27	4212.68	44818.6	12472.7	15.5515
44	2794.39	4214.7	37216.2	10357	15.5515
45	2803.51	4216.71	30286.4	8428.5	15.5515
46	2808.7	4218	26202.2	7291.91	15.5516
47	2816.76	4220	19710.1	5485.18	15.5515
48	2816.85	4220.02	19647.7	5467.81	15.5515
49	2832.75	4224.52	9157.49	2548.47	15.5515
50	2847.94	4230	1202.11	334.54	15.5516
51	2852.1	4231.5	0	0	0

List Of Coordinates

Piezoline

X	Y
2056	4234
3000	4234

External Boundary

X	Y
2056	4303.5
2056	4301.77
2056	4255.2
2056	4253.2
2056	4250.2
2056	4238
2056	4236
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2056	4218
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2056	4093
2056	4050
3000	4050
3000	4093
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3000	4165
3000	4169
3000	4175
3000	4185
3000	4191
3000	4197
3000	4208
3000	4218
3000	4220
3000	4230
3000	4234
3000	4236
3000	4240
2877.6	4240
2865.6	4236
2859.6	4234
2852.1	4231.5
2656.1	4231.5
2648.6	4234
2642.6	4236
2632.1	4239.5
2625.5	4239.5
2622.5	4240.5
2609.3	4240.5
2602.5	4238
2585.5	4238
2513	4267
2497.5	4267
2495.5	4267

2418	4292.9
2414	4292.9
2408	4291
2106	4306

Material Boundary

X	Y
2056	4301.77
2106	4304
2420	4288
2426.5	4287.5
2488	4267
2495.5	4267

Material Boundary

X	Y
2420	4288
2455	4276
2473	4264
2479	4264
2488	4267

Material Boundary

X	Y
2056	4255.2
2106	4256.3
2292.5	4252
2447.5	4255.5
2473	4264

Material Boundary

X	Y
2056	4253.2
2106	4254.3
2292.5	4250
2447.5	4253.5
2479	4264

Material Boundary

X	Y
2056	4250.2
2106	4251.3
2292.5	4247
2448	4250.5
2497.5	4267

Material Boundary

X	Y
2056	4238
2585.5	4238

Material Boundary

X	Y
2056	4236
2642.6	4236

Material Boundary

X	Y
2056	4234
2648.6	4234

Material Boundary

X	Y
2056	4230
3000	4230

Material Boundary

X	Y
2056	4220
3000	4220

Material Boundary

X	Y
2056	4218
3000	4218

Material Boundary

X	Y
2056	4208
3000	4208

Material Boundary

X	Y
2056	4197
3000	4197

Material Boundary

X	Y
2056	4191
3000	4191

Material Boundary

X	Y
2056	4185
3000	4185

Material Boundary

X	Y
2056	4175
3000	4175

Material Boundary

X	Y
2056	4169
3000	4169

Material Boundary

X	Y
2056	4165
3000	4165

Material Boundary

X	Y
2056	4153
3000	4153

Material Boundary

X	Y
2056	4149
3000	4149

Material Boundary

X	Y
2056	4140
3000	4140

Material Boundary

X	Y
2056	4119
3000	4119

Material Boundary

X	Y
2056	4104
3000	4104

Material Boundary

X	Y
2056	4093
3000	4093

Material Boundary

X	Y
2859.6	4234
3000	4234

Material Boundary

X	Y
2865.6	4236
3000	4236

APPENDIX E-5

SIMPLIFIED DEFORMATION ANALYSIS

AGEC
Applied GeoTech

PROJECT NO. 1160276 TITLE Cells 8-13 DATE 9/6/17 BY JRM

SUBJECT Simplified Deformation SHEET 1 OF 2

Based on Bray and Travasarou, 2007

Consider a range of periods for the landfill

T_s = 0.05 sec		1.5 T_s = 0.075 sec
0.5		0.75
1.0		1.5
1.5		2.25

From pseudostatic stability analysis $K_y = 0.26$ g

From Site Response Analysis

T	S
0.075 s	0.2 g
0.75	0.55
1.5	0.38
2.25 s	0.2

Based on:

$$\ln(D) = -1.10 - 2.83\ln(k_y) - 0.333(\ln(k_y))^2 + 0.566\ln(k_y)\ln(S_a(1.5T_s)) + 3.04\ln(S_a(1.5T_s)) - 0.244(\ln(S_a(1.5T_s)))^2 + 1.50T_s + 0.278(M-7) \pm \varepsilon$$

M	6.2
Ky	0.26 g
Eps	0.66

Ts (sec)	1.5Ts (sec)	Sa(1.5Ts) (g)	D (cm)	D -eps (cm)	D + eps (cm)
0.1	0.08	0.20	0.1	0.0	0.2
0.5	0.75	0.55	3.3	1.7	6.3
1.0	1.50	0.38	2.6	1.3	5.0
1.5	2.25	0.20	0.9	0.4	1.6

Estimated deformation max. 6 cm = 2½ inches

AGEC

Applied GeoTech

PROJECT NO. 1160276 TITLE Cells 8-13 DATE 9/8/17 BY JRy

SUBJECT Simplified Deformation SHEET 2 OF 2

Cell 12 - next to pond

Ky = 0.22g

M	6.2
Ky	0.22 g
Eps	0.66

Ts (sec)	1.5Ts (sec)	Sa(1.5Ts) (g)	D (cm)	D -eps (cm)	D + eps (cm)
0.1	0.08	0.20	0.2	0.1	0.3
0.5	0.75	0.55	4.7	2.5	9.2
1.0	1.50	0.38	3.9	2.0	7.5
1.5	2.25	0.20	1.4	0.7	2.6

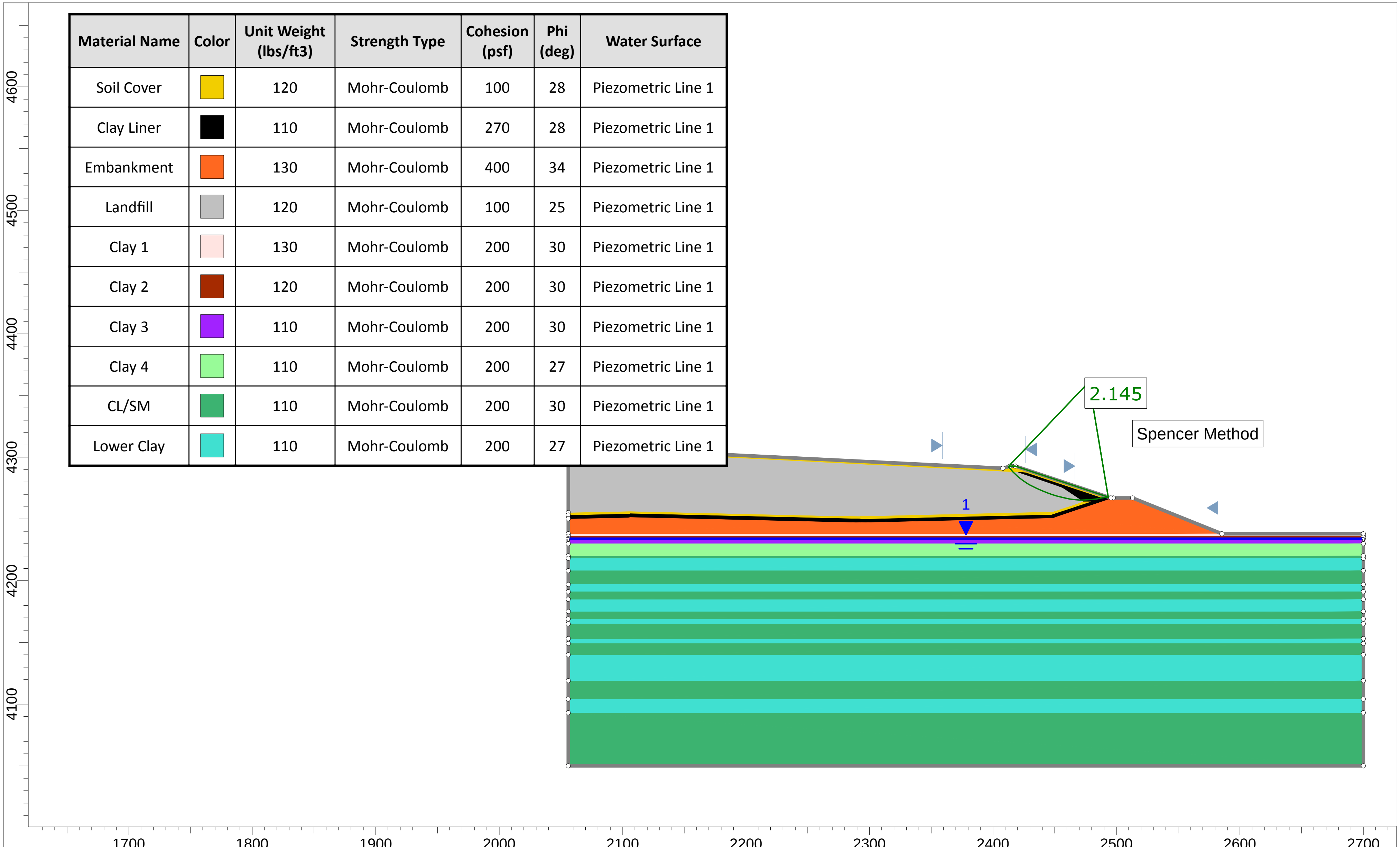
Estimated deformation max 9 cm = 3½ inches

APPENDIX E-6

SLOPE STABILITY - CLOSURE CAP

LONG TERM STATIC

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Soil Cover		120	Mohr-Coulomb	100	28	Piezometric Line 1
Clay Liner		110	Mohr-Coulomb	270	28	Piezometric Line 1
Embankment		130	Mohr-Coulomb	400	34	Piezometric Line 1
Landfill		120	Mohr-Coulomb	100	25	Piezometric Line 1
Clay 1		130	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 2		120	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 3		110	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 4		110	Mohr-Coulomb	200	27	Piezometric Line 1
CL/SM		110	Mohr-Coulomb	200	30	Piezometric Line 1
Lower Clay		110	Mohr-Coulomb	200	27	Piezometric Line 1



Project	SLIDE - An Interactive Slope Stability Program
Analysis Description	Cells 8 to 13 - Long Term Static (Cap)
Drawn By	JRM
Scale	1:1291
Company	AGEC
Date	9/8/2017
File Name	1160276 Cell 8 to 13 cap - long term static.slim

SLIDEINTERPRET 7.013

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	1160276 Cell 8 to 13 cap - long term static
Last saved with Slide version:	7.013
Project Title:	SLIDE - An Interactive Slope Stability Program
Analysis:	Cells 8 to 13 - Long Term Static (Cap)
Author:	JRM
Company:	AGEC
Date Created:	9/8/2017

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Material Properties

Property	Soil Cover	Clay Liner	Embankment	Landfill	Clay 1	Clay 2	Clay 3	Clay 4
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	130	120	130	120	110	110
Cohesion [psf]	100	270	400	100	200	200	200	200
Friction Angle [deg]	28	28	34	25	30	30	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1	1	1	1	1	1	1

Property	CL/SM	Lower Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	110	110
Cohesion [psf]	200	200
Friction Angle [deg]	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1

List Of Coordinates

Piezoline

X	Y
2056	4234
2700	4234

External Boundary

X	Y
2056	4303.5
2056	4301.77
2056	4255.2
2056	4253.2
2056	4250.2
2056	4238
2056	4236
2056	4234
2056	4230
2056	4220
2056	4218
2056	4208
2056	4197
2056	4191
2056	4185
2056	4175
2056	4169
2056	4165
2056	4153
2056	4149
2056	4140
2056	4119
2056	4104
2056	4093
2056	4050
2700	4050
2700	4093
2700	4104
2700	4119
2700	4140
2700	4149
2700	4153
2700	4165
2700	4169
2700	4175
2700	4185
2700	4191
2700	4197
2700	4208
2700	4218
2700	4220
2700	4230
2700	4234
2700	4236
2700	4238
2585.5	4238
2513	4267
2497.5	4267
2495.5	4267
2418	4292.9
2414	4292.9
2408	4291
2106	4306

Material Boundary

X	Y
2056	4301.77
2106	4304
2420	4288
2426.5	4287.5
2488	4267
2495.5	4267

Material Boundary

X	Y
2420	4288
2455	4276
2473	4264
2479	4264
2488	4267

Material Boundary

X	Y
2056	4255.2
2106	4256.3
2292.5	4252
2447.5	4255.5
2473	4264

Material Boundary

X	Y
2056	4253.2
2106	4254.3
2292.5	4250
2447.5	4253.5
2479	4264

Material Boundary

X	Y
2056	4250.2
2106	4251.3
2292.5	4247
2448	4250.5
2497.5	4267

Material Boundary

X	Y
2056	4238
2585.5	4238

Material Boundary

X	Y
2056	4236
2700	4236

Material Boundary

X	Y
2056	4234
2700	4234

Material Boundary

X	Y
2056	4230
2700	4230

Material Boundary

X	Y
2056	4220
2700	4220

Material Boundary

X	Y
2056	4218
2700	4218

Material Boundary

X	Y
2056	4208
2700	4208

Material Boundary

X	Y
2056	4197
2700	4197

Material Boundary

X	Y
2056	4191
2700	4191

Material Boundary

X	Y
2056	4185
2700	4185

Material Boundary

X	Y
2056	4175
2700	4175

Material Boundary

X	Y
2056	4169
2700	4169

Material Boundary

X	Y
2056	4165
2700	4165

Material Boundary

X	Y
2056	4153
2700	4153

Material Boundary

X	Y
2056	4149
2700	4149

Material Boundary

X	Y
2056	4140
2700	4140

Material Boundary

X	Y
2056	4119
2700	4119

Material Boundary

X	Y
2056	4104
2700	4104

Material Boundary

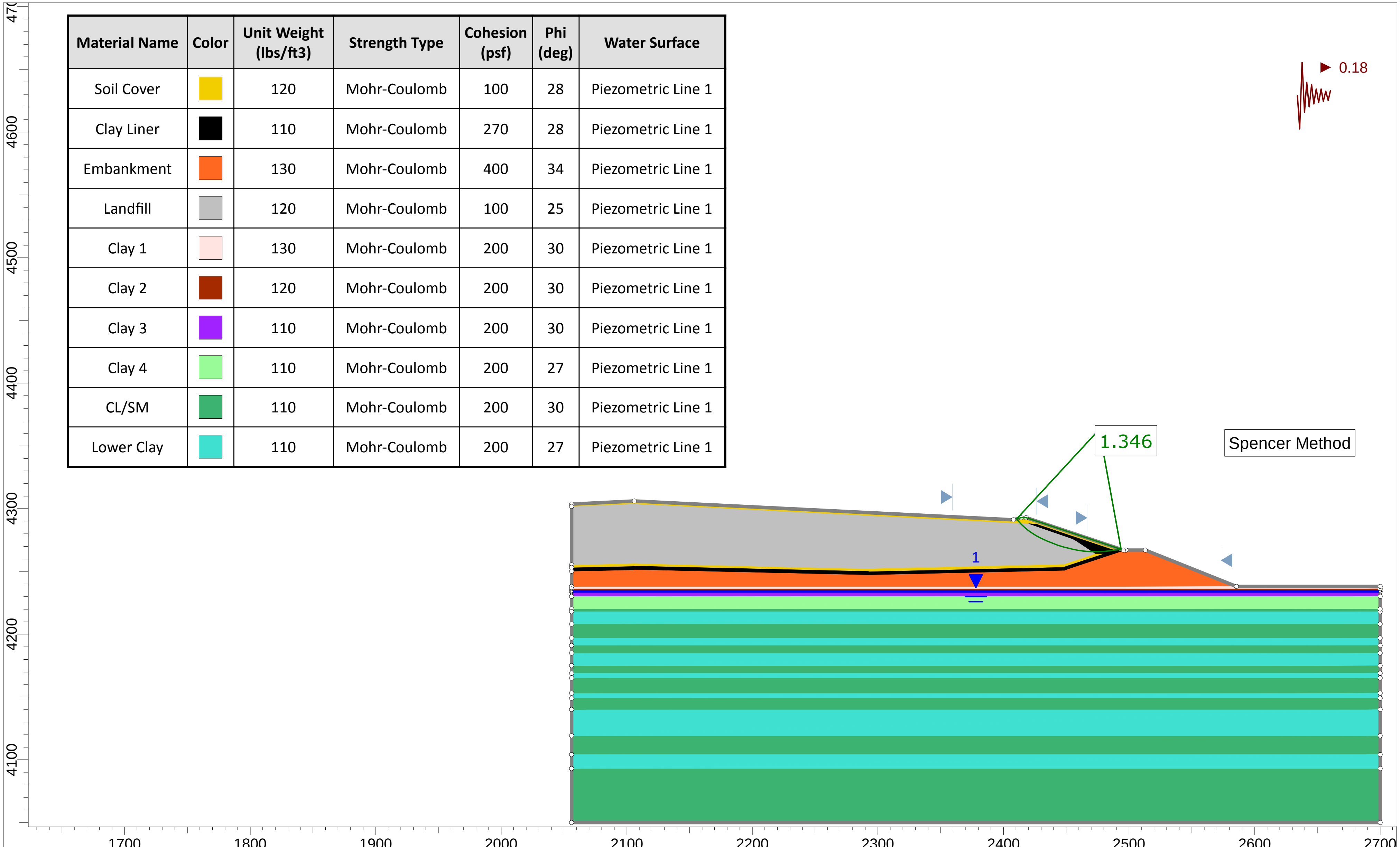
X	Y
2056	4093
2700	4093

APPENDIX E-7

SLOPE STABILITY - CLOSURE CAP

LONG TERM SEISMIC

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Soil Cover		120	Mohr-Coulomb	100	28	Piezometric Line 1
Clay Liner		110	Mohr-Coulomb	270	28	Piezometric Line 1
Embankment		130	Mohr-Coulomb	400	34	Piezometric Line 1
Landfill		120	Mohr-Coulomb	100	25	Piezometric Line 1
Clay 1		130	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 2		120	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 3		110	Mohr-Coulomb	200	30	Piezometric Line 1
Clay 4		110	Mohr-Coulomb	200	27	Piezometric Line 1
CL/SM		110	Mohr-Coulomb	200	30	Piezometric Line 1
Lower Clay		110	Mohr-Coulomb	200	27	Piezometric Line 1



Project	SLIDE - An Interactive Slope Stability Program
Analysis Description	Cells 8 to 13 - Long Term Seismic (Cap)
Drawn By	JRM
Scale	1:1269
Company	AGEC
Date	9/8/2017
File Name	1160276 Cell 8 to 13 cap - long term seismic.slim

SLIDEINTERPRET 7.013

Slide Analysis Information

SLIDE - An Interactive Slope Stability Program

Project Summary

File Name:	1160276 Cell 8 to 13 cap - long term seismic
Slide Modeler Version:	7.013
Project Title:	SLIDE - An Interactive Slope Stability Program
Analysis:	Cells 8 to 13 - Long Term Seismic (Cap)
Author:	JRM
Company:	AGEC
Date Created:	9/8/2017

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Failure Direction:	Left to Right
Data Output:	Standard
Maximum Material Properties:	20
Maximum Support Properties:	20

Analysis Options

Slices Type:	Vertical

Analysis Methods Used	
	Spencer

Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Search Method:	Auto Refine Search
Divisions along slope:	10
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Number of vertices per surface:	12
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Loading

Seismic Load Coefficient (Horizontal): 0.18

Material Properties

Property	Soil Cover	Clay Liner	Embankment	Landfill	Clay 1	Clay 2	Clay 3	Clay 4
Color								
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	130	120	130	120	110	110
Cohesion [psf]	100	270	400	100	200	200	200	200
Friction Angle [deg]	28	28	34	25	30	30	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1	1	1	1	1	1	1

Property	CL/SM	Lower Clay
Color		
Strength Type	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	110	110
Cohesion [psf]	200	200
Friction Angle [deg]	30	27
Water Surface	Piezometric Line 1	Piezometric Line 1
Hu Value	1	1

Global Minimums

Method: spencer

FS	1.346120
Axis Location:	2476.245, 4362.938
Left Slip Surface Endpoint:	2410.448, 4291.775
Right Slip Surface Endpoint:	2493.697, 4267.603
Resisting Moment:	5.37697e+006 lb-ft
Driving Moment:	3.99444e+006 lb-ft
Resisting Horizontal Force:	51994.3 lb
Driving Horizontal Force:	38625.5 lb
Total Slice Area:	797.967 ft2
Surface Horizontal Width:	83.249 ft
Surface Average Height:	9.58531 ft

Global Minimum Coordinates

Method: spencer

X	Y
2410.45	4291.78
2411.86	4290.01
2414.14	4287.55
2416.95	4284.93
2419.77	4282.6
2422.83	4280.43
2426.17	4278.39
2429.07	4276.82
2432.04	4275.36
2434.79	4274.13
2437.52	4273.01
2440.17	4272
2442.93	4271.04
2445.75	4270.14
2448.71	4269.27
2451.7	4268.49
2455.17	4267.68
2459.58	4266.83
2463.47	4266.25
2467.23	4265.85
2470.55	4265.64
2475.27	4265.71
2478.48	4265.86
2481.42	4266.09
2484.09	4266.38
2487.98	4267
2491.63	4267.27
2493.7	4267.6

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 2039
Number of Invalid Surfaces: 2462

Error Codes:

Error Code -105 reported for 86 surfaces
Error Code -111 reported for 4 surfaces
Error Code -113 reported for 2372 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.
-111 = safety factor equation did not converge
-113 = Surface intersects outside slope limits.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.34612

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [degrees]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.40708	186.317	-51.3793	Soil Cover	100	28	87.1095	117.26	32.461	-3550.22	32.461
2	1.55332	613.598	-47.2101	Soil Cover	100	28	147.646	198.75	185.721	-3442.91	185.721
3	0.726812	425.664	-47.2101	Landfill	100	25	176.609	237.737	295.379	-3366.06	295.379
4	1.40907	1015.34	-42.9349	Landfill	100	25	214.309	288.485	404.207	-3300.66	404.207
5	1.40907	1237.01	-42.9349	Landfill	100	25	246.788	332.206	497.968	-3218.86	497.968
6	1.40645	1441.1	-39.6483	Landfill	100	25	289.268	389.389	620.597	-3141.59	620.597
7	1.40645	1580.44	-39.6483	Landfill	100	25	310.772	418.337	682.679	-3068.86	682.679
8	1.52968	1833.03	-35.3061	Landfill	100	25	345.566	465.173	783.115	-2998.7	783.115
9	1.52968	1931.9	-35.3061	Landfill	100	25	360.504	485.282	826.242	-2931.1	826.242
10	1.67266	2209.25	-31.4291	Landfill	100	25	392.278	528.053	917.961	-2865.41	917.961
11	1.67266	2294.77	-31.4291	Landfill	100	25	404.746	544.837	953.956	-2801.62	953.956
12	1.4516	2053.54	-28.4044	Landfill	100	25	430.762	579.857	1029.06	-2745.24	1029.06
13	1.4516	2105.45	-28.4044	Landfill	100	25	439.843	592.081	1055.27	-2696.25	1055.27
14	1.48155	2195.91	-26.1195	Landfill	100	25	460.449	619.819	1114.76	-2649.1	1114.76
15	1.48155	2236.82	-26.1195	Landfill	100	25	467.678	629.551	1135.62	-2603.77	1135.62
16	1.37396	2106.11	-24.1202	Landfill	100	25	485.276	653.24	1186.43	-2561.91	1186.43
17	1.37396	2131.65	-24.1202	Landfill	100	25	490.273	659.966	1200.85	-2523.52	1200.85
18	1.36587	2140.38	-22.3725	Landfill	100	25	504.969	679.749	1243.28	-2486.79	1243.28
19	1.36587	2157.54	-22.3725	Landfill	100	25	508.422	684.397	1253.24	-2451.71	1253.24
20	1.32517	2106.24	-20.7685	Landfill	100	25	521.083	701.44	1289.79	-2418.48	1289.79
21	1.32517	2115.56	-20.7685	Landfill	100	25	523.059	704.1	1295.49	-2387.13	1295.49
22	1.37922	2208.35	-19.2591	Landfill	100	25	534.016	718.849	1327.12	-2356.41	1327.12
23	1.37922	2211.63	-19.2591	Landfill	100	25	534.698	719.768	1329.1	-2326.34	1329.1
24	1.41141	2263.17	-17.7595	Landfill	100	25	544.469	732.921	1357.3	-2297.2	1357.3
25	1.41141	2259.65	-17.7595	Landfill	100	25	543.742	731.942	1355.21	-2268.99	1355.21
26	1.48106	2363.59	-16.2513	Landfill	100	25	552.273	743.426	1379.83	-2241.42	1379.83
27	1.48106	2352.15	-16.2513	Landfill	100	25	549.971	740.327	1373.18	-2214.48	1373.18
28	1.49269	2355.25	-14.74	Landfill	100	25	557.084	749.902	1393.72	-2188.76	1393.72
29	1.49269	2336.02	-14.74	Landfill	100	25	553.171	744.634	1382.43	-2164.25	1382.43
30	1.73762	2689.63	-13.107	Landfill	100	25	559.084	752.594	1399.49	-2139.38	1399.49
31	1.73762	2652.57	-13.107	Landfill	100	25	552.462	743.68	1380.38	-2114.13	1380.38
32	2.20339	3289.81	-10.9353	Landfill	100	25	556.863	749.605	1393.08	-2088.23	1393.08
33	2.20339	3191.49	-10.9353	Landfill	100	25	542.6	730.405	1351.91	-2061.66	1351.91
34	1.94494	2725.31	-8.45092	Landfill	100	25	544.251	732.627	1356.67	-2039.36	1356.67
35	1.94494	2628.44	-8.45092	Landfill	100	25	527.785	710.462	1309.14	-2021.33	1309.14
36	1.88174	2441.69	-6.02462	Landfill	100	25	526.075	708.16	1304.21	-2006.12	1304.21
37	1.88174	2332.72	-6.02462	Landfill	100	25	506.275	681.507	1247.04	-1993.73	1247.04
38	1.65914	1959.31	-3.58507	Landfill	100	25	501.952	675.688	1234.57	-1984.29	1234.57
39	1.65914	1860.44	-3.58507	Landfill	100	25	480.855	647.289	1173.67	-1977.8	1173.67
40	2.36112	2470.5	0.8345	Clay Liner	270	28	702.322	945.41	1270.26	-1975.63	1270.26
41	2.36112	2256.58	0.8345	Clay Liner	270	28	662.315	891.555	1168.97	-1977.78	1168.97
42	1.60564	1407.71	2.70565	Clay Liner	270	28	644.479	867.546	1123.82	-1981.22	1123.82
43	1.60564	1299.52	2.70565	Clay Liner	270	28	613.759	826.193	1046.05	-1985.95	1046.05
44	1.47049	1091.64	4.41987	Clay Liner	270	28	598.011	804.994	1006.18	-1991.87	1006.18
45	1.47049	993.747	4.41987	Clay Liner	270	28	566.73	762.887	926.989	-1998.96	926.989
46	1.33459	813.986	6.26311	Clay Liner	270	28	550.675	741.274	886.341	-2007.07	886.341
47	1.33459	726.992	6.26311	Clay Liner	270	28	518.997	698.632	806.138	-2016.21	806.138
48	3.88992	1582.54	8.97584	Clay Liner	270	28	470.801	633.754	684.121	-2039.95	684.121
49	3.64808	774.318	4.22918	Soil Cover	100	28	191.499	257.781	296.744	-2067.54	296.744
50	2.06567	126.954	9.18431	Soil Cover	100	28	129.068	173.741	138.686	-2086.38	138.686

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.34612

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	2410.45	4291.78	0	0	0
2	2411.86	4290.01	-31.8594	-12.7863	21.8673
3	2413.41	4288.34	160.891	64.5709	21.8672
4	2414.14	4287.55	341.069	136.882	21.8672
5	2415.54	4286.24	751.765	301.709	21.8673
6	2416.95	4284.93	1279.52	513.513	21.8672
7	2418.36	4283.76	1855.39	744.629	21.8672
8	2419.77	4282.6	2498.45	1002.71	21.8672
9	2421.3	4281.51	3148.15	1263.46	21.8673
10	2422.83	4280.43	3839.52	1540.93	21.8673
11	2424.5	4279.41	4519.34	1813.76	21.8672
12	2426.17	4278.39	5230.49	2099.17	21.8672
13	2427.62	4277.6	5782.67	2320.78	21.8673
14	2429.07	4276.82	6351.58	2549.11	21.8673
15	2430.56	4276.09	6874.46	2758.95	21.8672
16	2432.04	4275.36	7409.15	2973.54	21.8672
17	2433.41	4274.75	7851.36	3151.02	21.8673
18	2434.79	4274.13	8300.19	3331.15	21.8673
19	2436.15	4273.57	8694.71	3489.48	21.8673
20	2437.52	4273.01	9093.2	3649.41	21.8673
21	2438.84	4272.51	9429.99	3784.57	21.8672
22	2440.17	4272	9768.7	3920.51	21.8673
23	2441.55	4271.52	10069.2	4041.11	21.8673
24	2442.93	4271.04	10370.3	4161.96	21.8673
25	2444.34	4270.59	10622.8	4263.28	21.8672
26	2445.75	4270.14	10874.7	4364.38	21.8672
27	2447.23	4269.7	11077.9	4445.94	21.8673
28	2448.71	4269.27	11279.6	4526.88	21.8672
29	2450.2	4268.88	11419.3	4582.95	21.8673
30	2451.7	4268.49	11557	4638.2	21.8672
31	2453.43	4268.08	11635.8	4669.86	21.8673
32	2455.17	4267.68	11711.8	4700.34	21.8673
33	2457.37	4267.25	11670	4683.58	21.8673
34	2459.58	4266.83	11624.5	4665.29	21.8672
35	2461.52	4266.54	11448.5	4594.68	21.8673
36	2463.47	4266.25	11273.4	4524.41	21.8673
37	2465.35	4266.05	10982	4407.45	21.8673
38	2467.23	4265.85	10696.9	4293.02	21.8672
39	2468.89	4265.75	10345.1	4151.83	21.8672
40	2470.55	4265.64	10004.1	4015	21.8673
41	2472.91	4265.68	8746.87	3510.41	21.8672
42	2475.27	4265.71	7549.04	3029.69	21.8673
43	2476.88	4265.79	6682.35	2681.85	21.8672
44	2478.48	4265.86	5851.41	2348.37	21.8673
45	2479.95	4265.98	5054.18	2028.41	21.8672
46	2481.42	4266.09	4294.32	1723.46	21.8673
47	2482.76	4266.24	3576.09	1435.21	21.8673
48	2484.09	4266.38	2896.23	1162.35	21.8672
49	2487.98	4267	929.361	372.984	21.8673
50	2491.63	4267.27	290.079	116.419	21.8673
51	2493.7	4267.6	0	0	0

List Of Coordinates

Piezoline

X	Y
2056	4234
2700	4234

External Boundary

X	Y
2056	4303.5
2056	4301.77
2056	4255.2
2056	4253.2
2056	4250.2
2056	4238
2056	4236
2056	4234
2056	4230
2056	4220
2056	4218
2056	4208
2056	4197
2056	4191
2056	4185
2056	4175
2056	4169
2056	4165
2056	4153
2056	4149
2056	4140
2056	4119
2056	4104
2056	4093
2056	4050
2700	4050
2700	4093
2700	4104
2700	4119
2700	4140
2700	4149
2700	4153
2700	4165
2700	4169
2700	4175
2700	4185
2700	4191
2700	4197
2700	4208
2700	4218
2700	4220
2700	4230
2700	4234
2700	4236
2700	4238
2585.5	4238
2513	4267
2497.5	4267
2495.5	4267
2418	4292.9
2414	4292.9
2408	4291
2106	4306

Material Boundary

X	Y
2056	4301.77
2106	4304
2420	4288
2426.5	4287.5
2488	4267
2495.5	4267

Material Boundary

X	Y
2420	4288
2455	4276
2473	4264
2479	4264
2488	4267

Material Boundary

X	Y
2056	4255.2
2106	4256.3
2292.5	4252
2447.5	4255.5
2473	4264

Material Boundary

X	Y
2056	4253.2
2106	4254.3
2292.5	4250
2447.5	4253.5
2479	4264

Material Boundary

X	Y
2056	4250.2
2106	4251.3
2292.5	4247
2448	4250.5
2497.5	4267

Material Boundary

X	Y
2056	4238
2585.5	4238

Material Boundary

X	Y
2056	4236
2700	4236

Material Boundary

X	Y
2056	4234
2700	4234

Material Boundary

X	Y
2056	4230
2700	4230

Material Boundary

X	Y
2056	4220
2700	4220

Material Boundary

X	Y
2056	4218
2700	4218

Material Boundary

X	Y
2056	4208
2700	4208

Material Boundary

X	Y
2056	4197
2700	4197

Material Boundary

X	Y
2056	4191
2700	4191

Material Boundary

X	Y
2056	4185
2700	4185

Material Boundary

X	Y
2056	4175
2700	4175

Material Boundary

X	Y
2056	4169
2700	4169

Material Boundary

X	Y
2056	4165
2700	4165

Material Boundary

X	Y
2056	4153
2700	4153

Material Boundary

X	Y
2056	4149
2700	4149

Material Boundary

X	Y
2056	4140
2700	4140

Material Boundary

X	Y
2056	4119
2700	4119

Material Boundary

X	Y
2056	4104
2700	4104

Material Boundary

X	Y
2056	4093
2700	4093

APPENDIX E-8

INTERFACE STABILITY

SOIL PROTECTIVE COVER

Interface Surfaces: (lower 10 ft)
- soil cover / Textured 80 mil HDPE
- Textured 80 mil HDPE / GCL
- GCL / Textured 80 mil HDPE
- Textured 80 mil HDPE / welded geocomposite (Non-woven geotextile)
- welded geocomposite / textured 60 mil HDPE
- textured 60 mil HDPE / clay liner

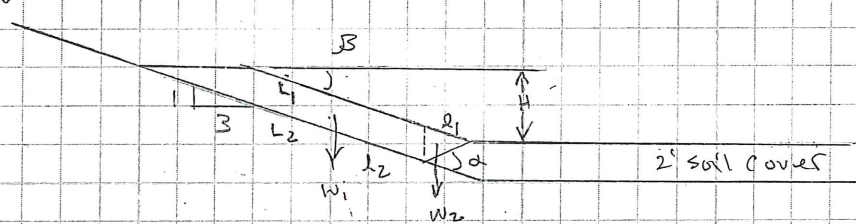
* critical surface is soil cover / textured HDPE

$\phi_{soil} = 28°$ use 85% 23.8° for contact

Interface Surfaces: (above 10' up slope)
- soil cover / textured 80 mil HDPE
- Textured 80 mil HDPE / GCL
- GCL / double-sided geocomposite
- double-sided geocomposite / 60 mil textured HDPE
- 60 mil textured HDPE / clay liner

* critical surface assumed between GCL and double-sided geocomposite
assumed $\phi = 22.5°$

Configuration:



$\alpha = 45° - \frac{28}{2} = 31°$ (where 28° is assumed ϕ for soil cover)

$\beta = \tan^{-1} 1/3 = 18.43°$

Failure slope $= \alpha - \beta = 12.57° = \theta$

$w_1 = \left(\frac{L_1 + L_2}{2}\right)(d)(\gamma)$ $d = 2'$, $\gamma = 110$ pcf

$l_1 = \frac{2}{\tan\alpha} + 2\tan\beta = 3.995$

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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 9/1/17 BY JRM

SUBJECT Protective Soil Cover Stability SHEET 2 OF 2

$$l_2 = \frac{2}{\tan\beta} - \frac{2}{\tan\alpha} = 2.671$$

$$L_1 = \frac{H}{\sin\beta} - l_1 \qquad L_2 = \frac{H}{\sin\beta} + l_2$$

$$w_1 = \left[\frac{\frac{H}{\sin\beta} - 3.995 + \frac{H}{\sin\beta} + 2.671}{2}\right](2)(110)$$

$$= \left[\frac{2H}{\sin\beta} - 1.324\right](110) = 695.70H - 145.64$$

$$w_2 = \tfrac{1}{2} l_1 d\gamma = \tfrac{1}{2}(3.995)(2)(110) = 439.45 \text{ lb}$$

$$SF = \frac{\text{Resisting Forces}}{\text{Driving Forces}}$$

$$= \frac{w_1 \cos\beta \tan\phi_\ell + w_2 \cos\theta \tan\phi_{soil} + w_2 \sin\theta}{w_1 \sin\beta}$$

$$= \frac{(695.70H - 145.64)(\cos 18.43^\circ)(\tan 22.5^\circ) + (439.45)(\cos 12.57^\circ)(\tan 28^\circ) + (439.45)(\sin 12.57^\circ)}{(695.70H - 145.64)(\sin 18.43)}$$

$$= \frac{273.4H + 262.76}{219.94H - 46.04}$$

H	SF
2	2.1
4	1.6
6	1.5
8	1.4
10	1.4

Including small amount of tension in the 80 mil HDPE

$$SF = \frac{273.4H + 262.76 + T}{219.94H - 46.04}$$

for H = 10 ft
T = 200 lb/ft

SF = 1.5 OK

APPENDIX E-9

INTERFACE STABILITY

ENTRY RAMP

AGEC
Applied GeoTech

PROJECT NO. 1160276 TITLE Cell 8-13 DATE 9/7/16 BY JRM

SUBJECT Entry Ramp Stability SHEET 1 OF 1

Slope : 10% = 5.71°

Interface Surfaces

Lower Ramp: soil cover (3') / textured 80 mil HDPE
textured 80 mil HDPE / GCL
GCL / textured 80 mil HDPE
textured 80 mil HDPE / double sided geocomposite
double sided geocomposite / textured 60 mil HDPE
textured 60 mil HDPE / clay liner

Upper Ramp: soil cover / textured 80 mil HDPE
textured 80 mil HDPE / GCL
GCL / double sided geocomposit
double sided geocomposit / textured 60 mil HDPE
textured 60 mil HDPE / clay liner

critical interface is GCL / double-sided geocomposit

$\phi = 22.5^\circ$

Stability:

$$\text{static SF} = \frac{\tan 22.5^\circ}{\tan 5.71^\circ} = 4.1 > 1.5 \quad \text{ok}$$

$$\text{Seismic SF} = \left[\frac{\cos i}{\sin i + k\cos i}\right]\tan\phi$$

$$= \left[\frac{\cos 5.71^\circ}{\sin 5.71^\circ + 0.18\cos 5.71^\circ}\right]\tan 22.5^\circ$$

$$= 1.5 > 1.3 \quad \text{ok}$$

APPENDIX E-10

INTERFACE STABILITY

CLOSURE CAP

AGEC
Applied GeoTech

PROJECT NO. 1160276 TITLE Cells 8-13 DATE 9/19/17 BY JRM

SUBJECT Interface Stability - Closure Cap SHEET 1 OF 2

① 3H:1V slope around perimeter of closure cap

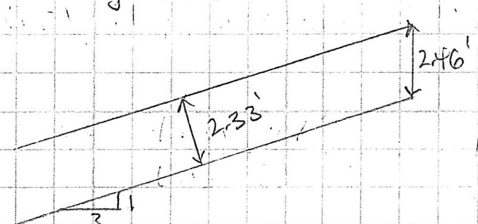
- 60 mil textured HDPE / compacted clay

For clay in contact with textured HDPE, the strength of the clay is expected to control. (Jones & Dixon, 1998)

For compacted clay: $c = 270$ psf
$\phi = 28°$ use $28(.95) = 23.8°$
$\gamma = 120$ pcf

Slope = 3H:1V = 18.43°

Slope Length (l) = 65 ft



$W = (120)(2.33)(65) = 18,174$ lb/ft

$W \cos 18.43° = 17,242$ lb/ft

$W \cos 18.43° \tan 23.8° = 7,605$ lb/ft

$cl = (270)(65) = 17,550$ lb/ft

Seismic = $(0.18)(W) = 3,271$ lb/ft

$W \sin 18.43° = 5,746$ lb/ft

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PROJECT NO. 1160276 TITLE Cells 8-13 DATE 9/19/17 BY JRM

SUBJECT Interface Stability - Closure Cap SHEET 2 OF 2

Static:

Driving = 5,746 lb/ft

Resist = 7,605 + 17,550 = 25,155 lb/ft

$FS = \frac{25,155}{5,746} = 4.4$ OK

Seismic:

Driving = 5,746 + 3,271 = 9,017 lb/ft

Resist = 25,155 lb/ft

$FS = \frac{25,155}{9,017} = 2.8$ OK

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Applied GeoTech

PROJECT NO. 1160276 TITLE Cells 8-13 DATE 9/19/17 BY JRM

SUBJECT Interface Stability - Closure Cap SHEET 1 OF

(2) 5% Slope at top of closure cap

$5\% = 2.86^\circ$

critical surface is textured HDPE vs. geocomposite

based on previous testing by AGEC $\phi = 26.9^\circ$ (wet)

Static Stability:

$$FS = \frac{\tan 26.9^\circ}{\tan 2.86^\circ} = 10 \quad \text{ok}$$

Seismic Stability:

$$FS = \left[\frac{\cos 2.86}{\sin 2.86 + 0.18 \cos 2.86}\right] \tan 26.9^\circ = 2.2 \quad \text{ok}$$

APPENDIX F

BEARING CAPACITY

AGEC
Applied GeoTech

PROJECT NO. 160276 TITLE Cells 8-13 DATE 8/31/17 BY JRM

SUBJECT Bearing Capacity SHEET 1 OF 2

Typical cell dimensions 780' x 780' (inside crest to inside crest)
1050' x 174' (embankment)

Load ave 58' high x 120 = 6960 psf single cell
28' high x 130 = 3640 psf embankment

Bearing - undrained $\phi = 0$ for clay

Meyerhoff

$q_{ult} = cN_c s_c d_c + \bar{q} N_q s_q d_q + \frac{1}{2}\gamma B N_\gamma s_\gamma d_\gamma$

$N_q = e^{\pi \tan\phi} \tan^2(45 + \frac{\phi}{2}) = 1$ for $\phi = 0$

$N_c = (N_q - 1)\cot\phi = 5.7$ for $\phi = 0$

$N_\gamma = (N_q - 1)\tan(1.4\phi) = 0$ for $\phi = 0$

$s_q = s_\gamma = d_q = d_\gamma = 1$ for $\phi = 0$

$s_c = 1 + 0.2 K_p \frac{B}{L}$ $K_p = \tan^2(45 + \frac{\phi}{2}) = 1$ for $\phi = 0$

$q_{ult} = c(5.14)(1 + 0.2(\frac{780}{780})) = 6.17c$ single cell

$= c(5.14)(1 + 0.2(\frac{174}{1050})) = 5.31c$ embank. only

		Entire cell		Embmk. only	
	c, psf	q_{ult}, ksf	SF	q_{ult}, ksf	SF
Upper clay	3700	22.8	4.5	19.6	5.8
2nd clay	1900	11.7	2.3	10.1	3.0
Ave upper 19'	963	5.9	1.2	5.1	1.5

Bearing - drained $\phi = 27°$ c = 200 psf $K_p = 2.663$ $N_q = 13.2$

$N_c = 23.94$ $s_c(\text{cell}) = 1.533$ $s_c(\text{embmk}) = 1.088$

$N_\gamma = 9.463$ $s_\gamma = 1 + 0.1 K_p \frac{B}{L}$ $s_\gamma(\text{cell}) = 1.266$ $s_\gamma(\text{embank}) = 1.044$

$q_{ult} = 200(23.94)(1.533)(1) + \frac{1}{2}(110)(780)(9.463)(1.266)(1) = 521$ ksf (cell)

$= 200(23.94)(1.088)(1) + \frac{1}{2}(110)(174)(9.463)(1.044)(1) = 100$ ksf (emb.)

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Applied GeoTech

PROJECT NO. 1160276 TITLE Cells 8-13 DATE 8/31/17 BY JRM

SUBJECT Bearing Capacity SHEET 2 OF 2

under drained condition

$$FS_{coll} = \frac{521}{6.96} = 75$$

$$FS_{emb} = \frac{100}{3.64} = 27$$

- The embankment and fill will be placed slow enough that undrained conditions are not reached.
- The rate of loading will result in a condition closer to the drained case.
- Slope stability analysis will govern design.

For the bearing capacity of the soil cover use

$$q_{all} = 250\,B + 600\,D$$ (from previous work)

For the bearing capacity of the clay liner

q_{all} = 1,500 psf static
2,000 psf impact load

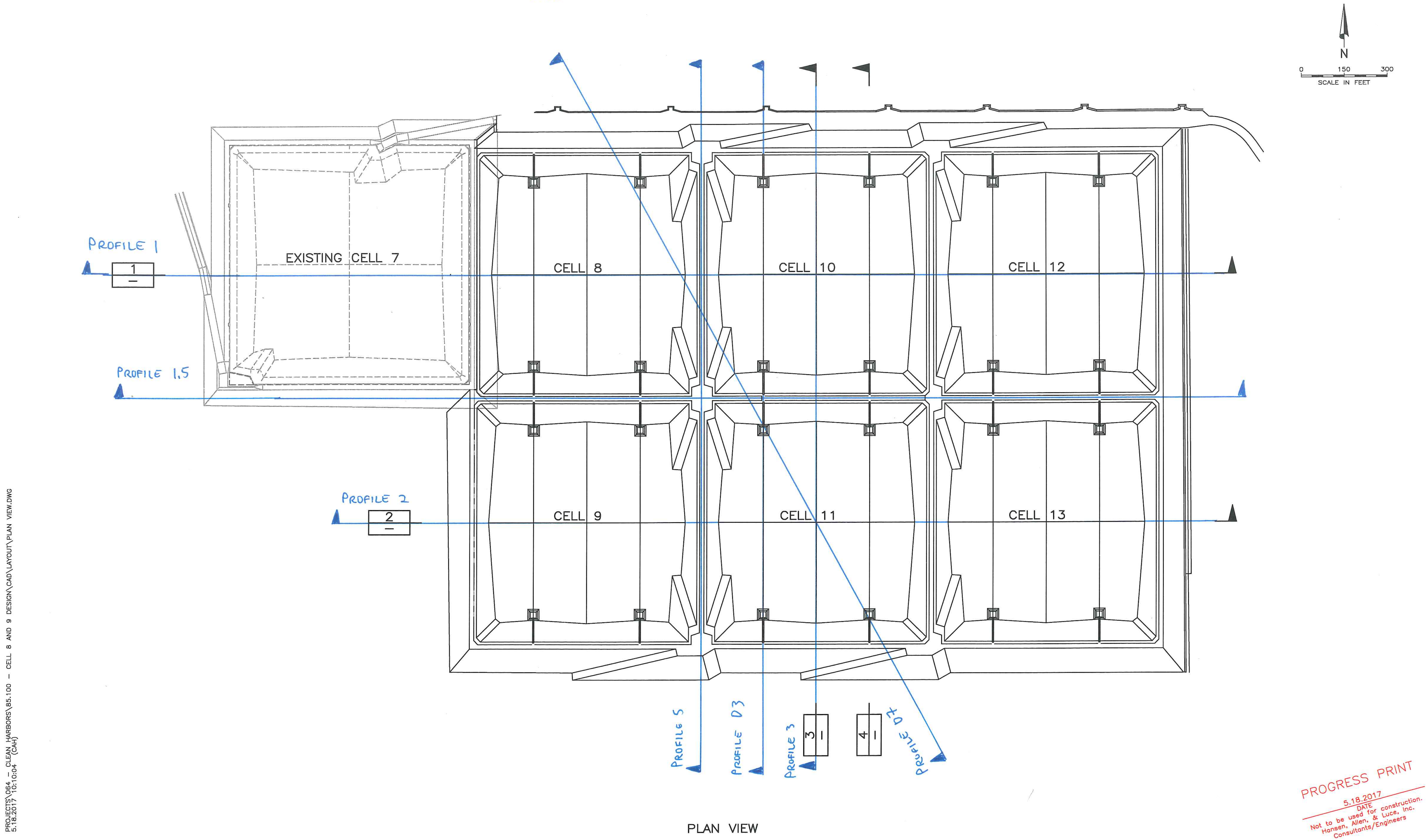
(From previous work)

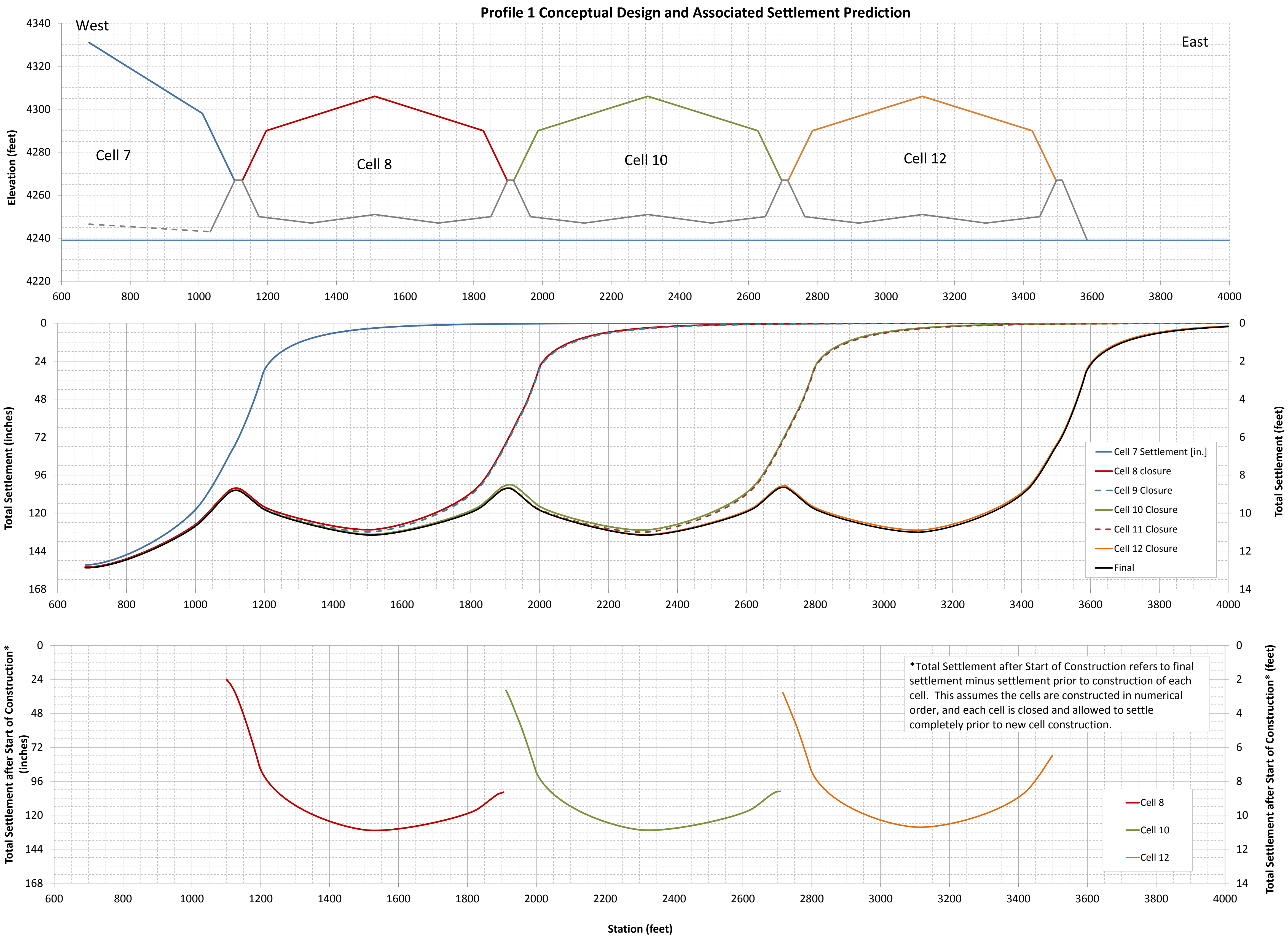
APPENDIX G

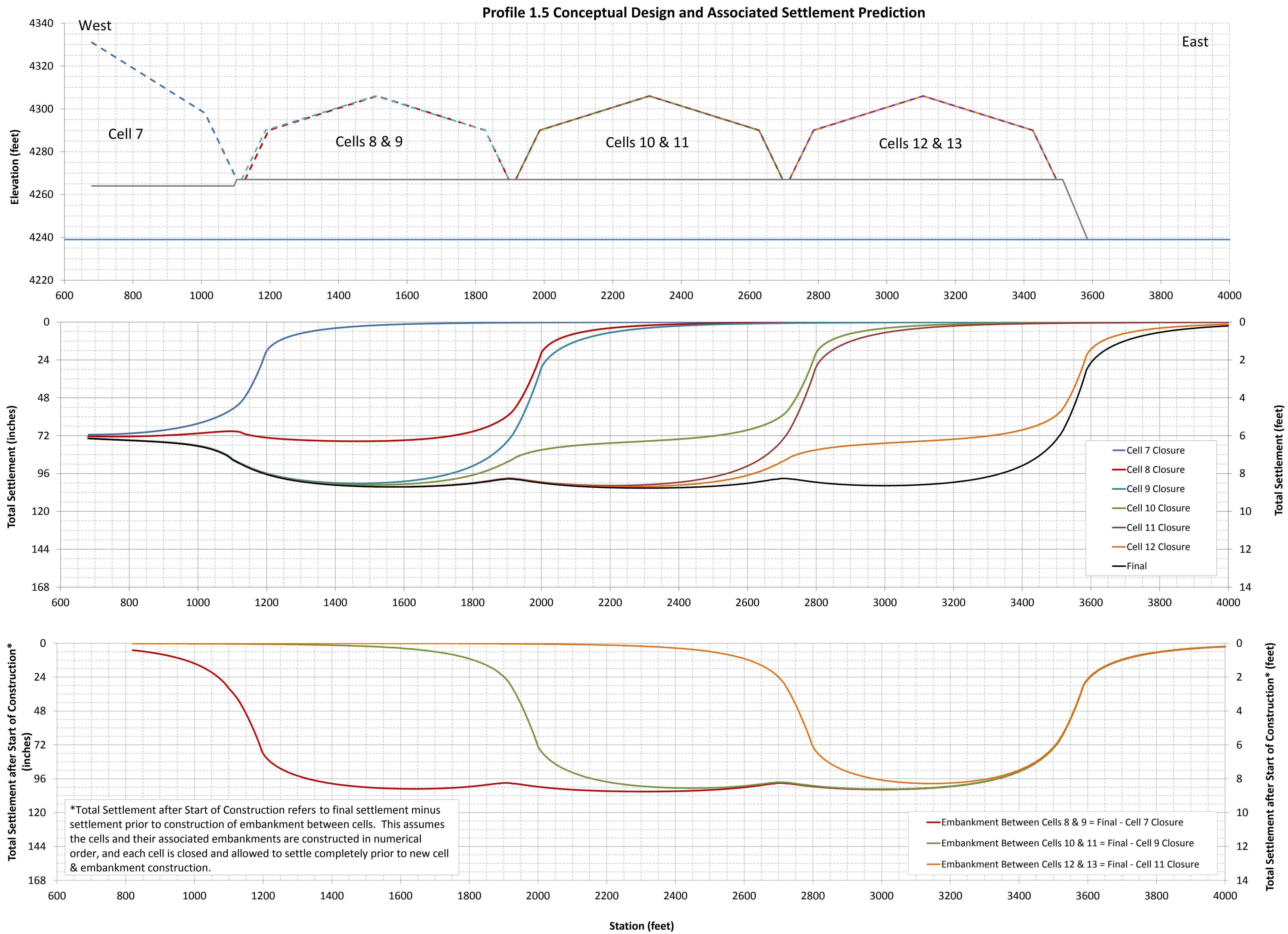
SETTLEMENT ANALYSIS

CLEAN HARBORS 1160276 TJN 6/29/17

PREDICTED SETTLEMENT PROFILES




Profile 1 Conceptual Design and Associated Settlement Prediction
West
East
Cell 7
Cell 8
Cell 10
Cell 12
Elevation (feet)
Total Settlement (inches)
Total Settlement (feet)
Cell 7 Settlement [in.]
Cell 8 closure
Cell 9 Closure
Cell 10 Closure
Cell 11 Closure
Cell 12 Closure
Final
Total Settlement after Start of Construction* (inches)
Total Settlement after Start of Construction* (feet)
*Total Settlement after Start of Construction refers to final settlement minus settlement prior to construction of each cell. This assumes the cells are constructed in numerical order, and each cell is closed and allowed to settle completely prior to new cell construction.
Cell 8
Cell 10
Cell 12
Station (feet)



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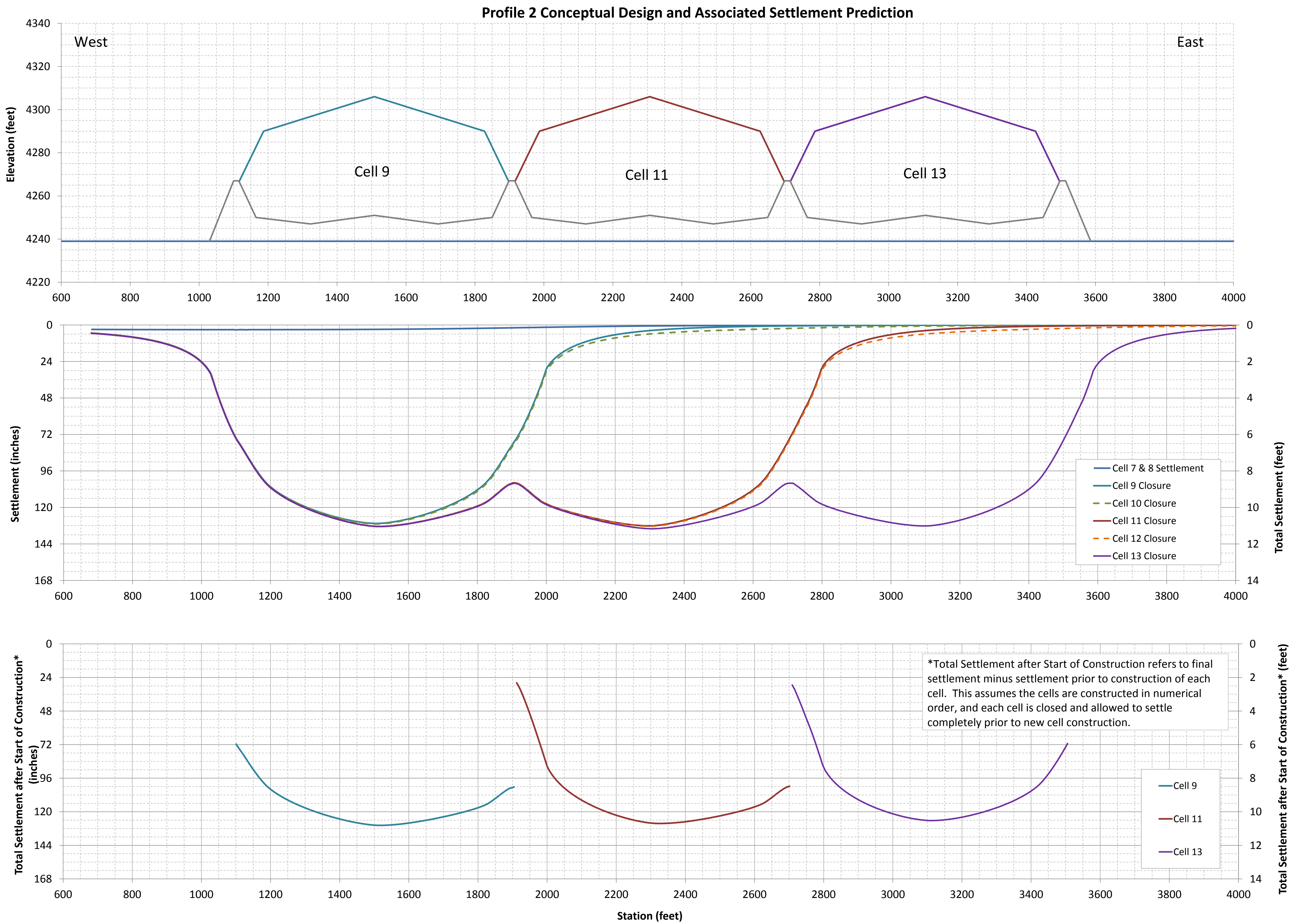
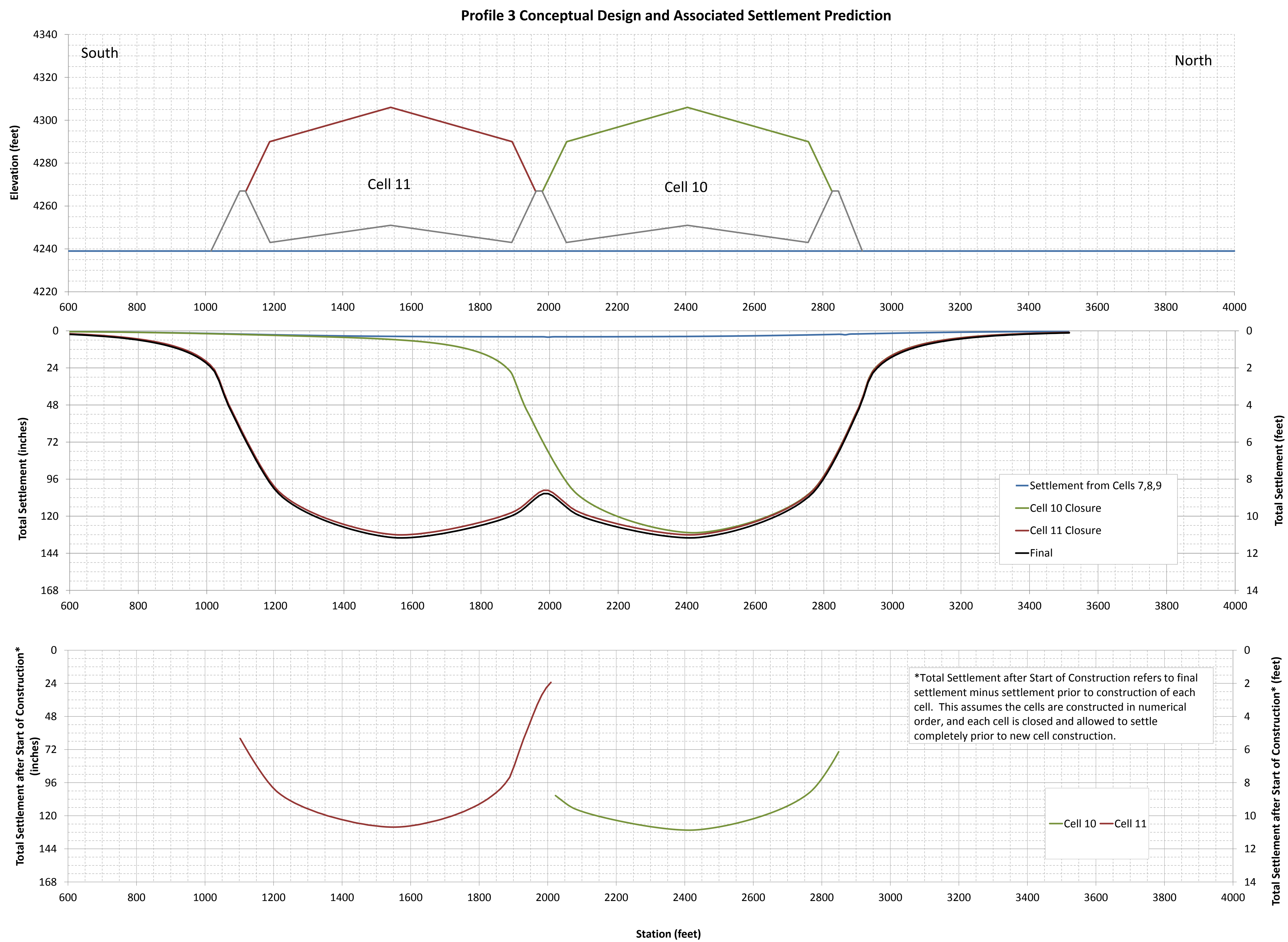
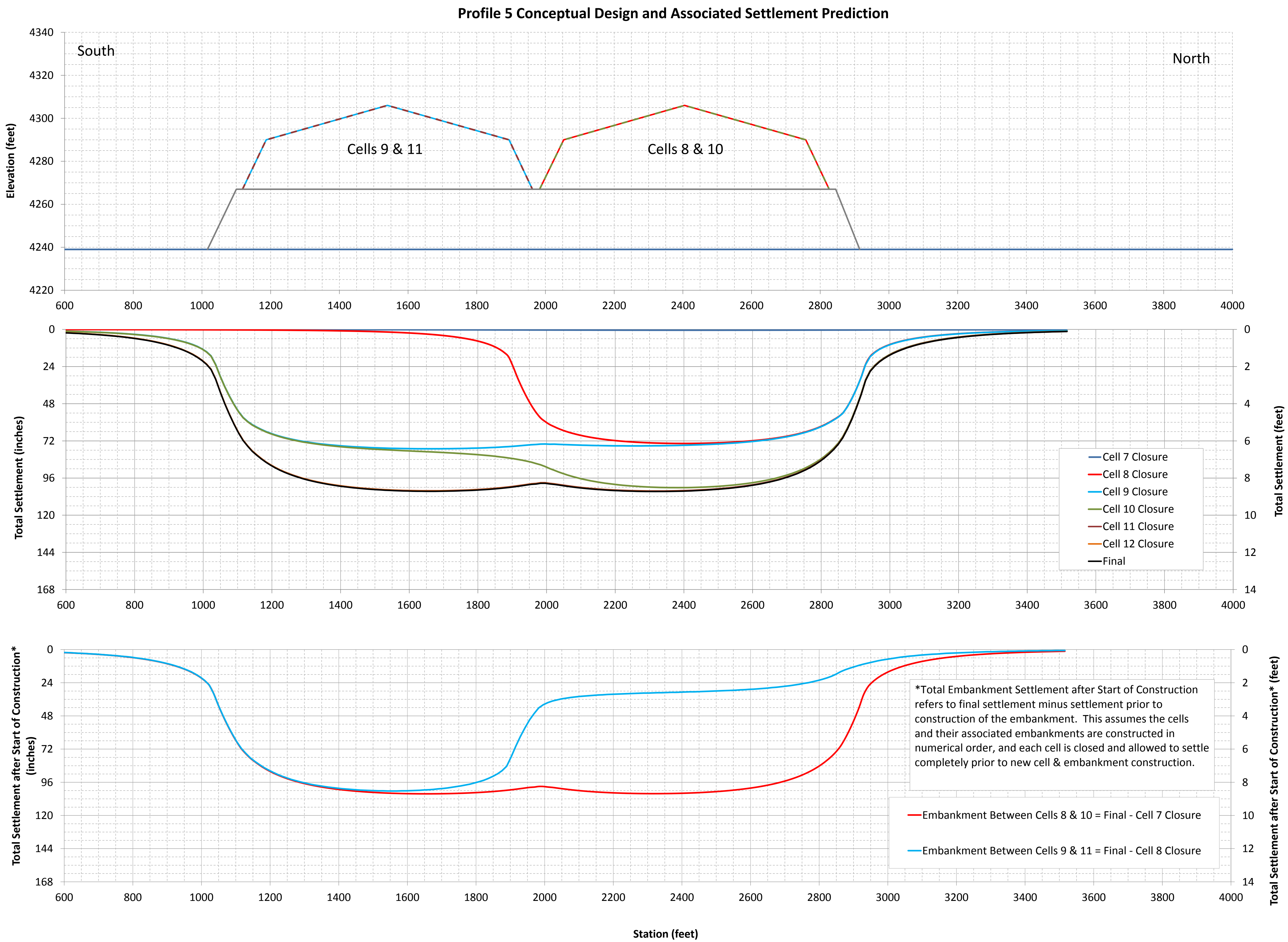


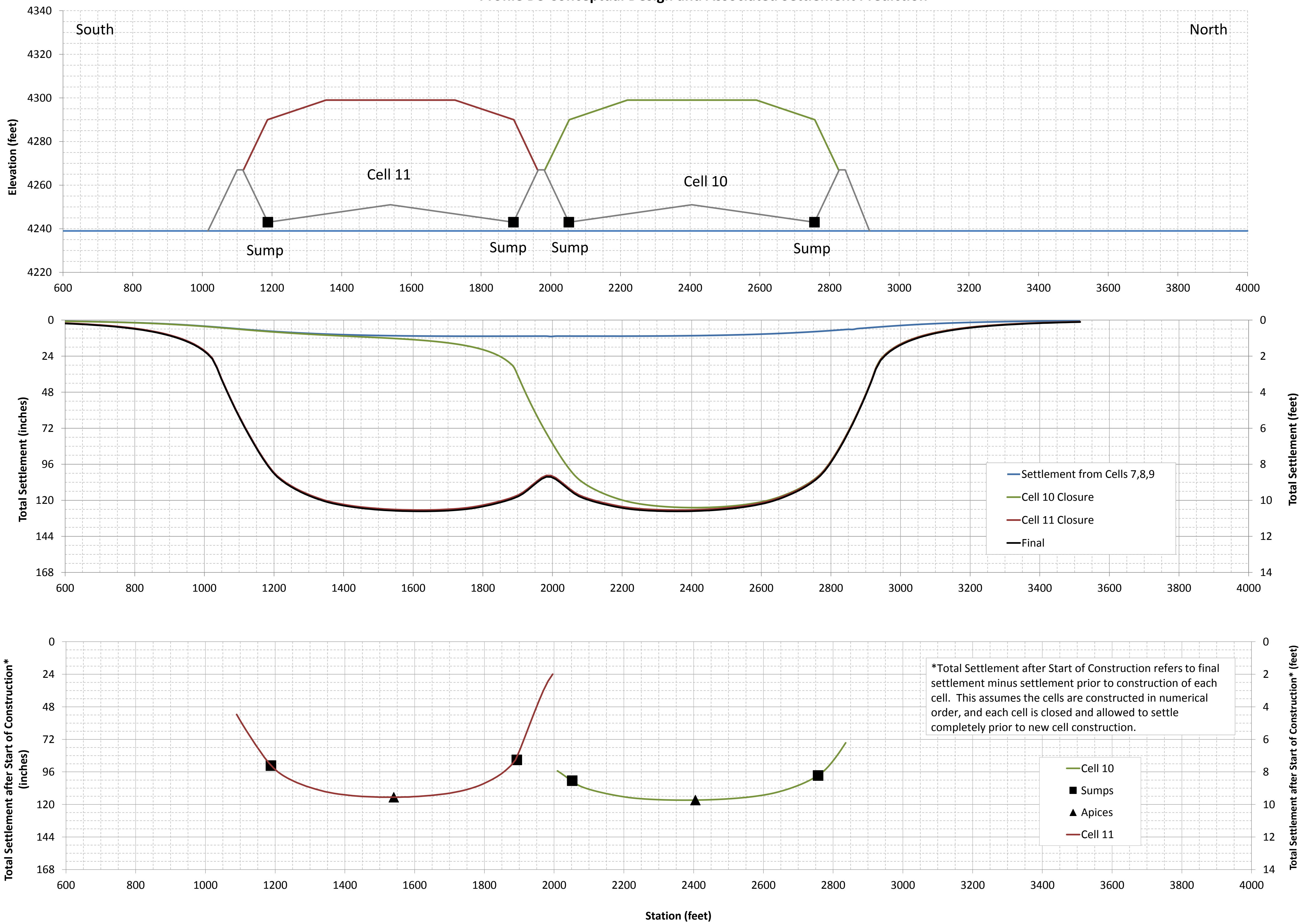
Profile 2 Conceptual Design and Associated Settlement Prediction
West
East
Cell 9
Cell 11
Cell 13
Elevation (feet)
4340
4320
4300
4280
4260
4240
4220
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Settlement (inches)
Total Settlement (feet)
0
24
48
72
96
120
144
168
0
2
4
6
8
10
12
14
Cell 7 & 8 Settlement
Cell 9 Closure
Cell 10 Closure
Cell 11 Closure
Cell 12 Closure
Cell 13 Closure
Total Settlement after Start of Construction* (inches)
Total Settlement after Start of Construction* (feet)
*Total Settlement after Start of Construction refers to final settlement minus settlement prior to construction of each cell. This assumes the cells are constructed in numerical order, and each cell is closed and allowed to settle completely prior to new cell construction.
Cell 9
Cell 11
Cell 13
Station (feet)


Profile 3 Conceptual Design and Associated Settlement Prediction
South
North
Cell 11
Cell 10
Elevation (feet)
Total Settlement (inches)
Total Settlement (feet)
Settlement from Cells 7,8,9
Cell 10 Closure
Cell 11 Closure
Final
Total Settlement after Start of Construction* (inches)
Total Settlement after Start of Construction* (feet)
*Total Settlement after Start of Construction refers to final settlement minus settlement prior to construction of each cell. This assumes the cells are constructed in numerical order, and each cell is closed and allowed to settle completely prior to new cell construction.
Cell 10
Cell 11
Station (feet)



H:\AGEC Project Files\2016 Projects\1160276 GT - C Landfill (JEN)\Cells 8,9,10,11,12,13 Concept Analysis\1160276 cell 8 through 13 3D

Profile D3 Conceptual Design and Associated Settlement Prediction



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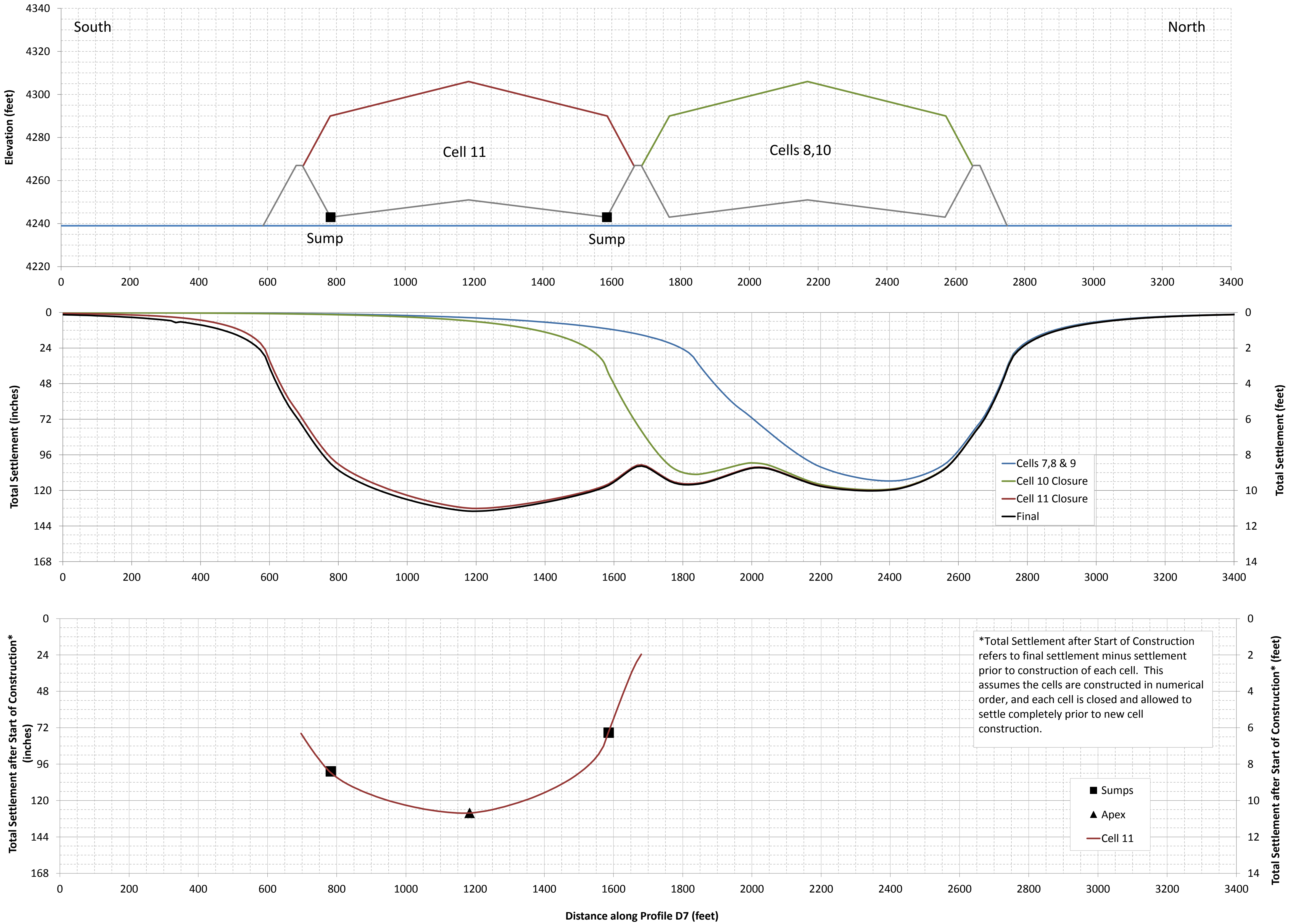
Profile D7 Conceptual Design and Associated Settlement Prediction



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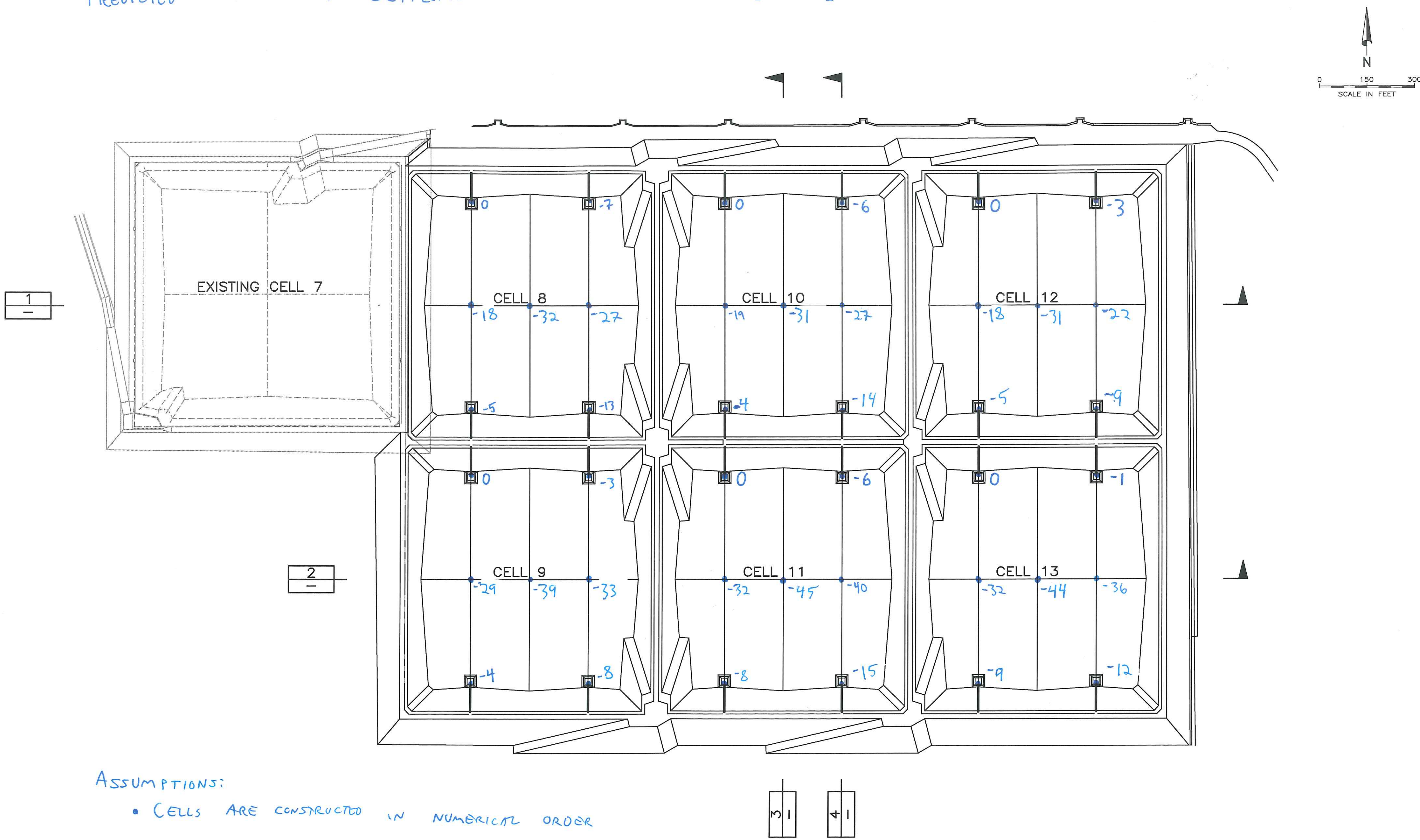
CLEAN HARBORS 116026 IJN 6/29/17
UPDATED 10/2/17

PREDICTED DIFFERENTIAL SETTLEMENT WITHIN EACH CELL [INCHES]



ASSUMPTIONS:

- CELLS ARE CONSTRUCTED IN NUMERICAL ORDER
- EACH CELL IS CLOSED AND ALLOWED TO SETTLE COMPLETELY PRIOR TO NEW CELL CONSTRUCTION

INDIVIDUAL DATUMS (0) SET FOR EACH CELL, AS THE HIGHEST OF THE 7 POINTS LABELLED FOR ANY GIVEN CELL.

PLAN VIEW

PROJECTS\064 – CLEAN HARBORS\85.100 – CELL 8 AND 9 DESIGN\CAD\LAYOUT\PLAN VIEW.DWG
5.18.2017 10:10:04 (CAH)

PROGRESS PRINT
5.18.2017
DATE
Not to be used for construction.
Hansen, Allen, & Luce, Inc.
Consultants/Engineers

APPENDIX H

SEISMIC ANALYSIS

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PROJECT NO. 1160276 TITLE CLEAN HARBORS, CELLS 8-13 DATE 8/31/17 BY WR/TJN
SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 1 OF 19

SITE SPECIFIC GROUND RESPONSE ANALYSIS

DETERMINE: PEAK HORIZONTAL GROUND ACCELERATION

ANALYSIS STEPS:

I. ESTIMATE DEPTH TO BEDROCK

II. DEFINE SOIL PROFILE ABOVE BEDROCK

III. ESTIMATE SOIL PARAMETERS

IV. ESTIMATE ROCK ACCELERATION

V. SELECT STRONG MOTION RECORDS

VI. USE COMPUTER PROGRAM "SHAKE2000" TO PERFORM GROUND RESPONSE ANALYSIS

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SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 2 OF 19

I. ESTIMATE DEPTH TO BEDROCK

(SEE ANALYSIS OF QUATERNARY AND TERTIARY SEDIMENTS)

DEPTH USED = 480 FEET

II. DEFINE SOIL PROFILE ABOVE BEDROCK

- IN A REPORT PERFORMED BY CHEN & ASSOC. IN FEB. 1986 A 300 FOOT DEEP EXPLORATORING BORING WAS DRILLED. (PROJECT # 520885)

THE LOGS FOR THE 300' BORING ARE SHOWN ON SHEETS 3 AND 4

THE COMPUTER PROGRAM "SHAKE" WILL ALLOW 20 LAYERS OF DIFFERENT SOIL TYPES INCLUDING THE BEDROCK

SOIL PROFILE

DEPTH INTERVAL (ft)	SOIL TYPE	# OF SUBLAYERS
0 - 15'	CLAY	2
15 - 45'	SAND	2
45 - 56'	CLAY	1
56 - 83'	SAND	1
83 - 115'	CLAY	2
115 - 160'	SAND	2
160 - 190'	SAND	1
190 - 235'	CLAY	2
235 - 305	SAND	2
* 305 - 380	CLAY	2
380 - 480	GRAVEL	2
** 480 -	BEDROCK	1
		TOTAL 20

* SOIL TYPES BELOW 305' WERE ESTIMATED BASED ON ANALYSIS OF QUATERNARY AND TERTIARY SEDIMENTS

NOTE: THE LAYER DIVISIONS WERE COMPARED WITH THE SOIL LAYER TYPES FROM THE SONIC LOG, WHICH WAS REPORTED IN THE SAME ABOVE REFERENCED REPORT.

** SEE SHEET 17

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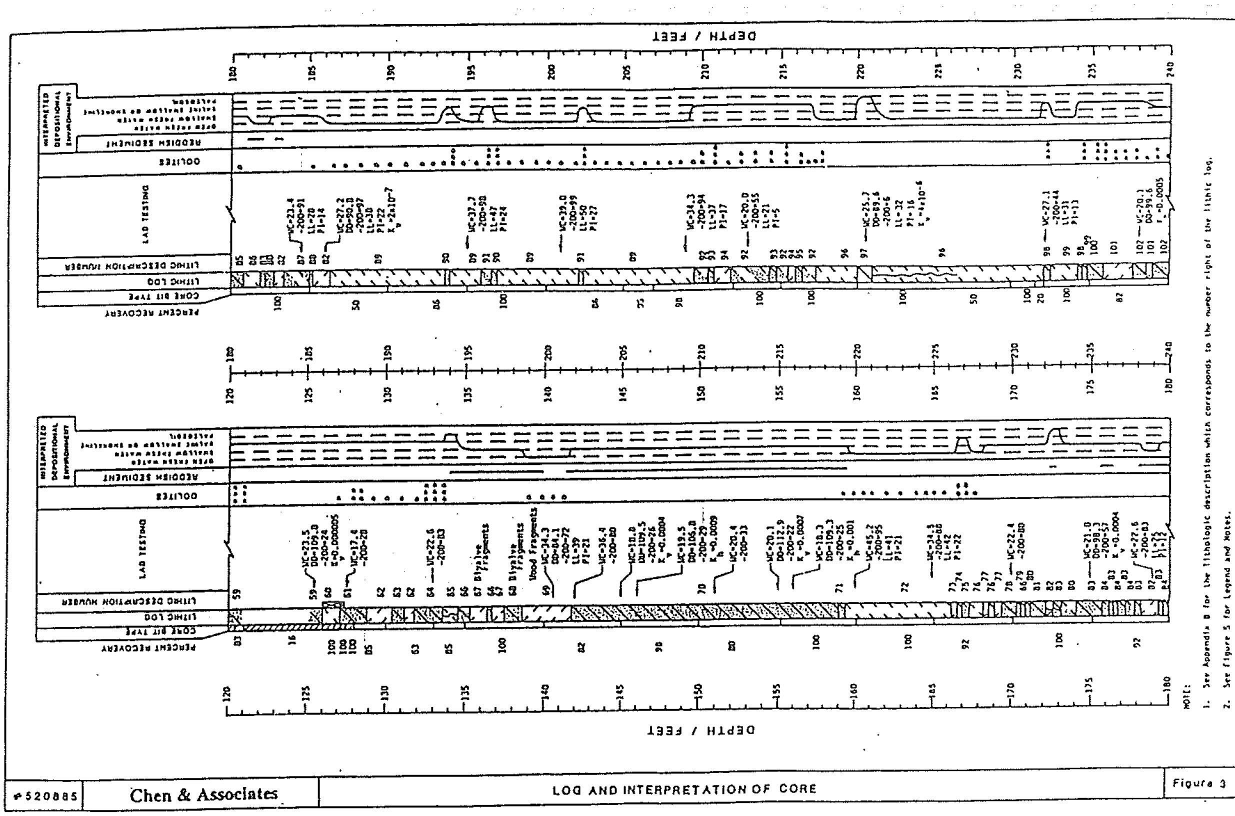
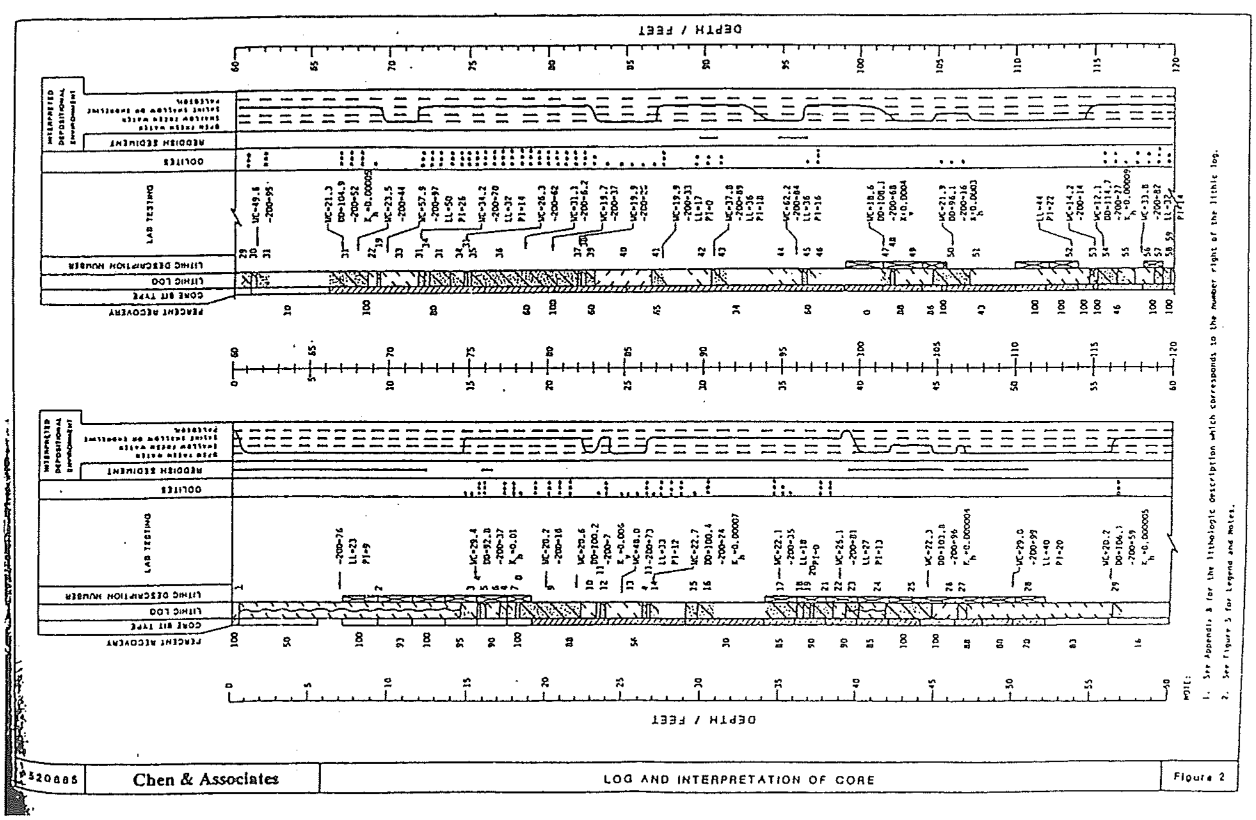
SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 3 OF 19





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PROJECT NO. 1160276 TITLE Clean Harbors, Cells 8-13 DATE 8/31/17 BY WR/TJN

SUBJECT Seismic Response Analysis SHEET 4 OF 19

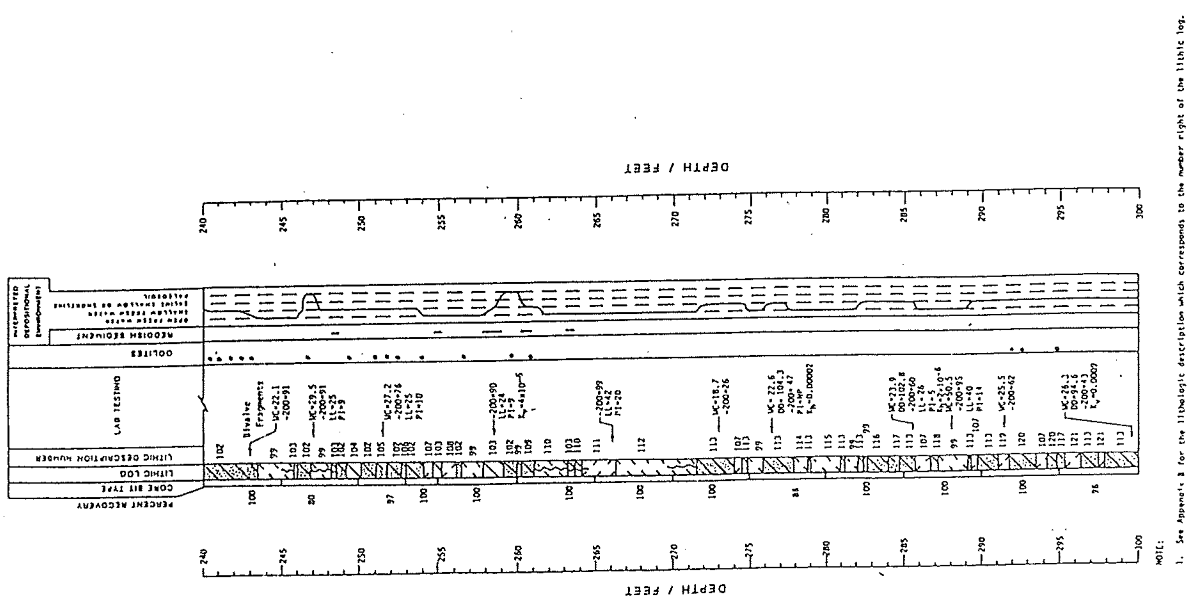
NOTES

1. The boring was drilled during the period of August 20, 1985 to August 30, 1985 with a 5-inch core bit.
2. The location of the boring is shown on Figure 1.
3. The elevation of the boring is approximately 4240 feet above sea level. The elevation is taken from a contour map of the site.
4. A water level is not indicated on the log since a drilling fluid was used during the drilling operation.
5. WC = Water Content (%);
   DD = Dry Density (pcf);
   -200 = Percent Passing No. 200 Sieve;
   LL = Liquid Limit (%);
   PI = Plasticity Index (%);
   K_v = Vertical Permeability (cm/sec);
   K_h = Horizontal Permeability (cm/sec).

LEGEND

- Clay
- Silty Clay
- Silt
- Silty Sand and Clay
- Clayey Sand
- Silty Sand
- Clayey Gravel
- Indicates no recovery of core in this zone.
- Indicates boring advanced using carbide, face-discharge core bit. The number left of symbol indicates percent of sample recovered.
- Indicates boring advanced using punch core system. The number left of symbol indicates the percent of sample recovered.
- Indicates Shelby tube sample obtained.
- 50 / 51 The numbers right of the log correspond to the soil description listed in Appendix B.
- Indicates portion of core which is porous.

#520885	Chen & Associates	LEGEND AND NOTES OF EXPLORATORY BORING	Figure 5



#520885	Chen & Associates	LOG AND INTERPRETATION OF CORE	Figure 4

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PROJECT NO. 1160276 TITLE CLEAN HARBORS, CELLS 8-13 DATE 8/31/17 BY WR / TJN

SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 5 OF 19

III. ESTIMATE SOIL PARAMETERS

DETERMINE: γ_{TOT} (TOTAL UNIT WEIGHT)

THE FOLLOWING VALUES OF γ_{TOT} WERE OBTAINED FROM LABORATORY TESTS PERFORMED ON SAMPLES FROM THE 300' BORING

DEPTH (ft)	γ_{TOT} (pcf)	DEPTH (CONT.)	γ_{TOT} (CONT.)
16	120	145	130
23	120	146	128
30	123	155	128
45	127	175	119
57	128	186	116
68	127	220	113
102	128	238	120
115	129	277	128
126	136	286	127
141	113	300	120

THE FOLLOWING $\gamma_{TOT.}$ VALUES WERE USED:

DEPTH INTERVAL (FT)	γ_{TOT} (pcf)
0-30'	120
30-40'	123
40-95'	127
95-125'	128
125-135'	135
135-145'	120
145-150'	130
150-160'	128
160-275'	120
275-300'	128
300-355'	120
355-370	125
370-480	130

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PROJECT NO. 1160276 TITLE Clean Harbors, Cells 8-13 DATE 8/31/17 BY WR/TJN
SUBJECT Seismic Response Analysis SHEET 6 OF 19

- CALCULATE EFFECTIVE STRESS TO DETERMINE SHEAR WAVE VELOCITIES AND MODULUS REDUCTION RELATIONSHIPS FOR SANDS

THE SPREADSHEET ON SHEET 9 HAS CALCULATED THE EFFECTIVE STRESSES AT 5' INTERVALS WITH THE ESTIMATED TOTAL UNIT WEIGHT VALUES AND THE GROUNDWATER LEVEL AT A DEPTH OF 10 FEET BELOW THE SURFACE.

SAMPLE CALCULATION:

$$\sigma_o' = \gamma' H$$

CALCULATED AT 15' $\sigma_o' = (120)\times(10) + (120-62.4)5 = 1488\, psf$ ✓

- ESTIMATE S_u (UNDRAINED SHEAR STRENGTH) FOR CLAY LAYERS

THERE IS SOME DATA AVAILABLE ON S_u FOR SOILS FROM 0 TO 60' AND NO DATA ON SOIL BELOW 60', THUS S_u VALUES WERE ESTIMATED AS FOLLOWS:

CLAY LAYER DEPTH INTERVAL	S_u (psf)
0 - 15'	300
45 - 56'	450
83 - 115'	600
190 - 235'	800
305 - 380'	1250

- CALCULATE SHEAR MODULUS (G) FOR SAND AND GRAVEL:

$$G = 1000\, K_2 (\sigma_o')^{\frac{1}{2}}$$ (eq. 8.48 DAS, FUNDAMENTALS OF SOIL DYNAMICS)

K_2 = COEFFICIENT BASED ON SHEAR STRAIN AND RELATIVE DENSITY

σ_o' = EFFECTIVE STRESS

K_2 VALUES OBTAINED FROM FIGURES 8.15 & 8.16 ON SHEET 7

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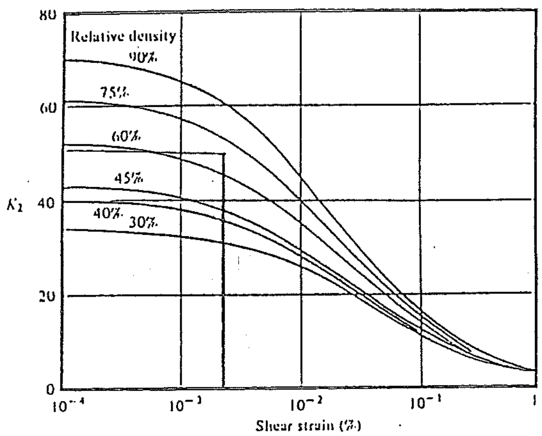
PROJECT NO. 1160276 TITLE CLEAN HARBORS, CELLS 8-13 DATE 8/31/17 BY WR / TJN

SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 7 OF 19

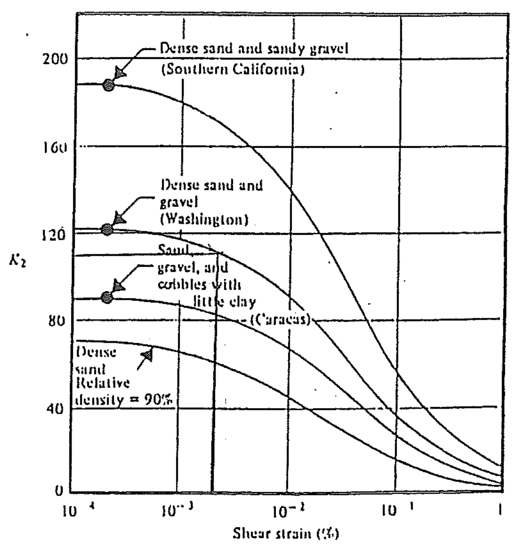


RELATIVE DENSITY FOR SAND ≈ 70% WITH SHEAR STRAIN ≈ 0.03%

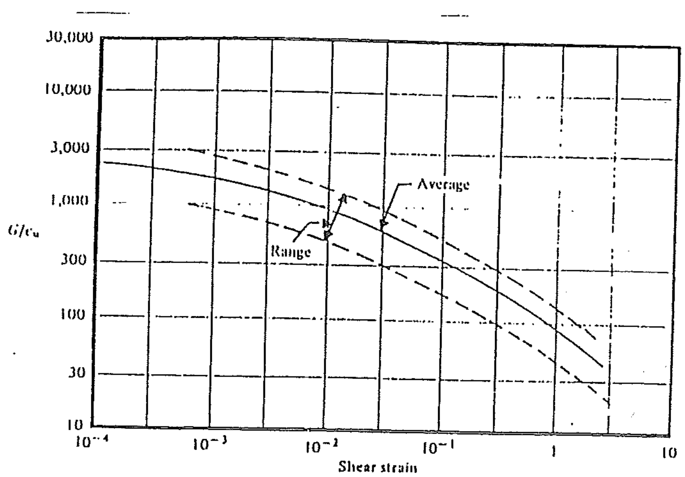
USE $K_2 \approx 50$ SANDS

FIGURE 8.15 Values of K_2 [Eq. (8.48)] for sand at different relative densities. [Seed, H. B., and Idriss, I. M. (1970, Fig. 5).]

FIGURE 8.16 Values of K_2 for gravelly soil. [Seed, H. B., and Idriss, I. M. (1970, Fig. 16).]



USE $K_2 \approx 110$ FOR GRAVELS



USE $G = 2000\, C_u$

NOTE C_u = UNDRAINED SHEAR STRENGTH

FIGURE 8.17 *In situ* shear modulus for saturated clays. [Seed, H. B., and Idriss, I. M. (1970, Fig. 13).]

FIGURES 8.15 - 8.17 DAS FUNDAMENTALS OF SOIL DYNAMICS

THE SPREADSHEET ON SHEET 9 ALSO HAS CALCULATED THE SHEAR MODULUS VALUES BASED ON THE ESTIMATED K_2 VALUE AND THE CALCULATED σ_0' VALUES.

SAMPLE CALCULATION: $G = K_2\,1000(\sigma_0')^{\frac{1}{2}}$

FOR SAND AT 20' $G = 50(1000)(1776)^{\frac{1}{2}} = 2.11 \times 10^6$ psf

- CALCULATE SHEAR MODULUS FOR CLAY BASED ON FIG. 8.17 (SHEET 7)

$G = 2000\,C_u$ WHERE $C_u = S_u$ (UNDRAINED SHEAR STRENGTH)

THE SPREADSHEET ON SHEET 9 ALSO HAS CALCULATED THE SHEAR MODULUS FOR CLAY:

SAMPLE CALCULATION:

FOR CLAY 15' $G = 2000(300) = 600{,}000$ psf

- CONVERT G TO V_s (SHEAR WAVE VELOCITY)

$$V_s = \left(\frac{G}{\rho}\right)^{1/2}$$ (eq. 20-15 BOWLES, FOUNDATION ANALYSIS AND DESIGN, 1988)

WHERE

G = SHEAR MODULUS

$\rho = \frac{\gamma}{g}$

g = gravity (FT/SEC²)

γ = UNIT WEIGHT (lb/FT³)

THE SPREADSHEET ON SHEET 9 ALSO HAS CONVERTED THE SHEAR MODULUS, G TO V_s, SHEAR WAVE VELOCITY (FT/SEC). THESE VALUES ARE LISTED IN THE COLUMN TITLED V_s (CALCULATED)

SAMPLE CALCULATION: FOR CLAY AT 5' $V_s = \left(\frac{600{,}000}{\left(\frac{120}{32.2}\right)}\right)^{1/2} = 401$ FT/SEC

THE SPREADSHEET ALSO CALCULATES THE AVERAGE V_s FOR EACH SOIL LAYER.

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SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 9 OF 19

Shear Wave Velocity Estimates based on calcultations and Sonic log:

GROUNDWATER DEPTH = 10 feet

DEPTH feet	UNIT WT. pcf	EFF. STRESS psf	SOIL TYPE	Su (estimated)	G (modulus)	Vs (calculated)	Vs (ave.calc)	Vs (sonic log)	Vs (average)	Vs (value used)	Vs 80%	Vs 120%
0	120	0	CLAY	300	600000	401						
5	120	600	CLAY	300	600000	401						
10	120	1200	CLAY	300	600000	401						
15	120	1488	CLAY	300	600000	401	401	579	490	525	420	630
20	120	1776	SAND		2107130.8	752						
25	120	2064	SAND		2271663.3	781						
30	123	2367	SAND		2432591.2	798						
35	123	2670	SAND		2583602.1	822						
40	127	2993	SAND		2735416.0	833						
45	127	3318	SAND		2879236	854	807	806	806	800	640	960
50	127	3639	CLAY	450	900000	478						
55	127	3962	CLAY	450	900000	478	478	660	569	625	500	750
60	127	4285	SAND		3272995.6	911						
65	127	4608	SAND		3394112.6	928						
70	127	4931	SAND		3511054	944						
75	127	5254	SAND		3624224.1	959						
80	127	5577	SAND		3733965.7	973	943	948	945	940	752	1128
85	127	5900	CLAY	600	1200000	552						
90	127	6223	CLAY	600	1200000	552						
95	128	6551	CLAY	600	1200000	549						
100	128	6879	CLAY	600	1200000	549						
105	128	7207	CLAY	600	1200000	549						
110	128	7535	CLAY	600	1200000	549						
115	128	7863	CLAY	600	1200000	549	550	757	654	750	600	900
120	128	8191	SAND		4525207.2	1067						
125	135	8554	SAND		4624391.9	1050						
130	135	8917	SAND		4721493.4	1061						
135	120	9205	SAND		4797134.6	1135						
140	120	9493	SAND		4871601.4	1143						
145	130	9831	SAND		4957570	1108						
150	128	10159	SAND		5039593.2	1128						
155	128	10487	SAND		5120302.7	1135	1103	1065	1084	1100	880	1320
160	120	10775	SAND		5190134.9	1160						
165	120	11063	SAND		5259039.8	1168						
170	120	11351	SAND		5327053.6	1196						
175	120	11639	SAND		5394209.9	1203						
180	120	11927	SAND		5460540.3	1210						
185	120	12215	SAND		5526074.6	1218	1199	1247	1223	1200	960	1440
190	120	12503	CLAY	800	1600000	655						
195	120	12791	CLAY	800	1600000	655						
200	120	13079	CLAY	800	1600000	655						
205	120	13367	CLAY	800	1600000	655						
210	120	13655	CLAY	800	1600000	655						
215	120	13943	CLAY	800	1600000	655						
220	120	14231	CLAY	800	1600000	655						
225	120	14519	CLAY	800	1600000	655						
230	120	14807	CLAY	800	1600000	655	655	1084	870	1000	800	1200
235	120	15095	SAND		6143085.5	1284						
240	120	15383	SAND		6201411.1	1290						
245	120	15671	SAND		6259193.2	1296						
250	120	15959	SAND		6316448.8	1302						
255	120	16247	SAND		6373186	1308						
260	120	16535	SAND		6429424.5	1313						
265	120	16823	SAND		6485175.4	1319	1302	1189	1245	1300	1040	1560
270	120	17111	SAND		6540451.1	1325						
275	128	17439	SAND		6602840.3	1289						
280	128	17767	SAND		6664645.5	1295						
285	128	18095	SAND		6725682.8	1301						
290	128	18423	SAND		6786567.6	1307						
295	128	18751	SAND		6846714.5	1312						
300	120	19039	SAND		6899094.1	1361	1313	1418	1364	1350	1080	1620
305	120	19327	CLAY	1250	2500000	819						
310	120	19615	CLAY	1250	2500000	819						
315	120	19903	CLAY	1250	2500000	819						
320	120	20191	CLAY	1250	2500000	819						
325	120	20479	CLAY	1250	2500000	819						
330	120	20767	CLAY	1250	2500000	819						
335	120	21055	CLAY	1250	2500000	819	819			1100	880	1320
340	120	21343	CLAY	1250	2500000	819						
345	120	21631	CLAY	1250	2500000	819						
350	120	21919	CLAY	1250	2500000	819						
355	125	22232	CLAY	1250	2500000	802						
360	125	22545	CLAY	1250	2500000	802						
365	125	22858	CLAY	1250	2500000	802						
370	130	23196	CLAY	1250	2500000	787	807			1100	880	1320
375	130	23534	GRAVEL		16874875	2044						
380	130	23872	GRAVEL		16995623	2052						
385	130	24210	GRAVEL		17115619	2059						
390	130	24548	GRAVEL		17234582	2066						
395	130	24886	GRAVEL		17352827	2073						
400	130	25224	GRAVEL		17470272	2080						
405	130	25562	GRAVEL		17586930	2087						
410	130	25900	GRAVEL		17702025	2094						
415	130	26238	GRAVEL		17817963	2101						
420	130	26576	GRAVEL		17932302	2108	2076			2100	1680	2520
425	130	26914	GRAVEL		18046036	2114						
430	130	27252	GRAVEL		18158998	2121						
435	130	27590	GRAVEL		18271262	2127						
440	130	27928	GRAVEL		18382840	2134						
445	130	28266	GRAVEL		18493745	2140						
450	130	28604	GRAVEL		18603989	2147						
455	130	28942	GRAVEL		18713583	2153						
460	130	29280	GRAVEL		18822540	2159						
465	130	29618	GRAVEL		18930869	2166						
470	130	29956	GRAVEL		19038582	2172	2143			2100	1680	2520

- COMPARE V_S VALUES (CALCULATED) WITH V_S VALUES DETERMINED FROM SONIC LOG. THE SONIC LOG WAS OBTAINED FROM THE REPORT PREPARED BY CHEN & ASSOC. (PROJECT # 520885) REPORTED IN FEBRUARY, 1986. THE SONIC LOG IS A RECORDING OF THE TIME REQUIRED FOR A COMPRESSIONAL SOUND WAVE TO TRAVERSE ONE FOOT OF FORMATION. THIS VALUE IS KNOWN AS THE INTERVAL TRANSIT TIME AND IS THE RECIPROCAL OF THE COMPRESSIONAL SOUND WAVE IN THE MATERIAL

THE FOLLOWING AVERAGE INTERVAL TRANSIT TIMES HAVE BEEN DETERMINED FROM THE SONIC LOG SHOWN ON SHEET 12.

DEPTH INTERVAL (FT.)	SONIC LOG VALUE (SEC/FT.)
0 - 15	0.000188
15 - 45	0.000190
45 - 56	0.000190
56 - 83	0.000180
83 - 115	0.000185
115 - 160	0.000175
160 - 190	0.000175
190 - 235	0.000172
235 - 270	0.000165
270 - 290	0.000168

CONVERT SONIC LOG VALUES TO V_P:

$$V_P\ (ft/sec) = 1/\text{SONIC LOG VALUE (SEC/FT)}$$

SAMPLE CALCULATION: $V_P = \frac{1}{0.000188} = 5319$ FT/SEC

DEPTH INTERVAL	V_P	DEPTH INTERVAL	V_P
0-15	5319	115-160	5714
15-45	5263	160-190	5714
45-56	5263	190-235	5814
56-83	5556	235-270	6061
83-115	5405	270-290	5952

THE U.S.G.S HAS RECENTLY PERFORMED DOWN HOLE SHEAR WAVE VELOCITY TESTS IN SALT LAKE VALLEY, UTAH

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SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 11 OF 19

THE RESULTS OF THESE TESTS ARE PUBLISHED BY TINSLEY AND OTHERS, 1991 "GEOLOGIC ASPECTS OF OF SHEAR-WAVE VELOCITY AND RELATIVE GROUND RESPONSE IN SALT LAKE VALLEY, UTAH"

THE PAPER DOES NOT REPORT SOIL PROFILES FOR THE 20-SITES AT WHICH THE WORK WAS PERFORMED. AFTER CONVERSING ABOUT THE PROFILES WITH MR. TINSLEY (U.S.G.S.) THREE SITES WERE CHOSEN FOR COMPARISON:

SITE	SITE LOCATION	LATITUDE	LONGITUDE	ELEVATION (FT)
SLCAIR	SALTAIR, MORTON SALT CO.	40.78170	111.97670	4208
SLCKSL	KSL RADIO TRANSMITTER	40.7780	112.10030	4215
SLCDUC	DUCK CLUB	40.79800	112.10080	4215

THESE SITE ARE NEAR THE SAME ELEVATION AS THE U.S.P.C.I. CELL 6 SITE, THE PROFILES GENERALLY CONSIST OF LAKE BONNEVILLE SEDIMENTS WHICH ARE INTERLAYERED SANDS, SILTS AND CLAYS.

DURING THE STUDY, BOTH V_p & V_s VALUES WERE MEASURED, THUS BY USING THE FOLLOWING RELATIONSHIP, POISSON'S RATIO (μ) WERE CALCULATED:

$$\mu = \frac{\left(\frac{V_p^2}{2V_s^2} - 1\right)}{\left(\frac{V_p^2}{V_s^2} - 1\right)}$$

ESTIMATE μ, BASED ON COMPARISON WITH THE THREE U.S.G.S. SITES.

IT WAS REPORTED THAT THE SLCAIR SITE WAS PREDOMINANTLY FINE-GRAINED SAND, THE SLCKSL SITE WAS INTERLAYERED AND THE SLCDUC SITE CONTAINED MORE CLAY THAN THE OTHER SITES.

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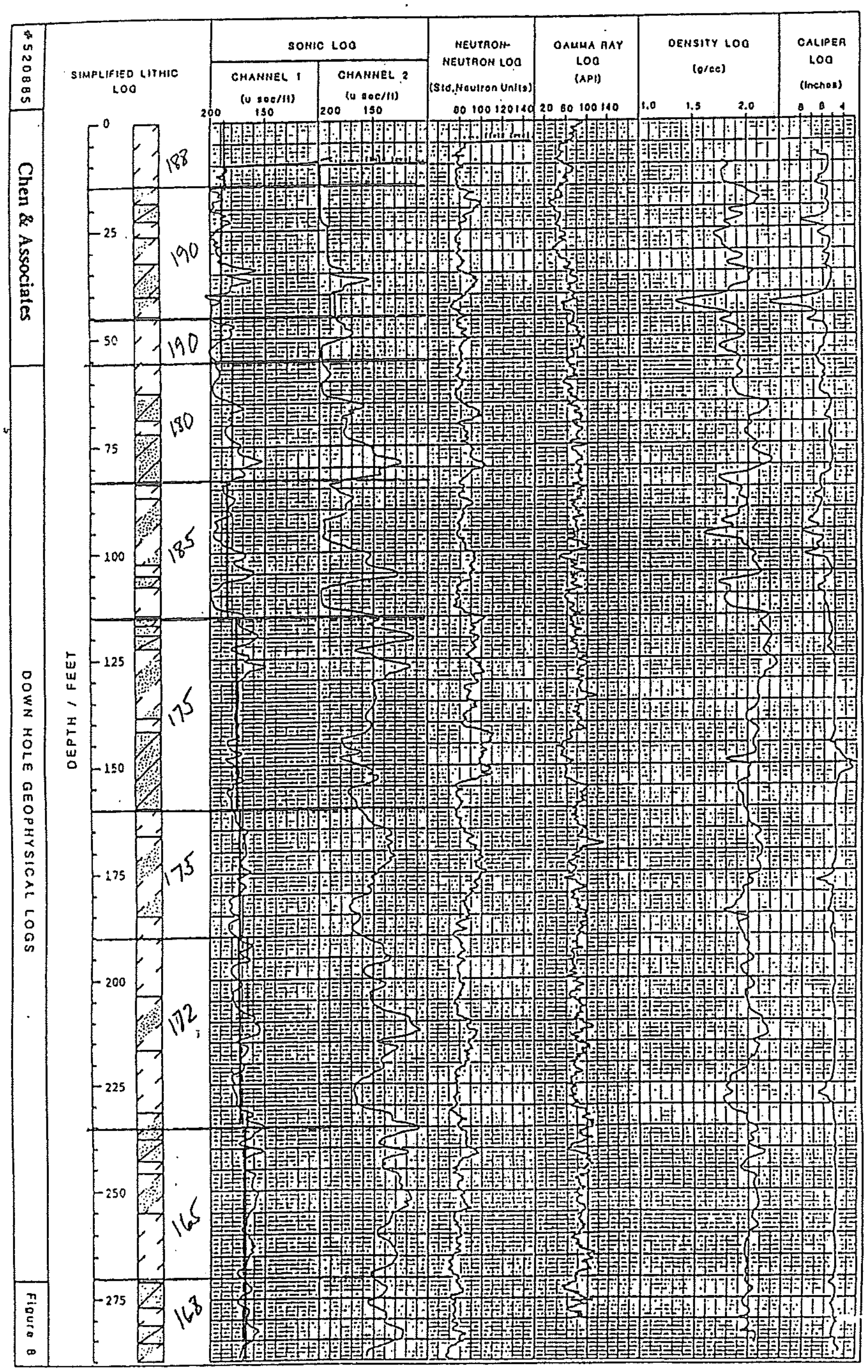
PROJECT NO. 1160276 TITLE CLEAN HARBORS, CELLS 8-13 DATE 8/31/17 BY WR/TJN

SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 12 OF 19

SONIC LOG OBTAINED FROM CHEN & ASSOC. REPORT #520885



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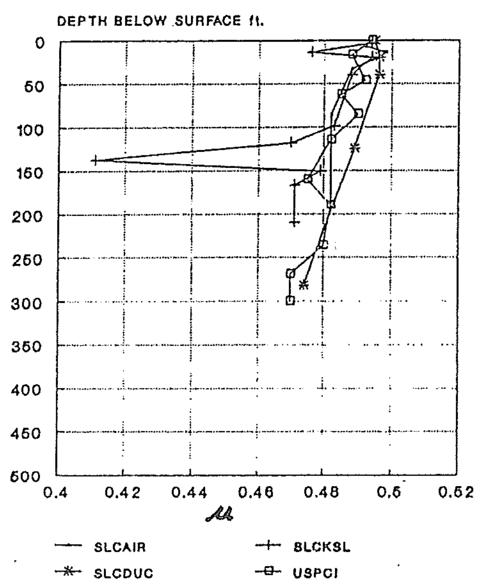
SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 13 OF 19

DEPTH INTERVAL (ft)	POISSON'S RATIO μ
0-15'	0.494
15-45'	0.488
45-56'	0.492
56-83'	0.485
83-115'	0.490
115-160'	0.482
160-190'	0.475
190-235'	0.482
235-270'	0.480
270-290'	0.470

PLOT VALUES OF μ WITH THREE U.S.G.S COMPARISON SITES:

POISSON'S RATIO COMPARISON



THE PLOT SHOWS GOOD COMPARISON WITH THE U.S.G.S DATA.

USING V_p VALUES FROM SONIC LOG, AND ESTIMATE μ VALUES, CALCULATE V_s:

$$V_s = V_p\left(\frac{1-2\mu}{2-2\mu}\right)^{1/2}$$

SAMPLE CALCULATION:

$$V_s = 5319\left(\frac{1-2(0.494)}{2-2(0.494)}\right)^{1/2} = 579 \text{ FT/SEC}$$

DEPTH INTERVAL	V_s (FT/SEC)
0-15'	579
15-45'	806
45-56'	660
56-83'	948
83-115'	757
115-160'	1065
160-190'	1247
190-235'	1084
235-270'	1189
270-290'	1416

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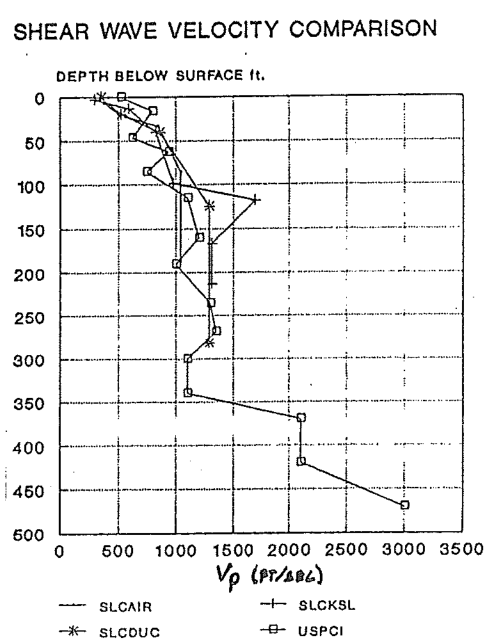
PROJECT NO. 1160276 TITLE CLEAN HARBORS, CELLS 8-13 DATE 8/31/17 BY WR/TJN

SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 14 OF 19

THE SPREADSHEET ON SHEET 9 HAS AVERAGED THE VALUES OF V_S (CALCULATED) AND V_S (SONIC LOG). AFTER REVIEWING THE VALUES OF V_S THE FOLLOWING V_S VALUES WERE USED IN THE ANALYSIS:

DEPTH INTERVAL	V_S (FT/SEC)
0-15'	525
15-45'	800
45-56'	625
56-83'	940
83-115'	750
115-160'	1100
160-190'	1200
190-235'	1000
235-270'	1300
270'-305'	1350
305-380'	1100
380-480'	2100
480 -	3000

THE VALUES OF V_S USED AT THE USPCI SITE COMPARED WITH THE THREE U.S.G.S. SITES ARE SHOWN BELOW:



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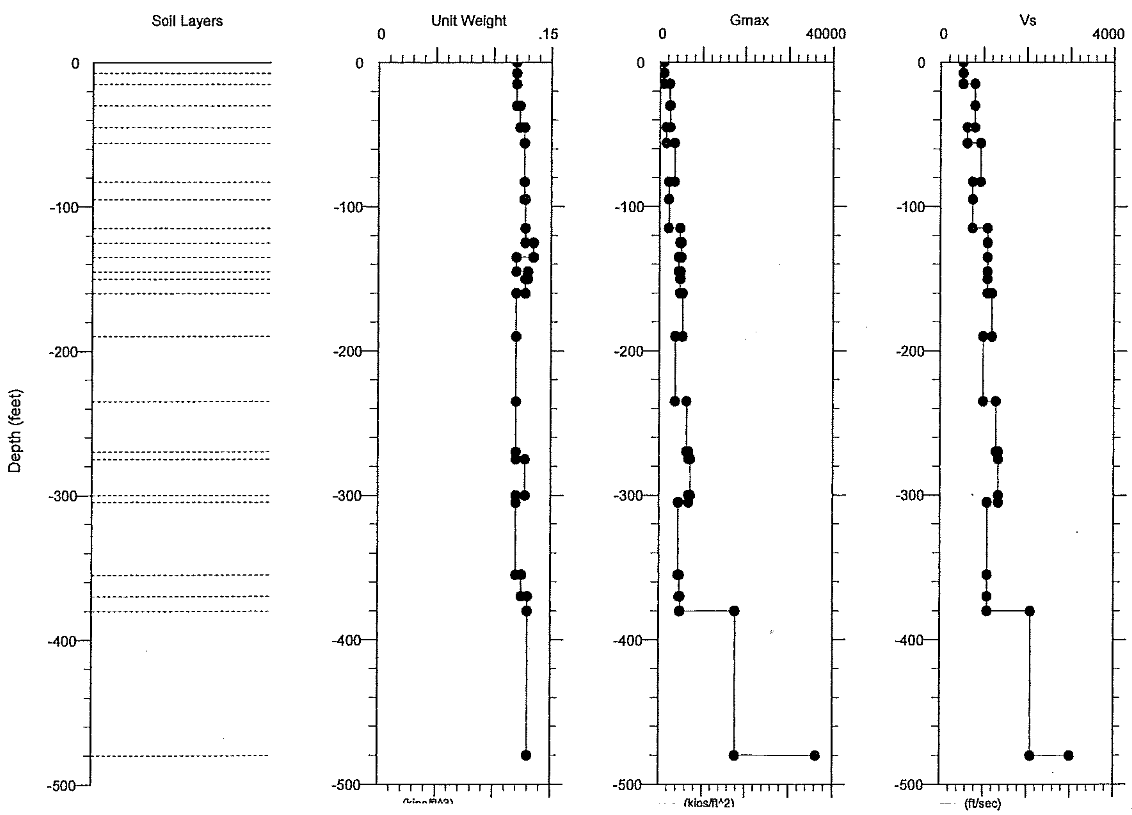
PROJECT NO. 1160276 TITLE Clean Harbors, Cells 8-13 DATE 8/31/17 BY TJN

SUBJECT Seismic Response Analysis SHEET 15 OF 19

Values Used for Analysis

Layer Number	Soil Type	Top Depth [ft]	Bottom Depth [ft]	Layer Thickness [ft]	Unit Weight [pcf]	Vs [ft/s]
1	2	0	7.5	7.5	120	525
2	2	7.5	15	7.5	120	525
3	1	15	30	15	120	800
4	1	30	45	15	123	800
5	2	45	56	11	127	625
6	1	56	83	27	127	940
7	2	83	95	12	127	750
8	2	95	115	20	128	750
9	1	115	125	10	128	1100
10	1	125	135	10	135	1100
11	1	135	145	10	120	1100
12	1	145	150	5	130	1100
13	1	150	160	10	128	1100
14	1	160	190	30	120	1200
15	2	190	235	45	120	1000
16	1	235	270	35	120	1300
17	1	270	275	5	120	1350
18	1	275	300	25	128	1350
19	1	300	305	5	120	1350
20	2	305	355	50	120	1100
21	2	355	370	15	125	1100
22	2	370	380	10	130	1100
23	3	380	480	100	130	2100
24	4	480			130	3000



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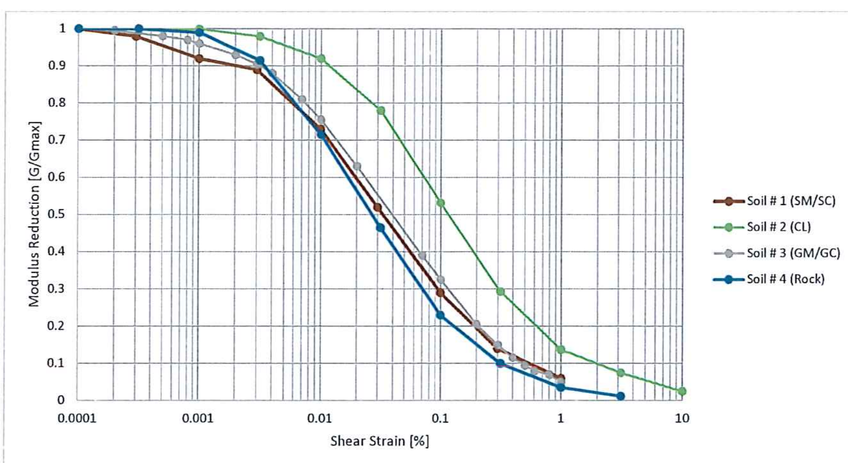
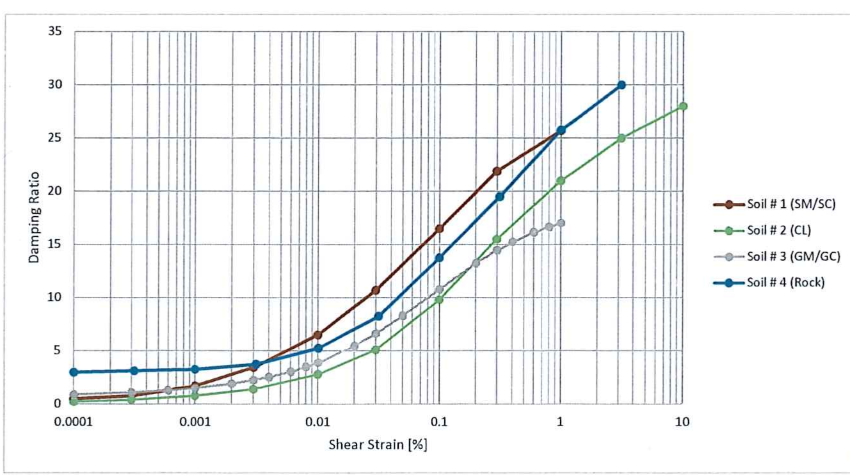
PROJECT NO. 1160276	TITLE CLEAN HARBORS, CELLS 8-13
DATE 8/31/17	BY TJN
SUBJECT SEISMIC RESPONSE ANALYSIS	SHEET 16 OF 19

Dynamic Soil Properties

Soil Type #	Soil Type	Modulus Reduction Model	Damping Ratio Model
1	SM/SC	Sand, Avg. (Seed & Idriss, 1970)	Sand, Avg. (Seed & Idriss, 1970)
2	CL	Clay, PI = 20-40 (Sun et al, 1988)	Clay (Idriss, 1990)
3	GM/GC	Gravel, mean (Rollins et al, 1998)	Gravel, mean (Rollins et al, 1998)
4	bedrock	rock 501 to 1000 ft. (EPRI, 1993)	rock 501 to 1000 ft. (EPRI, 1993)

Soil # 1 (SM/SC)				Soil # 2 (CL)				Soil # 3 (GM/GC)				Soil # 4 (Rock)			
Strain [%]	Modulus Reduction [G/Gmax]	Strain [%]	Damping Ratio	Strain [%]	Modulus Reduction [G/Gmax]	Strain [%]	Damping Ratio	Strain [%]	Modulus Reduction [G/Gmax]	Strain [%]	Damping Ratio	Strain [%]	Modulus Reduction [G/Gmax]	Strain [%]	Damping Ratio
0.0001	1	0.0001	0.5	0.0001	1	0.0001	0.24	0.0001	1	0.0001	0.9	0.0001	1	0.0001	3
0.0003	0.98	0.0003	0.8	0.001	0.999	0.0003	0.42	0.0002	0.995	0.0003	1.11	0.000316	1	0.000316	3.13
0.001	0.92	0.001	1.7	0.00316	0.98	0.001	0.8	0.0005	0.98	0.0006	1.3	0.001	0.99	0.001	3.27
0.003	0.89	0.003	3.45	0.01	0.92	0.003	1.4	0.0008	0.97	0.001	1.5	0.00316	0.915	0.00316	3.75
0.01	0.73	0.01	6.5	0.0316	0.78	0.01	2.8	0.001	0.96	0.002	1.91	0.0101	0.715	0.0101	5.25
0.03	0.52	0.03	10.7	0.1	0.532	0.03	5.1	0.002	0.93	0.003	2.24	0.0316	0.465	0.0316	8.25
0.1	0.29	0.1	16.5	0.316	0.293	0.1	9.8	0.003	0.905	0.004	2.54	0.1	0.23	0.1	13.75
0.3	0.14	0.3	21.9	1	0.137	0.3	15.5	0.004	0.88	0.006	3.05	0.316	0.1	0.316	19.5
1	0.06	1	25.7	3.16	0.075	1	21	0.007	0.81	0.008	3.5	1	0.035	1	25.75
				10	0.025	3.16	25	0.01	0.755	0.01	3.89	3.16	0.012	3.16	30
						10	28	0.02	0.63	0.02	5.45				
								0.07	0.39	0.03	6.61				
								0.1	0.325	0.05	8.28				
								0.2	0.205	0.1	10.79				
								0.3	0.15	0.2	13.23				
								0.4	0.115	0.3	14.47				
								0.5	0.095	0.4	15.24				
								0.6	0.08	0.6	16.14				
								0.8	0.07	0.8	16.66				
								1	0.05	1	17.01				





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PROJECT NO. 1160276 TITLE CLEAN HARBORS, CELLS 8-13 DATE 8/31/17 BY TJN

SUBJECT SEISMIC RESPONSE ANALYSIS SHEET 17 OF 19

IV. ESTIMATE ROCK ACCELERATION AT CLEAN HARBORS SITE

N 40.817° W 113.206°

→ THE ROCK PGA FOR 2% PROBABILITY OF EXCEEDANCE IN 50 YEARS IS 0.147, TAKEN FROM FIG. 22-7 OF ASCE 7-10 (USING USGS U.S. SEISMIC DESIGN MAPS TOOL AT EARTHQUAKE.USGS.GOV). PRINT-OUT PROVIDED IN BACK.

V. SELECT STRONG GROUND MOTION RECORDS:

→ SELECT GROUND MOTION RECORDS TO MATCH THE MEAN MAGNITUDE, DISTANCE, & PGA FROM THE USGS DEAGGREGATION TOOL. PRINTOUT PROVIDED IN BACK.

MEAN DISTANCE, r = 26 km
MEAN MAGNITUDE, m = 6.2
PGA = 0.147
ROCK MOTIONS, $V_s \gtrsim$ 760 m/s (2,500 ft/s) (NO LESS THAN 400)

Location	Year	RSN	Filename	Fault Type	M	distance [km]	Vs30 [m/s]	PGA [g]	Target PGA [g]	acceleration scaling factor
Norcia, Italy	1979	156	CSC-EW	Normal	5.9	5	585	0.208	0.147	0.7
Norcia, Italy	1979	156	CSC-NS	Normal	5.9	5	585	0.154	0.147	1.0
Irpinia, Italy	1980	291	VLT000	Normal	6.9	30	575	0.096	0.147	1.5
Irpinia, Italy	1980	291	VLT270	Normal	6.9	30	575	0.099	0.147	1.5
Edgecumbe, New Zealand	1987	587	MAT083	Normal	6.6	16	551	0.283	0.147	0.5
Edgecumbe, New Zealand	1987	587	MAT353	Normal	6.6	16	551	0.24	0.147	0.6
Northridge, CA	1992	957	HOW060	Reverse	6.69	17	582	0.111	0.147	1.3
Northridge, CA	1992	957	HOW330	Reverse	6.69	17	582	0.159	0.147	0.9
Little Skull Mtn., NV	1992	1741	LSM2000	Normal	5.65	25	593	0.118	0.147	1.2
Little Skull Mtn., NV	1992	1741	LSM2270	Normal	5.65	25	593	0.09	0.147	1.6
Lazio-Abruzzo, Italy	1984	3605	CSS000	Normal	5.8	24	437	0.145	0.147	1.0
Lazio-Abruzzo, Italy	1984	3605	CSS090	Normal	5.8	24	437	0.113	0.147	1.3
Umbria, Italy	1984	4316	PTL000	Normal	5.6	25	497	0.194	0.147	0.8
Umbria, Italy	1984	4316	PTL090	Normal	5.6	25	497	0.19	0.147	0.8
Umbria Marche, Italy	1997	4351	MTL000	Normal	6	25	437	0.116	0.147	1.3
Umbria Marche, Italy	1997	4351	MTL270	Normal	6	25	437	0.109	0.147	1.3

RUN SHAKE 2000

OPTION 1 DYNAMIC SOIL PROPERTIES

		MODULUS REDUCTION	DAMPING
(1)	SAND:	SAND, AVE. (SEED & IDRISS, 1970)	SAND, AVE (SEED & IDRISS, 1
(2)	CLAY:	CLAY, PI = 20-40 (SUN ET AL, 1988)	CLAY (IDRISS, 1990)
(3)	GRAVEL:	GRAVEL, MEAN (ROLLINS ET AL, 1998)	GRAVEL, MEAN (ROLLINS ET AL, 1
(4)	BEDROCK:	ROCK 501 TO 1000 FT (EPRI, 1993)	ROCK 501 TO 1000 FT (EPRI, 1

OPTION 2: SOIL PROFILE

* VALUES USED FROM ABOVE

OPTION 3: INPUT MOTIONS

* MOTIONS USED FROM ABOVE

OPTION 4: INPUT MOTION

* INPUT MOTION SET TO BE BEDROCK MOTION AT TOP OF LAYER 24 (480 FT DEPTH)

OPTION 5: NO. OF ITERATIONS

- SET # OF ITERATIONS TO 10
- SET STRAIN RATIO TO $\frac{M-1}{10} = \frac{6.2-1}{10} = 0.52$

OPTION 6: ACCELERATION AT SUBLAYER

- SET ACCELERATION & TIME HISTORY TO BE RECORDED WITHIN TOP SUBLAYER, MAX. ACCELERATION ONLY IN SUBSEQUENT SUBLAYERS. ODD SUBLAYERS ONLY

OPTION 7: STRESS & STRAIN TIME HISTORIES TO BE COMPUTED AT TOP OF LAYER 1

OPTION 9: RESPONSE SPECTRUM AT SURFACE

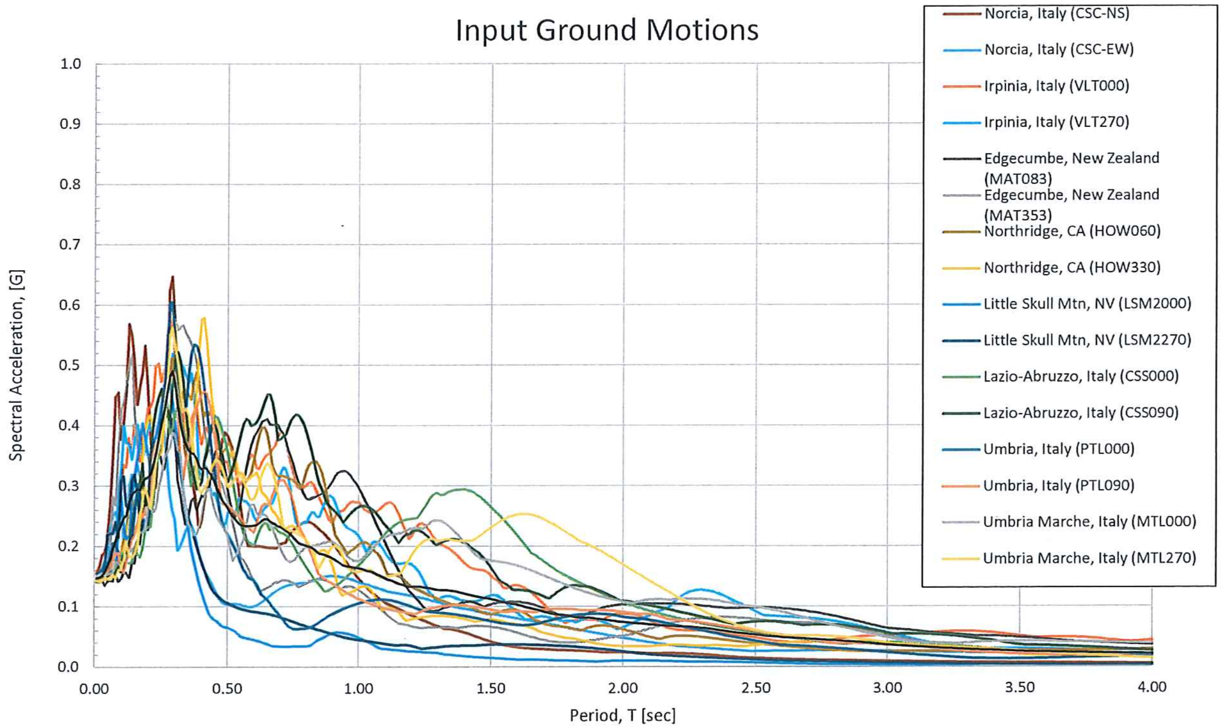
- CALCULATE RESPONSE SPECTRUM AT TOP OF ISOLATOR 1, OUTCROP MOTION

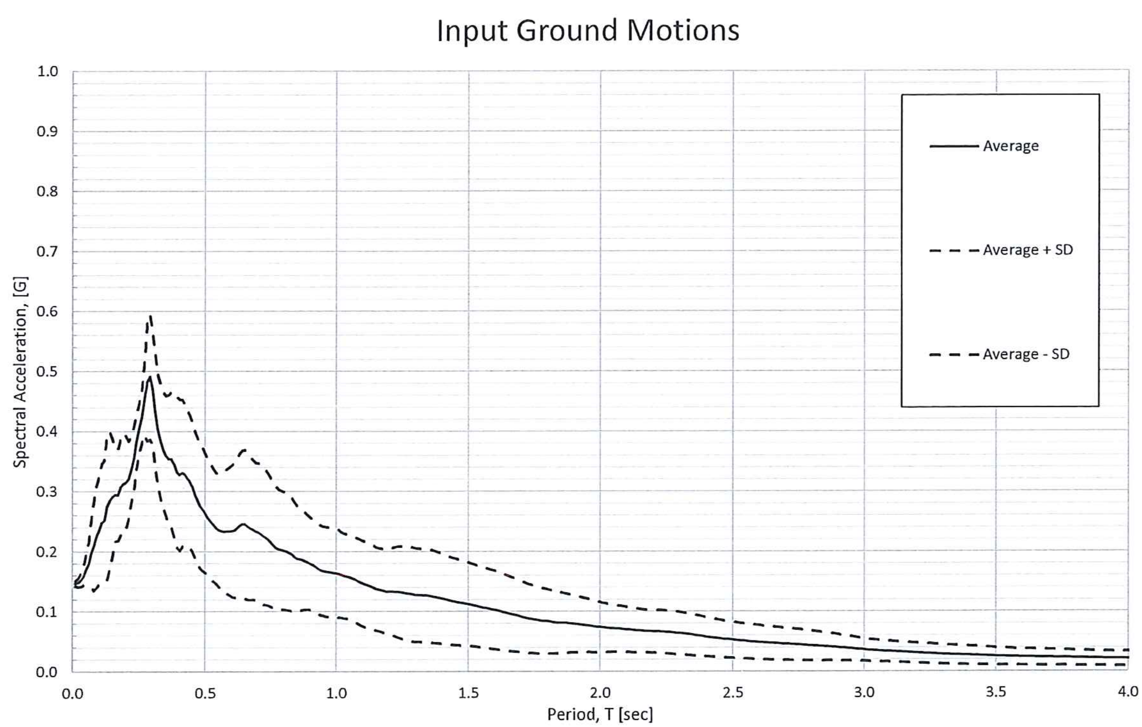
RESULTS

AVERAGE PGA FOR MAXIMUM CONSIDERED EARTHQUAKE (MCE)

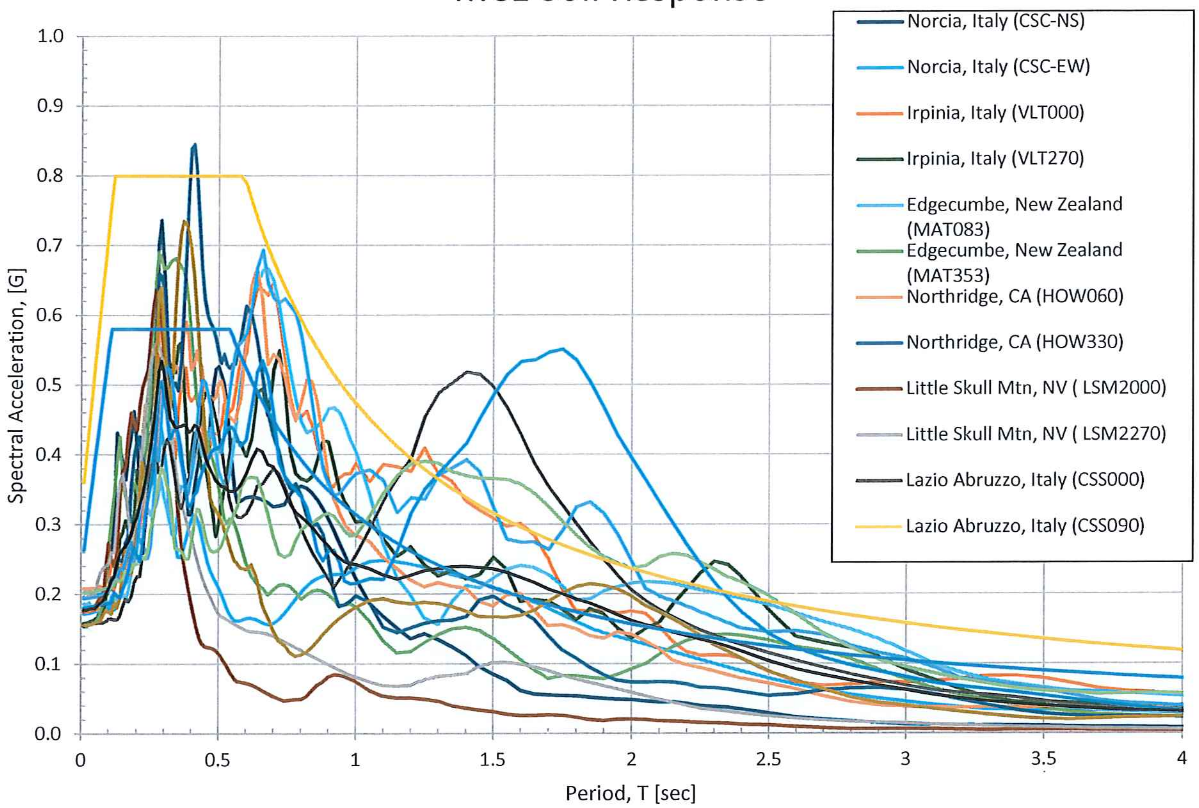
= 0.18 g

* RESULTS ARE SHOWN IN FOLLOWING PAGES

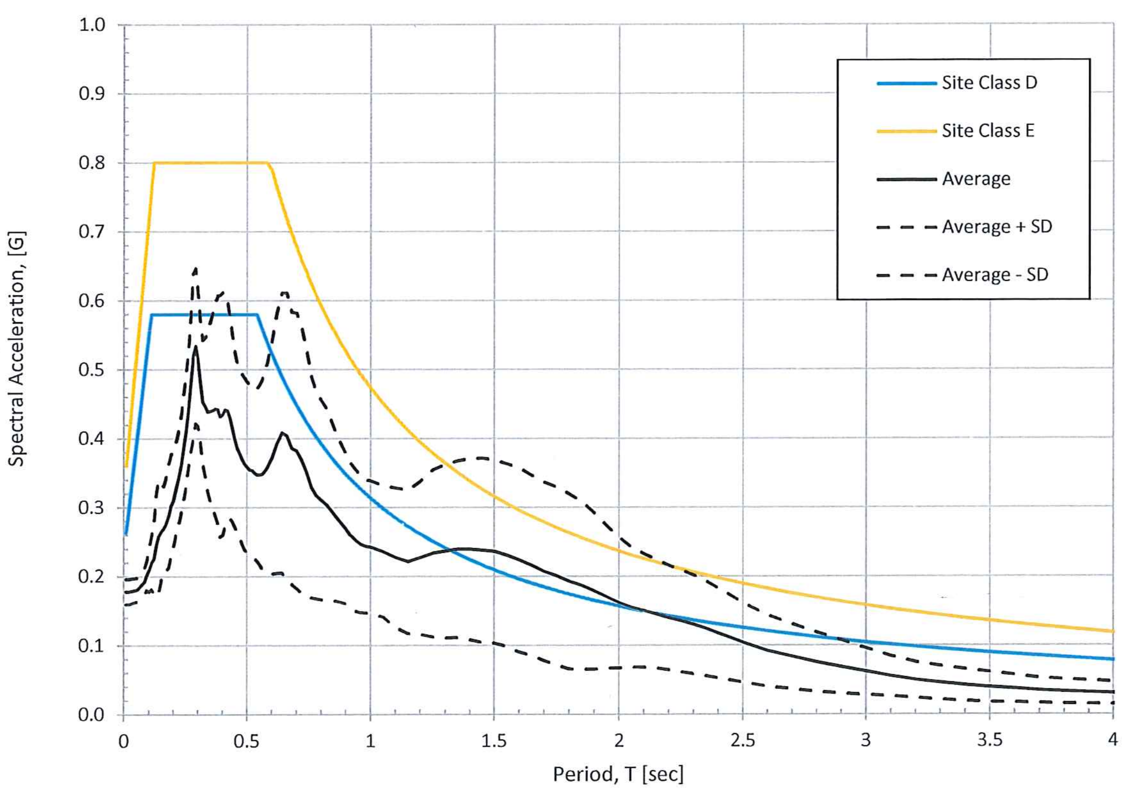

Input Ground Motions
Spectral Acceleration, [G]
Period, T [sec]
Norcia, Italy (CSC-NS)
Norcia, Italy (CSC-EW)
Irpinia, Italy (VLT000)
Irpinia, Italy (VLT270)
Edgecumbe, New Zealand (MAT083)
Edgecumbe, New Zealand (MAT353)
Northridge, CA (HOW060)
Northridge, CA (HOW330)
Little Skull Mtn, NV (LSM2000)
Little Skull Mtn, NV (LSM2270)
Lazio-Abruzzo, Italy (CSS000)
Lazio-Abruzzo, Italy (CSS090)
Umbria, Italy (PTL000)
Umbria, Italy (PTL090)
Umbria Marche, Italy (MTL000)
Umbria Marche, Italy (MTL270)


Input Ground Motions
Spectral Acceleration, [G]
Period, T [sec]
Average
Average + SD
Average - SD

MCE Soil Response



MCE Soil Response



Period	Norcia, Italy		Irpinia, Italy		Edgecumbe, New Zealand		Northridge, CA		Little Skull Mountain, NV		Lazio-Abruzzo, Italy		Umbria, Italy		Umbria Marche, Italy				
	Norcia, Italy (CSC-NS)	Norcia, Italy (CSC-EW)	Irpinia, Italy (VLT000)	Irpinia, Italy (VLT270)	Edgecumbe, New Zealand (MAT083)	Edgecumbe, New Zealand (MAT353)	Northridge, CA (HOW060)	Northridge, CA (HOW330)	Little Skull Mtn, NV (LSM2000)	Little Skull Mtn, NV (LSM2270)	Lazio Abruzzo, Italy (CSS000)	Lazio Abruzzo, Italy (CSS090)	Umbria, Italy (PTL000)	Umbria, Italy (PTL090)	Umbria Marche, Italy (MTL000)	Umbria Marche, Italy (MTL270)	Average	Average + SD	Average - SD
	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%	Sa 5%			
(sec)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)			
0.01	0.15	0.17	0.17	0.16	0.19	0.16	0.21	0.20	0.18	0.20	0.16	0.19	0.16	0.17	0.20	0.18	0.18	0.20	0.16
0.02	0.16	0.17	0.18	0.16	0.19	0.15	0.21	0.20	0.18	0.20	0.16	0.19	0.16	0.17	0.20	0.18	0.18	0.20	0.16
0.03	0.16	0.17	0.18	0.16	0.19	0.16	0.21	0.20	0.18	0.20	0.16	0.19	0.16	0.17	0.20	0.18	0.18	0.20	0.16
0.04	0.16	0.17	0.18	0.16	0.18	0.16	0.21	0.20	0.18	0.20	0.16	0.20	0.16	0.18	0.20	0.18	0.18	0.20	0.16
0.05	0.16	0.18	0.18	0.16	0.18	0.16	0.21	0.20	0.18	0.20	0.16	0.20	0.16	0.18	0.20	0.18	0.18	0.20	0.16
0.06	0.16	0.18	0.18	0.17	0.19	0.16	0.21	0.20	0.19	0.22	0.16	0.20	0.16	0.18	0.21	0.18	0.18	0.20	0.17
0.07	0.18	0.18	0.18	0.17	0.19	0.18	0.21	0.20	0.20	0.23	0.16	0.20	0.16	0.18	0.21	0.19	0.19	0.21	0.17
0.08	0.19	0.19	0.19	0.17	0.19	0.19	0.21	0.20	0.18	0.24	0.16	0.20	0.17	0.18	0.21	0.19	0.19	0.21	0.17
0.09	0.22	0.19	0.20	0.20	0.19	0.21	0.21	0.20	0.24	0.24	0.16	0.20	0.18	0.18	0.21	0.19	0.20	0.22	0.18
0.1	0.23	0.18	0.22	0.21	0.19	0.27	0.21	0.21	0.27	0.24	0.16	0.20	0.18	0.18	0.21	0.19	0.21	0.24	0.18
0.11	0.27	0.20	0.24	0.21	0.19	0.31	0.22	0.22	0.25	0.26	0.16	0.21	0.17	0.19	0.21	0.19	0.22	0.26	0.18
0.12	0.32	0.18	0.25	0.21	0.19	0.34	0.21	0.23	0.24	0.26	0.16	0.22	0.19	0.20	0.21	0.20	0.23	0.27	0.18
0.13	0.43	0.19	0.23	0.23	0.19	0.39	0.22	0.26	0.26	0.32	0.16	0.22	0.18	0.21	0.22	0.20	0.25	0.32	0.17
0.14	0.41	0.19	0.22	0.28	0.20	0.43	0.22	0.25	0.34	0.36	0.17	0.24	0.19	0.22	0.22	0.20	0.26	0.34	0.18
0.15	0.39	0.21	0.25	0.29	0.20	0.37	0.23	0.25	0.38	0.37	0.18	0.24	0.23	0.22	0.22	0.21	0.26	0.34	0.19
0.16	0.36	0.23	0.24	0.31	0.19	0.34	0.25	0.27	0.38	0.35	0.19	0.25	0.26	0.22	0.23	0.22	0.27	0.33	0.21
0.17	0.41	0.28	0.26	0.29	0.21	0.33	0.23	0.28	0.43	0.31	0.19	0.26	0.25	0.22	0.23	0.24	0.28	0.34	0.21
0.18	0.43	0.31	0.26	0.28	0.23	0.35	0.23	0.36	0.46	0.27	0.20	0.28	0.23	0.23	0.23	0.25	0.29	0.36	0.21
0.19	0.46	0.29	0.29	0.32	0.26	0.36	0.25	0.40	0.44	0.29	0.22	0.25	0.26	0.25	0.24	0.27	0.30	0.38	0.23
0.2	0.42	0.28	0.31	0.38	0.27	0.35	0.30	0.42	0.43	0.30	0.22	0.27	0.29	0.25	0.24	0.26	0.31	0.38	0.24
0.21	0.37	0.28	0.38	0.36	0.29	0.34	0.30	0.43	0.47	0.36	0.23	0.32	0.35	0.28	0.25	0.25	0.33	0.39	0.26
0.22	0.32	0.27	0.42	0.37	0.31	0.33	0.30	0.40	0.50	0.41	0.26	0.34	0.39	0.34	0.25	0.27	0.34	0.41	0.28
0.23	0.34	0.26	0.47	0.36	0.32	0.40	0.35	0.38	0.51	0.46	0.30	0.35	0.36	0.36	0.25	0.31	0.36	0.43	0.29
0.24	0.44	0.25	0.48	0.35	0.32	0.44	0.40	0.37	0.52	0.50	0.35	0.39	0.39	0.40	0.26	0.34	0.39	0.46	0.31
0.25	0.46	0.27	0.47	0.42	0.31	0.48	0.41	0.40	0.56	0.53	0.38	0.33	0.43	0.42	0.29	0.36	0.41	0.49	0.33
0.26	0.47	0.32	0.49	0.46	0.32	0.54	0.42	0.48	0.61	0.55	0.41	0.41	0.45	0.45	0.31	0.38	0.44	0.53	0.36
0.27	0.57	0.39	0.49	0.47	0.33	0.65	0.41	0.57	0.64	0.56	0.41	0.41	0.54	0.49	0.33	0.44	0.48	0.58	0.38
0.28	0.70	0.43	0.56	0.52	0.35	0.69	0.44	0.66	0.63	0.56	0.37	0.39	0.63	0.52	0.36	0.50	0.52	0.64	0.40
0.29	0.74	0.44	0.60	0.54	0.37	0.68	0.49	0.66	0.59	0.54	0.38	0.46	0.64	0.53	0.38	0.51	0.53	0.65	0.42
0.3	0.67	0.41	0.54	0.52	0.34	0.67	0.51	0.64	0.55	0.52	0.41	0.50	0.57	0.52	0.38	0.48	0.52	0.61	0.42
0.31	0.58	0.37	0.48	0.53	0.33	0.67	0.46	0.57	0.51	0.49	0.42	0.53	0.50	0.47	0.36	0.46	0.48	0.57	0.40
0.32	0.52	0.33	0.44	0.53	0.30	0.68	0.49	0.46	0.47	0.46	0.41	0.52	0.47	0.41	0.34	0.42	0.45	0.54	0.36
0.33	0.49	0.29	0.43	0.52	0.29	0.68	0.52	0.50	0.42	0.42	0.39	0.50	0.52	0.44	0.31	0.43	0.45	0.55	0.35
0.34	0.46	0.28	0.39	0.52	0.29	0.68	0.53	0.50	0.37	0.39	0.37	0.47	0.61	0.45	0.27	0.44	0.44	0.55	0.32
0.35	0.42	0.25	0.46	0.56	0.32	0.68	0.52	0.49	0.33	0.36	0.34	0.42	0.68	0.52	0.26	0.43	0.44	0.57	0.31
0.36	0.40	0.25	0.50	0.56	0.35	0.67	0.51	0.53	0.28	0.34	0.32	0.39	0.72	0.55	0.26	0.41	0.44	0.58	0.30
0.37	0.38	0.27	0.51	0.51	0.35	0.67	0.57	0.60	0.25	0.32	0.33	0.37	0.73	0.58	0.26	0.38	0.44	0.60	0.29
0.38	0.36	0.28	0.52	0.45	0.35	0.65	0.59	0.68	0.23	0.31	0.36	0.35	0.73	0.61	0.25	0.35	0.44	0.61	0.28
0.39	0.31	0.29	0.49	0.38	0.36	0.62	0.57	0.78	0.21	0.29	0.37	0.34	0.72	0.62	0.25	0.33	0.43	0.61	0.26
0.4	0.31	0.31	0.48	0.41	0.37	0.57	0.52	0.84	0.19	0.28	0.38	0.38	0.70	0.64	0.27	0.33	0.44	0.61	0.26
0.41	0.35	0.31	0.43	0.43	0.39	0.52	0.53	0.84	0.17	0.27	0.40	0.42	0.66	0.64	0.30	0.34	0.44	0.61	0.27
0.42	0.38	0.31	0.49	0.43	0.41	0.48	0.55	0.81	0.15	0.25	0.43	0.44	0.61	0.64	0.32	0.35	0.44	0.60	0.28
0.43	0.40	0.30	0.47	0.40	0.42	0.46	0.53	0.74	0.14	0.24	0.45	0.49	0.55	0.62	0.32	0.37	0.43	0.58	0.28
0.44	0.41	0.28	0.44	0.38	0.40	0.45	0.52	0.67	0.13	0.23	0.47	0.51	0.49	0.59	0.31	0.38	0.42	0.55	0.28
0.45	0.40	0.26	0.41	0.38	0.40	0.44	0.49	0.62	0.13	0.21	0.49	0.50	0.44	0.55	0.29	0.39	0.40	0.53	0.27
0.46	0.39	0.25	0.39	0.37	0.42	0.42	0.48	0.60	0.12	0.20	0.49	0.49	0.39	0.50	0.27	0.39	0.39	0.51	0.26
0.47	0.45	0.23	0.42	0.34	0.44	0.40	0.48	0.59	0.12	0.20	0.48	0.47	0.34	0.44	0.26	0.40	0.38	0.50	0.26
0.48	0.50	0.23	0.43	0.32	0.42	0.39	0.48	0.58	0.12	0.19	0.47	0.43	0.33	0.38	0.26	0.41	0.37	0.49	0.25
0.49	0.52	0.22	0.43	0.28	0.40	0.38	0.48	0.57	0.12	0.18	0.45	0.41	0.32	0.37	0.26	0.41	0.36	0.49	0.24
0.5	0.53	0.21	0.43	0.30	0.38	0.36	0.50	0.55	0.12	0.17	0.43	0.41	0.31	0.37	0.26	0.41	0.36	0.48	0.23
0.51	0.52	0.20	0.44	0.33	0.37	0.34	0.51	0.53	0.11	0.17	0.41	0.40	0.31	0.36	0.27	0.42	0.35	0.48	0.23
0.52	0.50	0.19	0.47	0.35	0.36	0.31	0.49	0.54	0.10	0.17	0.38	0.43	0.30	0.36	0.28	0.43	0.35	0.48	0.23
0.53	0.47	0.18	0.47	0.38	0.35	0.30	0.46	0.53	0.10	0.16	0.36	0.46	0.28	0.35	0.29	0.44	0.35	0.47	0.23
0.54	0.43	0.17	0.46	0.40	0.37	0.31	0.46	0.52	0.08	0.16	0.34	0.49	0.27	0.35	0.30	0.44	0.35	0.47	0.22
0.55	0.39	0.17	0.47	0.42	0.40	0.31	0.45	0.53	0.08	0.16	0.32	0.52	0.26	0.34	0.31	0.44	0.35	0.48	0.22
0.56	0.35	0.16	0.49	0.43	0.44	0.30	0.45	0.53	0.08	0.16	0.31	0.54	0.25	0.34	0.32	0.43	0.35	0.48	0.21
0.57	0.33	0.16	0.51	0.42	0.47	0.29	0.46	0.56	0.07	0.15	0.31	0.56	0.24	0.33	0.33	0.42	0.35	0.50	0.21
0.58	0.33	0.16	0.54	0.42	0.51	0.27	0.48	0.56	0.07	0.15	0.31	0.56	0.24	0.34	0.35	0.41	0.36	0.51	0.21
0.6	0.34	0.17	0.54	0.40	0.57	0.25	0.56	0.61	0.07	0.15	0.31	0.57	0.24	0.39	0.37	0.42	0.37	0.54	0.20
0.62	0.34	0.17	0.61	0.42	0.62	0.23	0.64	0.60	0.07	0.15	0.33	0.61	0.24	0.43	0.37	0.47	0.39	0.58	0.20
0.64	0.34	0.16	0.64	0.49	0.64	0.22	0.67	0.56	0.07	0.15	0.35	0.67	0.22	0.46	0.37	0.52	0.41	0.61	0.21
0.66	0.34	0.16	0.64	0.50	0.67	0.21	0.62	0.51	0.06	0.14	0.36	0.69	0.19	0.50	0.35	0.53	0.40	0.61	0.20
0.68	0.33	0.16	0.63	0.46	0.67	0.20	0.53	0.46	0.06	0.14	0.37	0.65	0.17	0.54	0.31	0.51	0.39	0.58	0.19
0.7	0.33	0.16	0.65	0.52	0.65	0.21	0.54	0.43	0.05	0.14	0.38	0.62	0.15	0.55	0.28	0.46	0.38	0.58	0.18
0.72	0.33	0.16	0.60	0.55	0.61	0.21	0.54	0.40	0.05	0.14	0.37	0.62	0.13	0.54	0.26	0.39	0.37	0.56	0.18
0.74	0.33	0.17	0.54	0.50	0.56	0.21	0.51	0.37	0.05	0.13	0.36	0.62	0.13	0.50	0.25	0.37	0.35	0.53	0.17
0.76	0.34	0.18	0.48	0.41	0.52	0.21	0.47	0.35	0.05	0.13	0.34	0.61	0.12	0.45	0.26	0.36	0.33	0.49	0.17
0.78	0.35	0.19	0.45	0.37	0.48	0.20	0.45	0.36	0.05	0.12	0.31	0.60	0.11	0.39	0.28	0.35	0.32	0.47	0.17
0.8	0.36	0.20	0.46	0.37	0.45	0.19	0.48	0.34	0.05	0.12	0.29	0.57	0.11	0.36	0.29	0.34	0.31	0.46	0.17
0.82	0.35	0.21	0.46	0.36	0.43	0.20	0.51	0.31	0.05	0.12	0.28	0.53	0.12	0.32	0.30	0.32	0.30	0.44	0.17
0.84	0.35	0.22	0.44	0.37	0.44	0.20	0.50	0.30	0.06	0.11	0.26	0.47	0.12	0.29	0.30	0.30	0.30	0.43	0.17
0.86	0.34	0.22	0.41	0.39	0.44	0.21	0.47	0.30	0.07	0.11	0.25	0.42	0.13	0.25	0.31	0.26	0.29	0.41	0.16
0.88	0.32	0.23	0.38	0.42	0.45	0.20	0.42	0.29	0.07	0.10	0.24	0.38	0.14	0.23	0.31	0.25	0.28	0.39	0.16
0.9	0.31	0.23	0.36	0.42	0.47	0.20	0.37	0.25	0.08	0.10	0.22	0.36	0.15	0.22	0.32	0.26	0.27	0.38	0.16
0.92	0.29	0.23	0.35	0.39	0.47	0.19	0.34	0.21	0.08	0.10	0.21	0.34	0.16	0.22	0.31	0.26	0.26	0.36	0.15
0.94	0.27	0.23	0.37	0.35	0.46	0.18	0.32	0.18	0.08	0.09	0.22	0.34	0.17	0.21	0.30	0.25	0.25	0.35	0.15
0.96	0.26	0.23	0.37	0.33	0.44	0.19	0.30	0.19	0.08	0.09	0.23	0.35	0.17	0.20	0.29	0.22	0.25	0.35	0.15
0.98	0.24	0.23	0.37	0.32	0.42	0.19	0.29	0.19	0.08	0.08	0.24	0.37	0.18	0.20	0.28	0.22	0.24	0.34	0.15
1	0.22	0.24	0.39	0.30	0.40	0.18	0.29	0.20	0.07	0.08	0.26	0.37	0.18	0.19	0.28	0.22	0.24	0.34	0.15
1.05	0.19	0.25	0.36	0.30	0.34	0.16	0.28	0.19	0.06	0.07	0.29	0.38	0.19	0.18	0.31	0.22	0.24	0.33	0.14
1.1	0.17	0.25	0.39	0.28	0.27	0.13	0.25	0.15	0.05	0.07	0.33	0.35	0.19	0.16	0.35	0.22	0.23	0.33	0.13
1.15	0.15	0.25	0.38	0.25	0.22	0.12	0.24	0.15	0.05	0.07	0.37	0.32	0.19	0.16	0.37	0.26	0.22	0.33	0.12
1.2	0.14	0.24	0.38	0.27	0.20	0.12	0.22	0.15	0.05	0.07	0.39	0.34	0.19	0.18	0.39	0.32	0.23	0.34	0.12
1.25	0.14	0.24	0.41	0.24	0.17	0.13	0.21	0.16	0.05	0.08	0.45	0.34	0.19	0.19	0.39	0.35	0.23	0.35	0.11
1.3	0.13	0.23	0.37	0.23	0.16	0.14	0.22	0.16	0.05	0.08	0.49	0.37	0.19	0.20	0.39	0.37	0.24	0.36	0.11
1.35	0.12	0.23	0.36	0.23	0.19	0.15	0.21	0.16	0.04	0.08	0.50	0.38	0.18	0.21	0.38	0.39	0.24	0.37	0.11
1.4	0.11	0.22	0.33	0.22	0.21	0.15	0.21	0.17	0.04	0.09	0.52	0.39	0.18	0.21	0.37	0.42	0.24	0.37	0.11
1.45	0.10	0.22	0.32	0.23	0.21	0.15	0.19	0.19	0.03	0.10	0.52	0.33	0.17	0.20	0.37	0.45	0.24	0.37	0.10
1.5	0.09	0.21	0.31	0.25	0.22	0.14	0.18	0.20	0.03	0.10	0.50	0.33	0.17	0.21	0.37	0.49	0.24	0.37	0.10
1.55	0.08	0.20	0.30	0.24	0.24	0.12	0.20	0.19	0.03	0.10	0.47	0.28	0.17	0.22	0.36	0.52	0.23	0.36	0.10
1.6	0.06	0.20	0.30	0.19	0.24	0.11	0.20	0.18	0.03	0.10	0.43	0.27	0.17	0.22	0.36	0.53	0.22	0.36	0.09
1.65	0.06	0.19	0.28	0.19	0.24	0.09	0.18	0.16	0.03	0.10	0.39	0.27	0.18	0.23	0.34	0.54	0.22	0.35	0.09
1.7	0.06	0.18	0.25	0.19	0.23	0.08	0.15	0.14	0.03	0.09	0.35	0.26	0.19	0.24	0.33	0.55	0.21	0.34	0.08
1.75	0.05	0.17	0.21	0.18	0.21	0.08	0.16	0.12	0.03	0.08	0.33	0.29	0.20	0.24	0.30	0.55	0.20	0.33	0.07
1.8	0.05	0.16	0.18	0.16	0.19	0.08	0.15	0.11	0.02	0.08	0.30	0.32	0.21	0.24	0.28	0.54	0.19	0.32	0.07
1.85	0.05	0.15	0.18	0.18	0.19	0.08	0.14	0.10	0.02	0.07	0.27	0.33	0.21	0.23	0.27	0.50	0.19	0.31	0.07
1.9	0.05	0.14	0.18	0.17	0.20	0.08	0.14	0.08	0.02	0.07	0.25	0.32	0.21	0.23	0.25	0.47	0.18	0.29	0.07
1.95	0.05	0.14	0.17	0.15	0.21	0.09	0.15	0.08	0.02	0.06	0.23	0.29	0.21	0.22	0.24	0.43	0.17	0.27	0.07
2	0.05	0.13	0.18	0.14	0.22	0.09	0.14	0.07	0.02	0.06	0.21	0.25	0.20	0.21	0.24	0.40	0.16	0.26	0.07
2.05	0.05	0.13	0.17	0.15	0.22	0.10	0.13	0.07	0.02	0.05	0.19	0.21	0.18	0.20	0.24	0.36	0.16	0.24	0.07
2.1	0.05	0.12	0.15	0.16	0.22	0.11	0.12	0.07	0.02	0.05	0.18	0.20	0.17	0.20	0.25	0.33	0.15	0.23	0.07
2.15	0.04	0.12	0.13	0.19	0.21	0.12	0.11	0.07	0.02	0.04	0.17	0.19	0.16	0.19	0.26	0.30	0.15	0.22	0.07
2.2	0.04	0.11	0.12	0.21	0.21	0.13	0.10	0.07	0.02	0.04	0.16	0.18	0.15	0.17	0.26	0.27	0.14	0.22	0.06
2.25	0.04	0.11	0.11	0.23	0.21	0.14	0.09	0.07	0.02	0.04	0.15	0.17	0.14	0.16	0.25	0.24	0.14	0.21	0.06
2.3	0.04	0.10	0.11	0.25	0.20	0.14	0.09	0.07	0.02	0.03	0.14	0.17	0.13	0.15	0.23	0.22	0.13	0.20	0.06
2.35	0.04	0.09	0.11	0.24	0.20	0.14	0.08	0.06	0.01	0.03	0.13	0.16	0.12	0.14	0.22	0.19	0.12	0.19	0.06
2.4	0.03	0.09	0.11	0.22	0.13	0.14	0.08	0.06	0.01	0.03	0.13	0.15	0.11	0.13	0.22	0.17	0.12	0.18	0.05
2.5	0.03	0.08	0.09	0.18	0.18	0.13	0.07	0.05	0.01	0.03	0.12	0.15	0.09	0.11	0.20	0.14	0.10	0.16	0.05
2.6	0.02	0.07	0.07	0.14	0.17	0.12	0.05	0.06	0.01	0.02	0.10	0.15	0.08	0.10	0.17	0.12	0.09	0.14	0.04
2.7	0.02	0.06	0.07	0.13	0.16	0.12	0.05	0.06	0.01	0.02	0.09	0.14	0.06	0.09	0.14	0.11	0.08	0.13	0.04
2.8	0.02	0.06	0.07	0.12	0.15	0.11	0.05	0.06	0.01	0.02	0.09	0.13	0.05	0.07	0.12	0.10	0.08	0.12	0.03
2.9	0.01	0.05	0.07	0.11	0.14	0.09	0.04	0.07	0.01	0.02	0.08	0.12	0.04	0.07	0.11	0.09	0.07	0.11	0.03
3	0.01	0.05	0.07	0.09	0.12	0.08	0.04	0.06	0.01	0.01	0.07	0.11	0.04	0.06	0.10	0.08	0.06	0.10	0.03
3.1	0.01	0.04	0.08	0.08	0.10	0.06	0.04	0.06	0.01	0.01	0.06	0.10	0.04	0.05	0.09	0.07	0.06	0.08	0.03
3.2	0.01	0.04	0.08	0.06	0.09	0.06	0.04	0.05	0.01	0.01	0.06	0.08	0.03	0.05	0.08	0.07	0.05	0.08	0.02
3.3	0.01	0.03	0.08	0.05	0.08	0.05	0.04	0.04	0.00	0.01	0.06	0.07	0.03	0.05	0.07	0.06	0.05	0.07	0.02
3.4	0.01	0.03	0.08	0.04	0.07	0.04	0.04	0.03	0.01	0.01	0.05	0.07	0.02	0.04	0.06	0.06	0.04	0.07	0.02
3.5	0.01	0.03	0.08	0.04	0.07	0.04	0.04	0.03	0.01	0.01	0.05	0.06	0.02	0.04	0.06	0.05	0.04	0.06	0.02
3.6	0.01	0.03	0.07	0.04	0.06	0.03	0.04	0.03	0.01	0.01	0.04	0.06	0.02	0.04	0.06	0.05	0.04	0.06	0.02
3.7	0.01	0.03	0.06	0.04	0.06	0.03	0.04	0.02	0.00	0.01	0.04	0.05	0.02	0.04	0.06	0.04	0.03	0.05	0.02
3.8	0.01	0.03	0.06	0.04	0.06	0.03	0.04	0.02	0.00	0.01	0.04	0.04	0.02	0.03	0.06	0.04	0.03	0.05	0.02
3.9	0.01	0.03	0.06	0.04	0.06	0.02	0.04	0.02	0.00	0.01	0.04	0.04	0.02	0.03	0.06	0.04	0.03	0.05	0.01
4	0.01	0.03	0.05	0.04	0.05	0.02	0.04	0.02	0.00	0.01	0.03	0.04	0.02	0.03	0.06	0.03	0.03	0.05	0.01
4.1	0.01	0.03	0.06	0.04	0.05	0.02	0.04	0.02	0.00	0.01	0.03	0.04	0.02	0.03	0.05	0.03	0.03	0.05	0.01
4.2	0.01	0.03	0.06	0.04	0.05	0.02	0.04	0.02	0.00	0.00	0.03	0.04	0.02	0.03	0.05	0.03	0.03	0.04	0.01
4.3	0.01	0.03	0.05	0.04	0.05	0.02	0.04	0.02	0.00	0.00	0.03	0.03	0.02	0.02	0.05	0.03	0.03	0.04	0.01
4.4	0.01	0.02	0.05	0.04	0.05	0.02	0.04	0.02	0.00	0.00	0.03	0.03	0.02	0.02	0.05	0.03	0.03	0.04	0.01
4.5	0.01	0.02	0.05	0.04	0.04	0.02	0.04	0.02	0.00	0.00	0.03	0.03	0.02	0.02	0.05	0.02	0.03	0.04	0.01
4.6	0.01	0.02	0.04	0.04	0.04	0.02	0.04	0.02	0.00	0.00	0.03	0.03	0.02	0.02	0.05	0.02	0.03	0.04	0.01
4.7	0.01	0.02	0.04	0.04	0.04	0.02	0.04	0.02	0.00	0.00	0.03	0.03	0.02	0.02	0.05	0.02	0.02	0.04	0.01
4.8	0.01	0.02	0.03	0.04	0.04	0.02	0.03	0.01	0.00	0.00	0.02	0.02	0.02	0.02	0.05	0.02	0.02	0.04	0.01
4.9	0.01	0.02	0.03	0.04	0.04	0.01	0.03	0.01	0.00	0.00	0.02	0.02	0.02	0.02	0.05	0.02	0.02	0.04	0.01
5	0.00	0.02	0.03	0.04	0.04	0.01	0.03	0.01	0.00	0.00	0.02	0.02	0.01	0.02	0.05	0.02	0.02	0.03	0.01
5.1	0.00	0.02	0.03	0.04	0.04	0.01	0.03	0.01	0.00	0.00	0.02	0.02	0.01	0.02	0.05	0.02	0.02	0.03	0.01
5.2	0.00	0.02	0.03	0.03	0.04	0.01	0.03	0.01	0.00	0.00	0.02	0.02	0.01	0.02	0.05	0.02	0.02	0.03	0.01
5.4	0.00	0.02	0.03	0.03	0.04	0.01	0.02	0.01	0.00	0.00	0.02	0.02	0.01	0.02	0.04	0.02	0.02	0.03	0.01
5.6	0.00	0.01	0.02	0.03	0.03	0.01	0.02	0.01	0.00	0.00	0.02	0.02	0.01	0.02	0.04	0.02	0.02	0.03	0.01
5.8	0.00	0.01	0.02	0.02	0.03	0.01	0.02	0.01	0.00	0.00	0.02	0.01	0.01	0.02	0.04	0.02	0.01	0.02	0.01
6	0.00	0.01	0.02	0.02	0.03	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.02	0.01	0.02	0.00
6.2	0.00	0.01	0.02	0.01	0.03	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.01	0.01	0.02	0.00
6.4	0.00	0.01	0.02	0.01	0.03	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.01	0.01	0.02	0.00
6.6	0.00	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.02	0.00
6.8	0.00	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.02	0.00
7	0.00	0.01	0.01	0.01	0.03	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.02	0.00
7.3	0.00	0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.02	0.00
7.6	0.00	0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00
8	0.00	0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00
8.5	0.00	0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00
9	0.00	0.01	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.02	0.01	0.01	0.01	0.00
9.5	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00
10	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00
10.5	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

^ Input

Edition

Dynamic: Conterminous U.S. 2008

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

40.817

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western long...

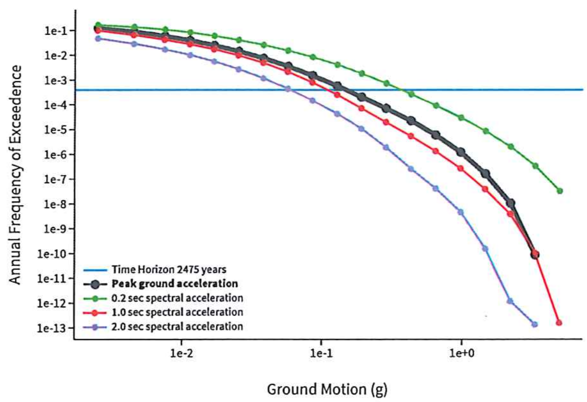
-113.206

Site Class

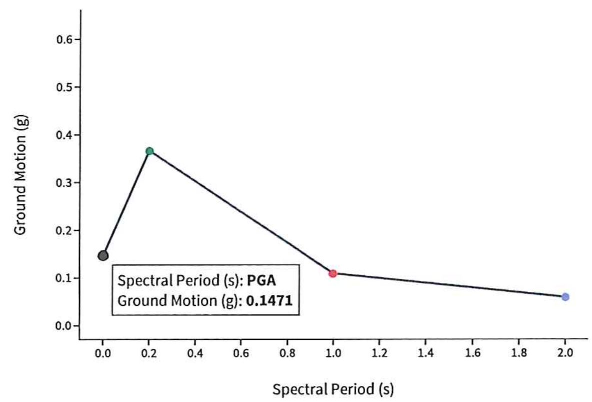
760 m/s (B/C boundary)

^ Hazard Curve

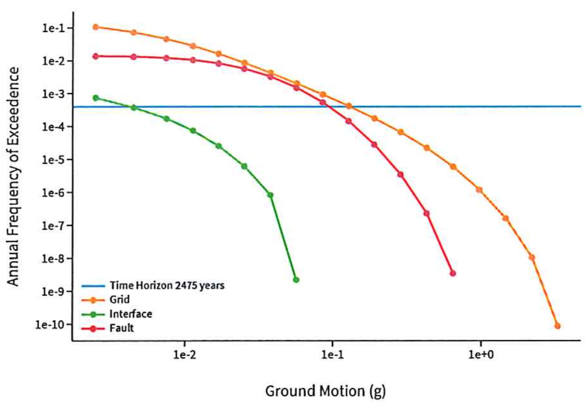
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak ground acceleration

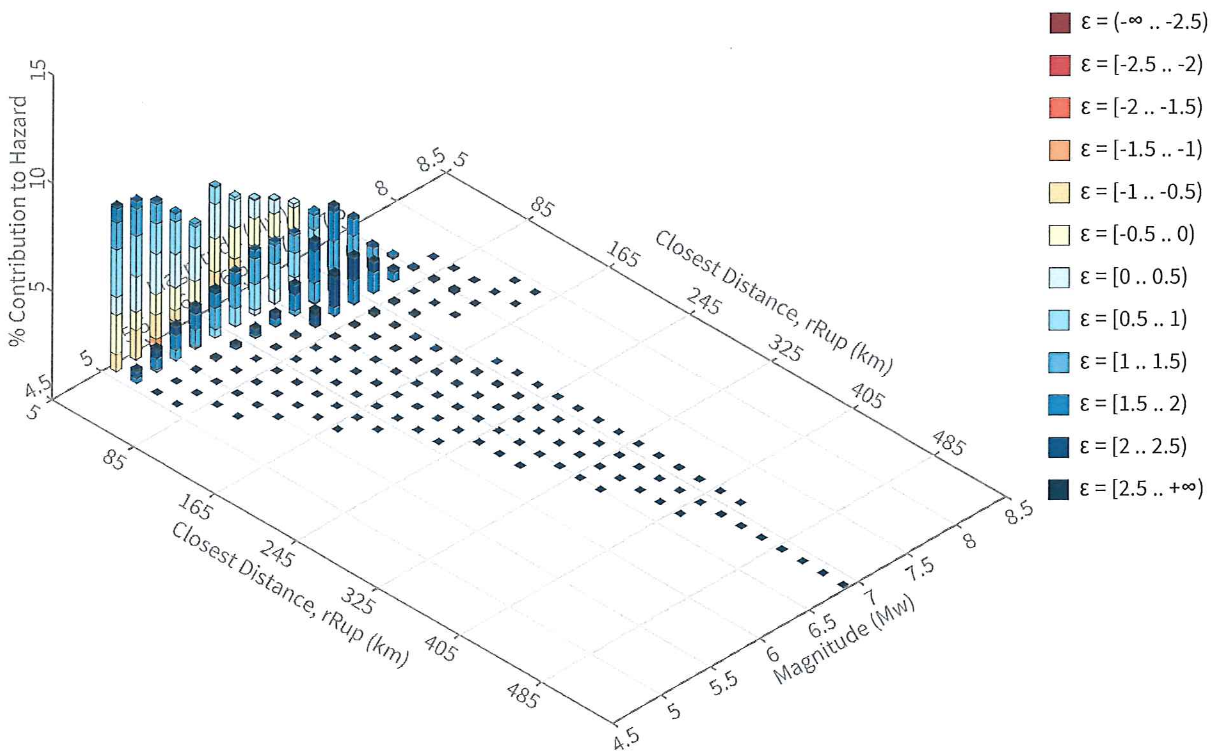


View Raw Data

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.14706357 g

Recovered targets

Return period: 2635.1078 yrs
Exceedance rate: 0.00037949112 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.68 %

Mean (for all sources)

r: 25.99 km
m: 6.17
ε_0: 0.65 σ

Mode (largest r-m bin)

r: 9.87 km
m: 5.1
ε_0: 0.51 σ
Contribution: 7.61 %

Mode (largest ε_0 bin)

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
EXTmap.ch.in (opt)	Grid							53.11
PointSourceFinite: -113.206, 40.902		10.17	5.73	-0.02	113.206°W	40.902°N	0.00	7.20
PointSourceFinite: -113.206, 40.830		5.22	5.56	-0.83	113.206°W	40.830°N	0.00	7.05
PointSourceFinite: -113.206, 40.929		12.43	5.82	0.21	113.206°W	40.929°N	0.00	5.38
PointSourceFinite: -113.206, 40.893		9.44	5.71	-0.11	113.206°W	40.893°N	0.00	3.63
PointSourceFinite: -113.206, 40.956		14.72	5.92	0.40	113.206°W	40.956°N	0.00	2.89
PointSourceFinite: -113.206, 41.001		18.58	6.07	0.66	113.206°W	41.001°N	0.00	1.97
PointSourceFinite: -113.206, 40.938		13.19	5.85	0.28	113.206°W	40.938°N	0.00	1.84
PointSourceFinite: -113.206, 41.010		19.36	6.10	0.70	113.206°W	41.010°N	0.00	1.80
PointSourceFinite: -113.206, 41.055		23.35	6.23	0.91	113.206°W	41.055°N	0.00	1.67
PointSourceFinite: -113.206, 40.965		15.49	5.95	0.46	113.206°W	40.965°N	0.00	1.39
PointSourceFinite: -113.206, 41.046		22.54	6.20	0.87	113.206°W	41.046°N	0.00	1.35
PointSourceFinite: -113.206, 40.974		16.26	5.98	0.51	113.206°W	40.974°N	0.00	1.33
PointSourceFinite: -113.206, 41.109		28.29	6.35	1.11	113.206°W	41.109°N	0.00	1.32
PointSourceFinite: -113.206, 40.983		17.03	6.01	0.56	113.206°W	40.983°N	0.00	1.26
PointSourceFinite: -113.206, 40.992		17.80	6.04	0.61	113.206°W	40.992°N	0.00	1.18
PointSourceFinite: -113.206, 41.136		30.82	6.40	1.20	113.206°W	41.136°N	0.00	1.15
EXTmap.gr.in (opt)	Grid							26.34
PointSourceFinite: -113.206, 40.902		10.17	5.73	-0.02	113.206°W	40.902°N	0.00	3.59
PointSourceFinite: -113.206, 40.830		5.22	5.56	-0.83	113.206°W	40.830°N	0.00	3.52
PointSourceFinite: -113.206, 40.929		12.43	5.82	0.21	113.206°W	40.929°N	0.00	2.69
PointSourceFinite: -113.206, 40.893		9.44	5.71	-0.11	113.206°W	40.893°N	0.00	1.81
PointSourceFinite: -113.206, 40.956		14.72	5.92	0.40	113.206°W	40.956°N	0.00	1.44
ut.3dip.ch	Fault							12.22
Stansbury 50		40.72	7.07	1.18	112.659°W	40.690°N	106.94	3.70
Stansbury 40		37.15	7.07	1.03	112.659°W	40.690°N	106.94	2.30
ut.3dip.gr	Fault							6.94
Stansbury 50		44.57	6.81	1.52	112.659°W	40.690°N	106.94	2.22
Stansbury 40		41.54	6.81	1.40	112.659°W	40.690°N	106.94	1.33

APPENDIX I

LIQUEFACTION ANALYSIS

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PROJECT NO. 1160276 TITLE CLEAN HARBORS DATE 10/2/2017 BY TJN
SUBJECT LIQ. INDUCED SETTLEMENT - CPT SHEET 1 OF 1

LIQUIFACTION - INDUCED SETTLEMENT ESTIMATES WERE CALCULATED FROM 15 CPT SOUNDINGS PREVIOUSLY PERFORMED ON THE SITE. THE NCEER 1998 METHOD WAS USED, WITHIN THE CLIQ V2.0 SOFTWARE DEVELOPED BY PETER ROBERTSON & GREGG DRILLING. AN EARTHQUAKE MAGNITUDE OF 6.2 WAS USED, WITH A PGA OF 0.18 G.

A LAYER TRANSITION CORRECTION WAS USED, SUCH THAT SETTLEMENT WAS NOT CALCULATED FOR LAYERS IN WHICH I_c WAS RAPIDLY CHANGING, WITHIN $1.70 \leq I_c \leq 3.00$. THIS ATTEMPTS TO CORRECT FOR ADDITIONAL SETTLEMENT ESTIMATED DUE TO READINGS AFFECTED BY TRANSITIONING FROM CLAY-LIKE TO SAND-LIKE MATERIAL AND VICE VERSA.

THE FOLLOWING LIQUEFACTION - INDUCED SETTLEMENTS WERE CALCULATED:

CPT	ESTIMATED SETTLEMENT (IN)
L-1	3.5
L-3	1.7
L-5	0.8
L-7	1.4
L-9	1.5
L-11	4.5
L-13	1.5
L-14	1.4
L-16	2.9
L-18	2.0
L-20	3.5
L-31	0.6
L-32	0.7
L-33	0.4
L-34	0.3

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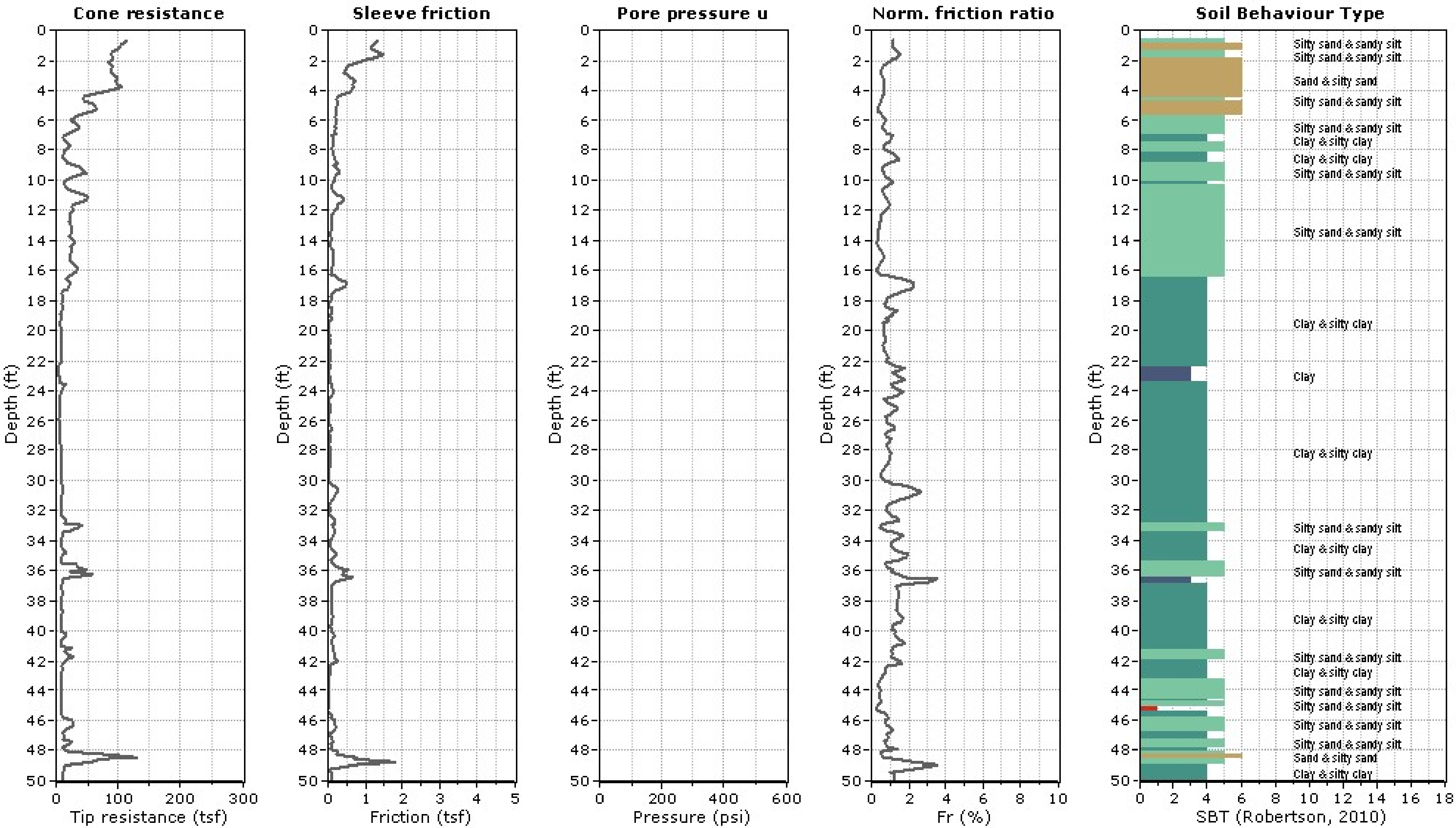
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-1
Total depth: 91.37 ft, Date: 2/1/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling



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600 W. Sandy Parkway
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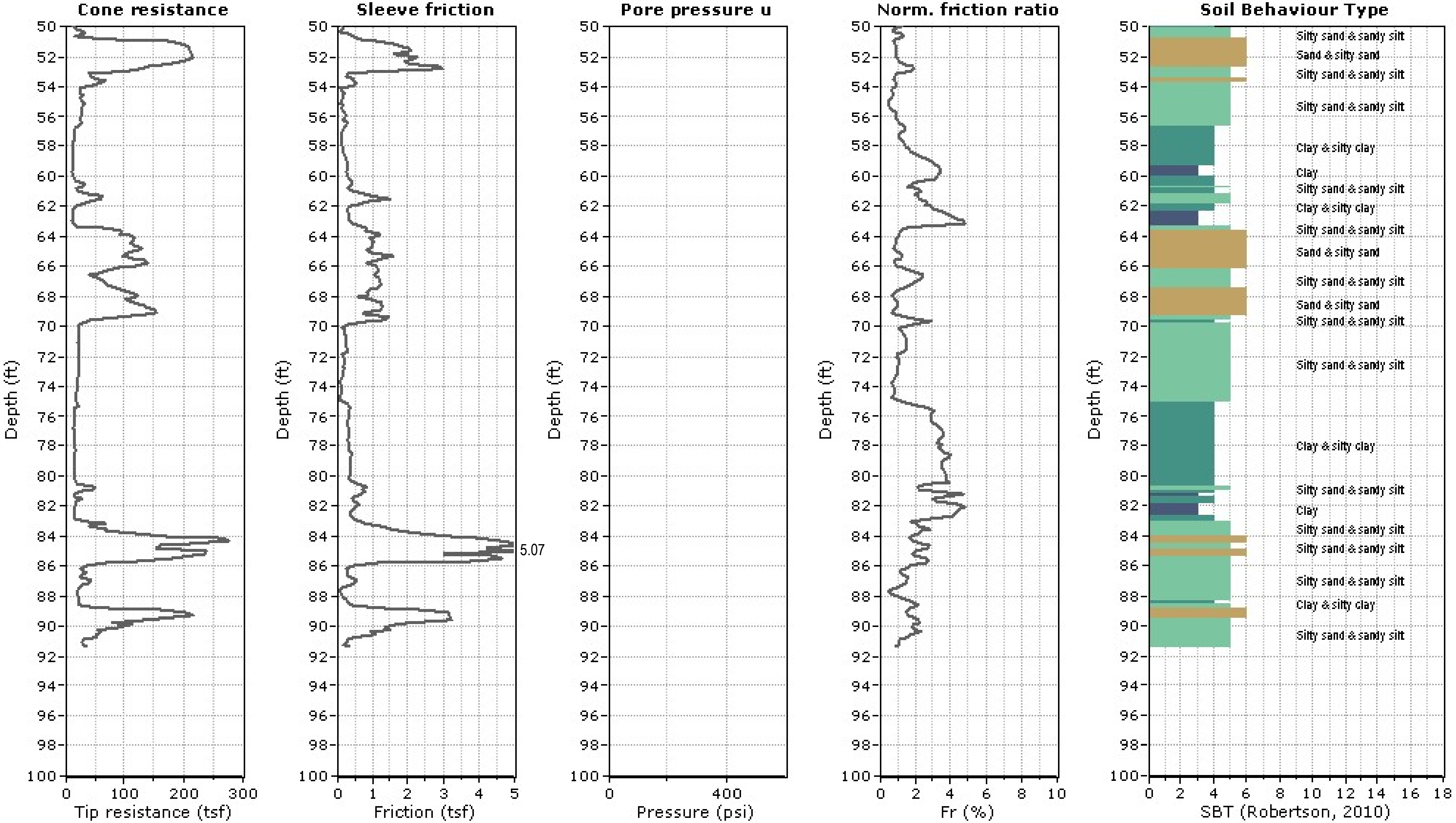
CPT: L-1
Total depth: 91.37 ft, Date: 2/1/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



600 W. Sandy Parkway
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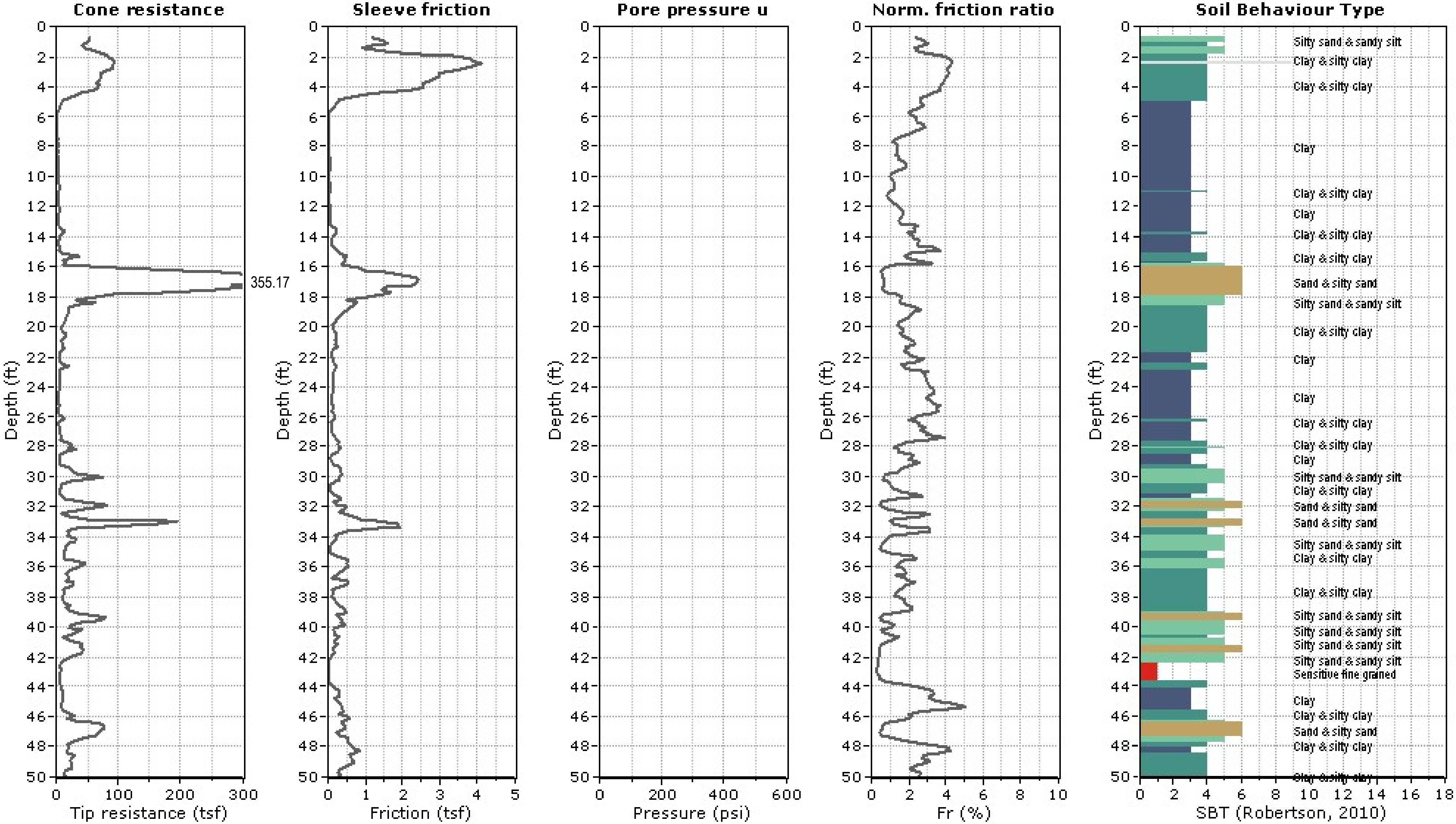
801.566.6399

CPT: L-3
Total depth: 91.54 ft, Date: 4/7/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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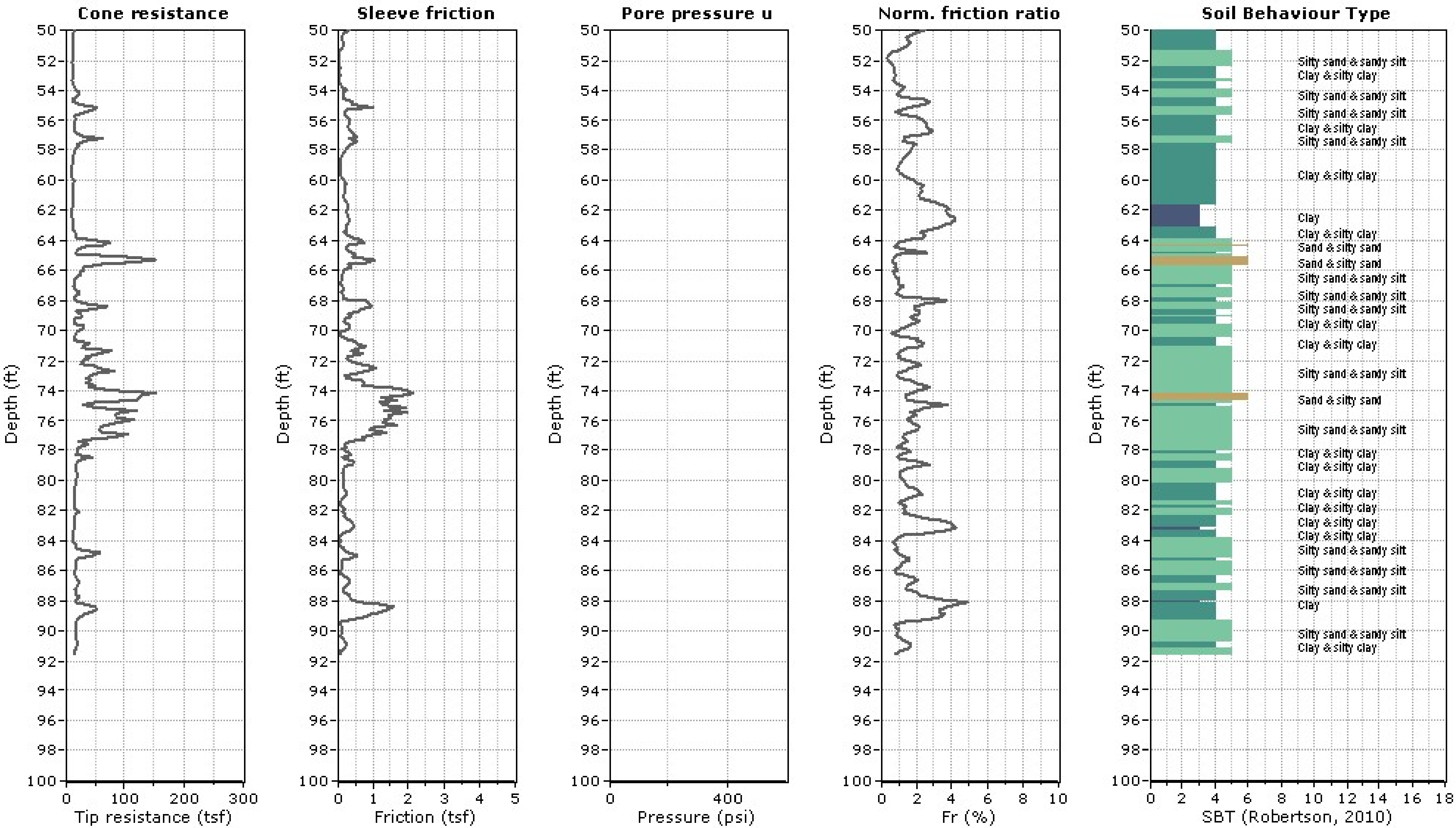
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-3
Total depth: 91.54 ft, Date: 4/7/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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600 W. Sandy Parkway
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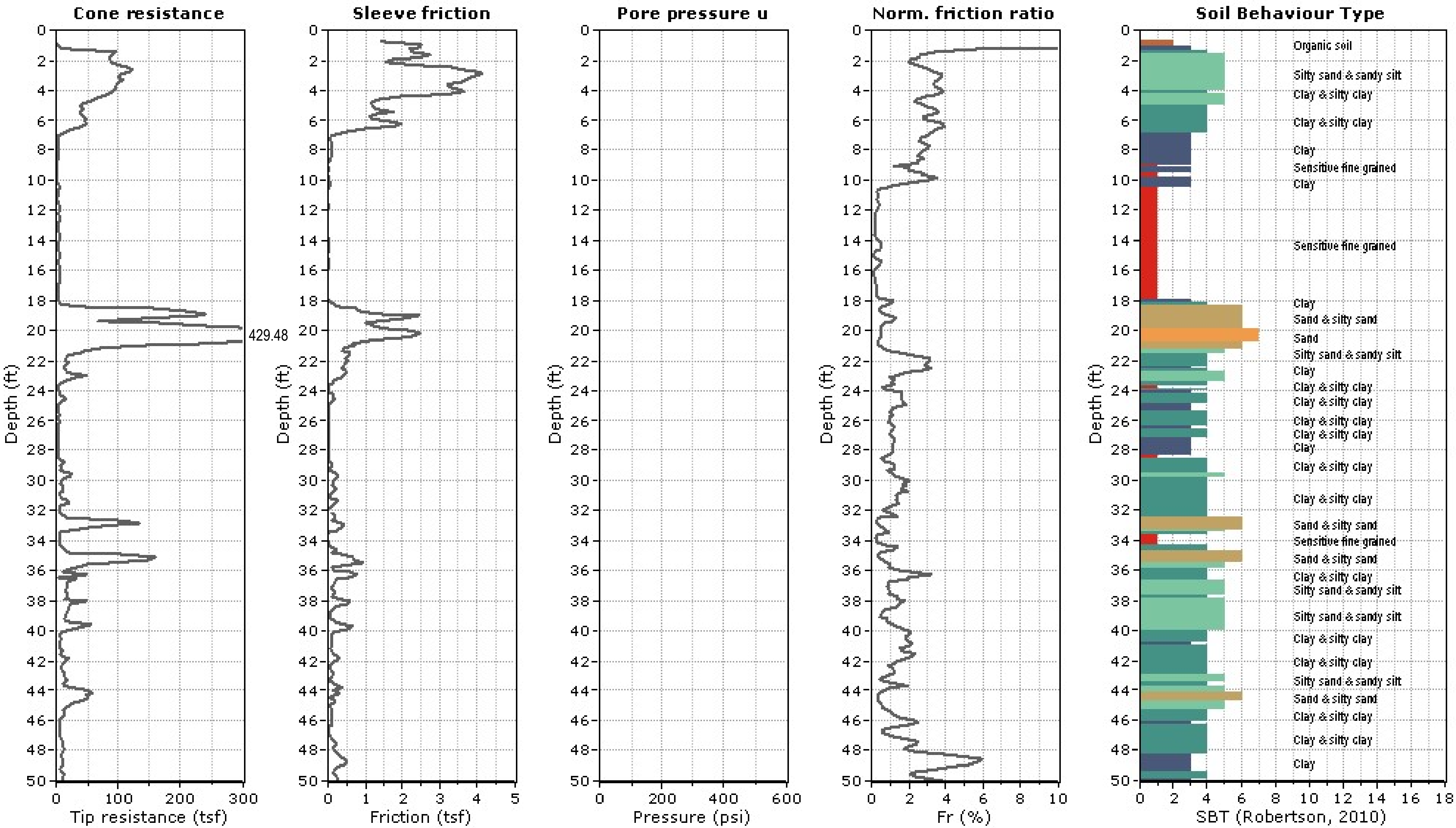
801.566.6399

CPT: L-5

Total depth: 91.04 ft, Date: 4/29/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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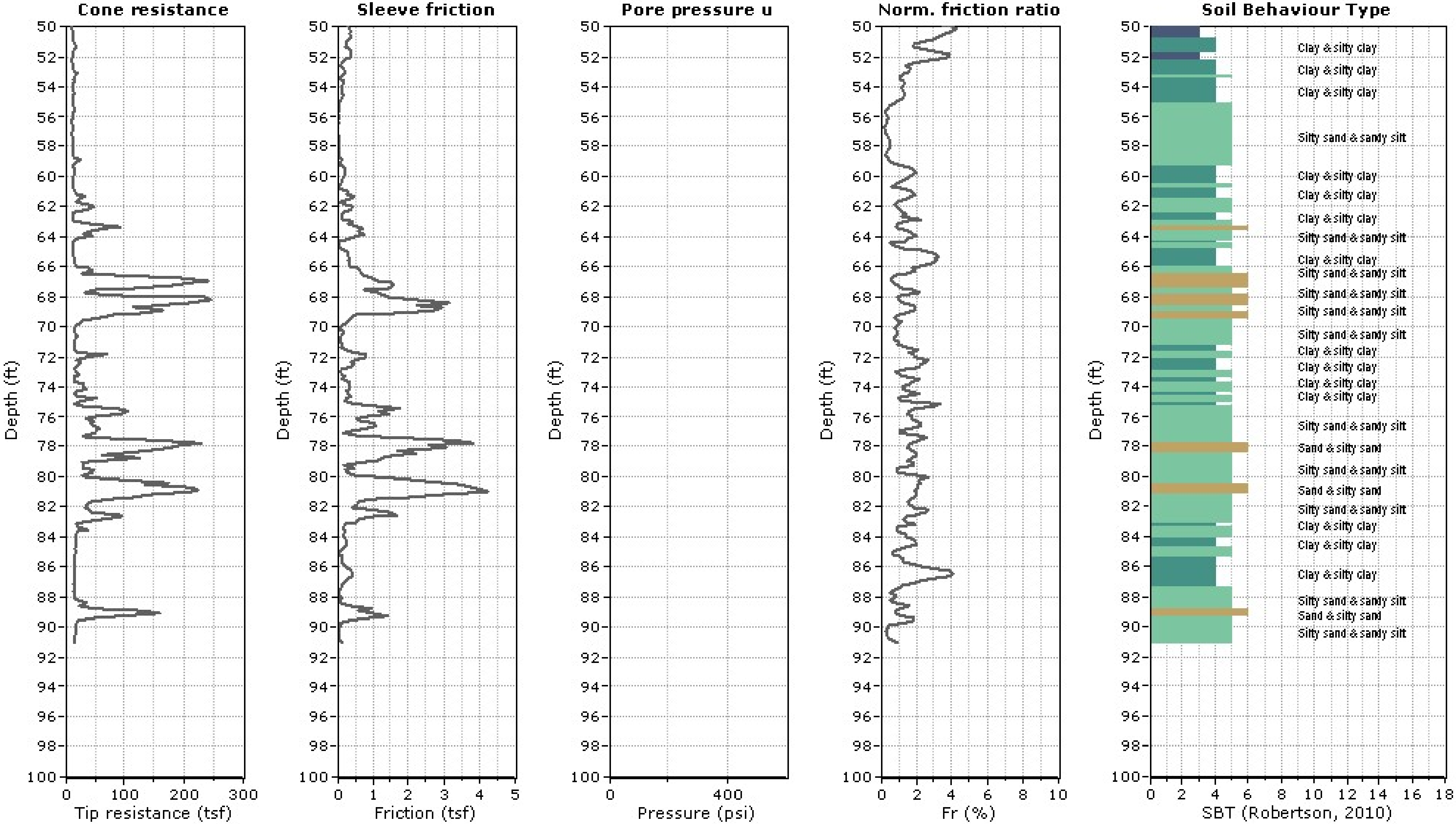
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-5
Total depth: 91.04 ft, Date: 4/29/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling



600 W. Sandy Parkway
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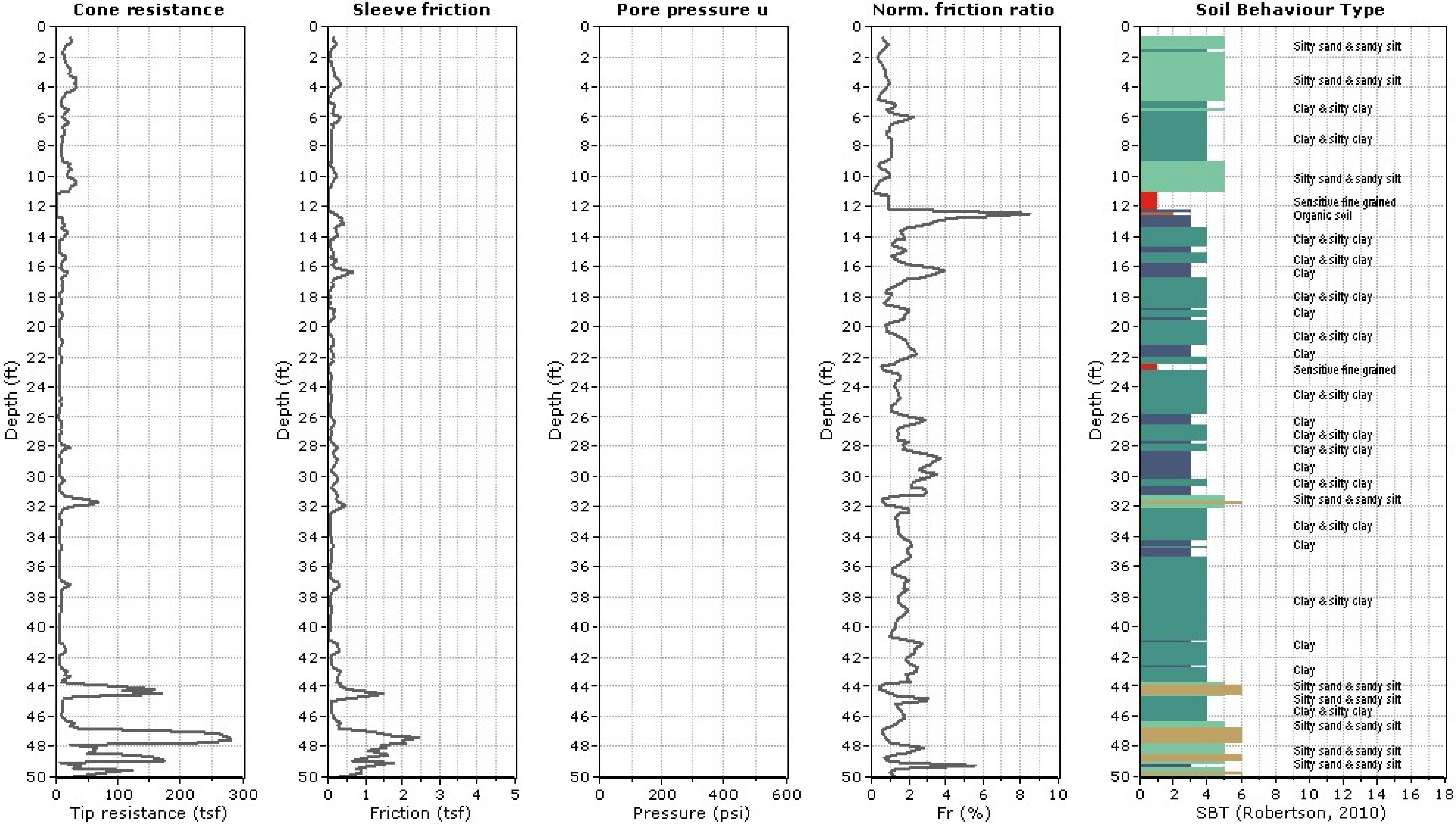
Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-7
Total depth: 91.37 ft, Date: 4/27/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling



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600 W. Sandy Parkway
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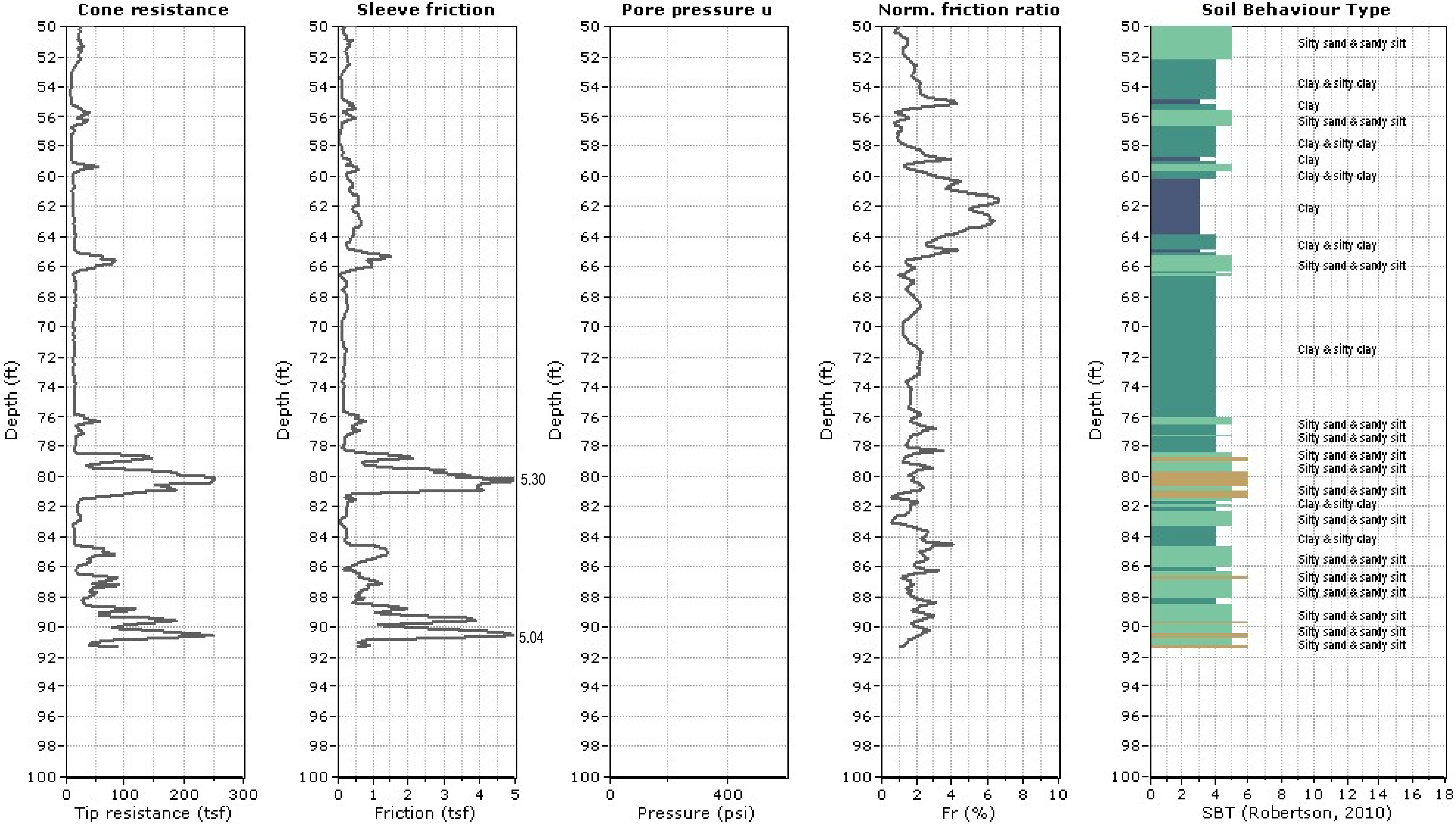
801.566.6399

CPT: L-7

Total depth: 91.37 ft, Date: 4/27/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**

Location: **see Figure 1**



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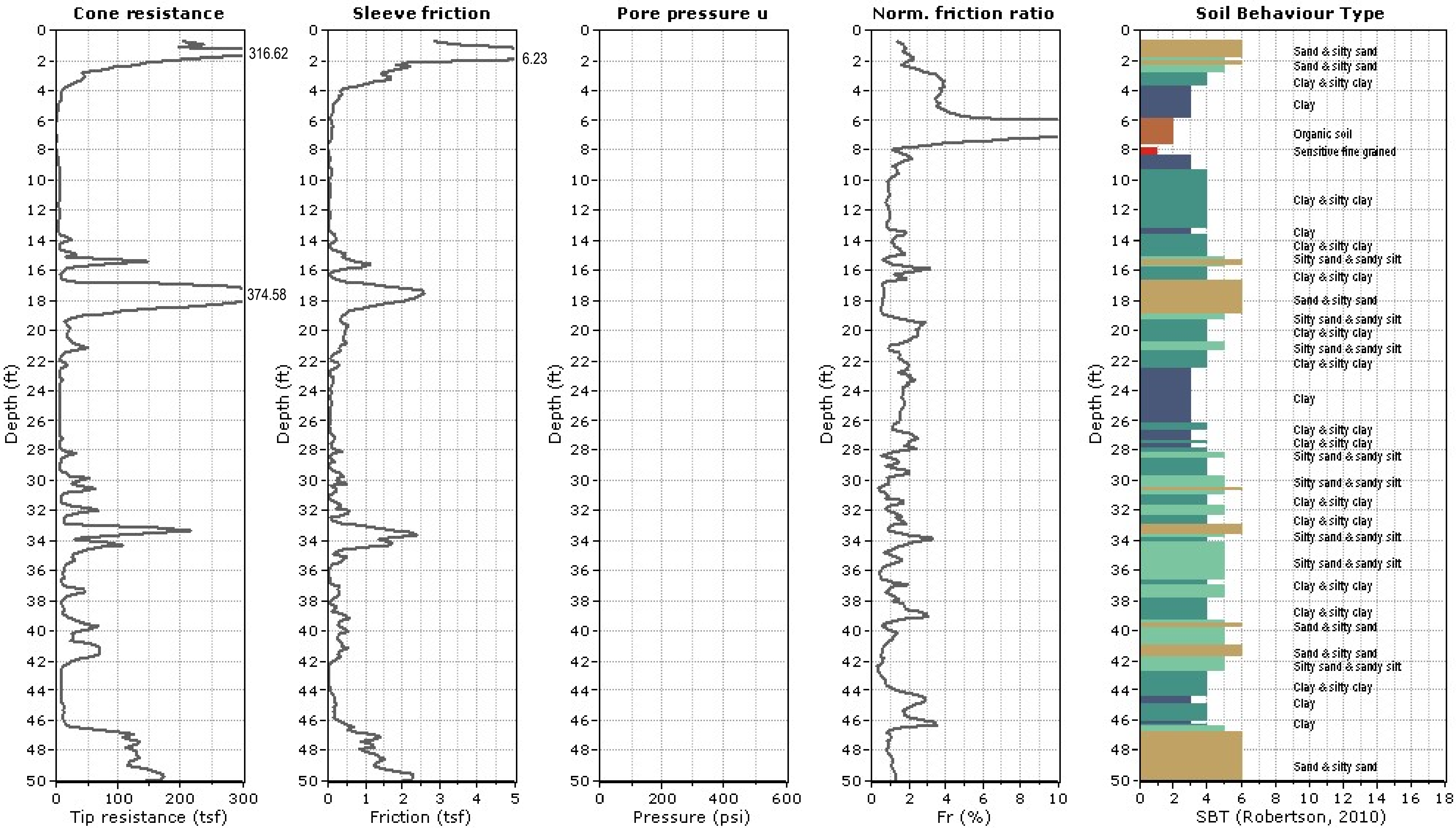
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-9

Total depth: 78.90 ft, Date: 4/30/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: 1160276 - Clean Harbors
Location: see Figure 1



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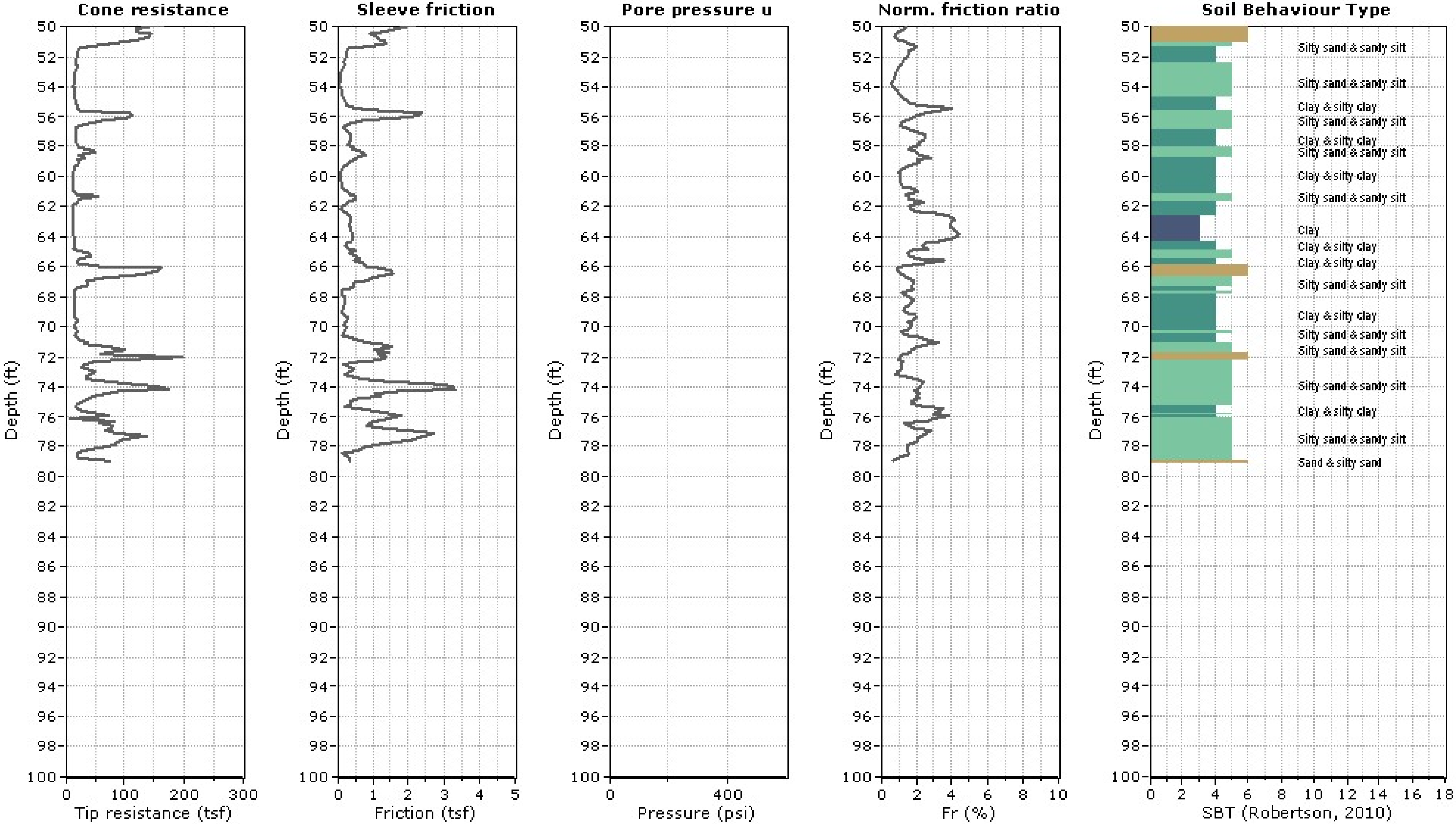
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-9
Total depth: 78.90 ft, Date: 4/30/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: 1160276 - Clean Harbors
Location: see Figure 1



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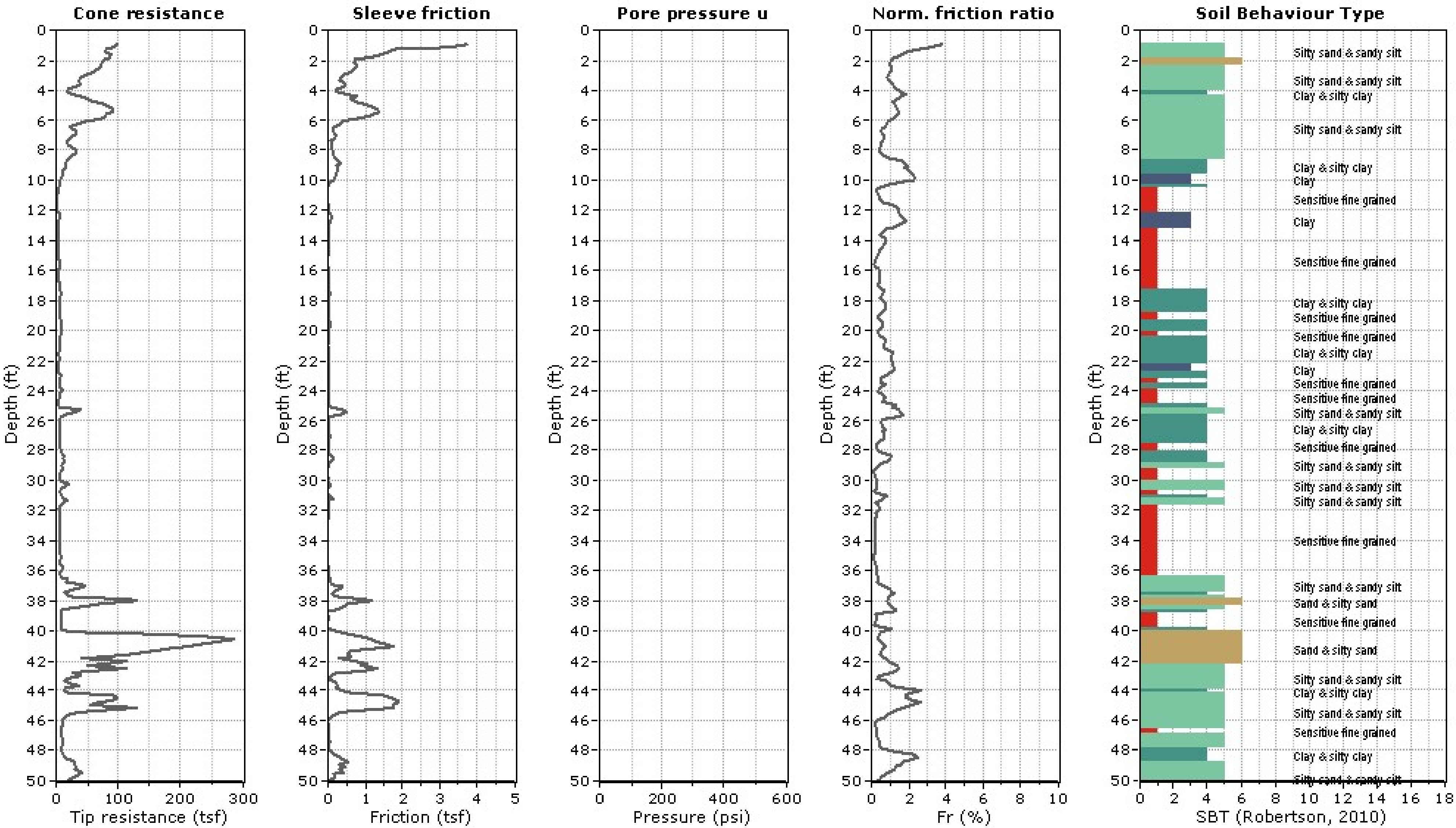
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-11
Total depth: 84.15 ft, Date: 4/27/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

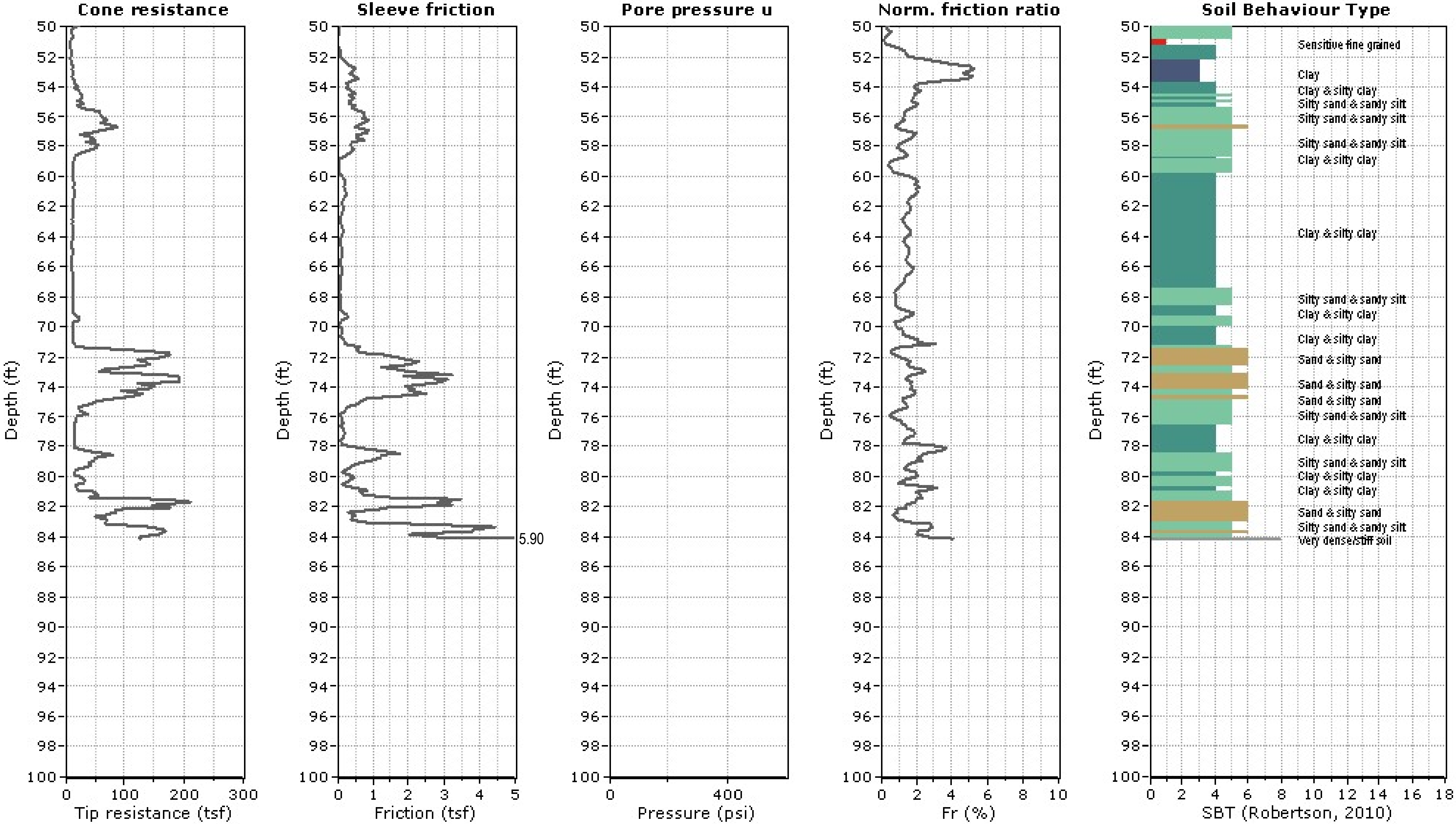


600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

Applied GeoTech

CPT: L-11
Total depth: 84.15 ft, Date: 4/27/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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600 W. Sandy Parkway
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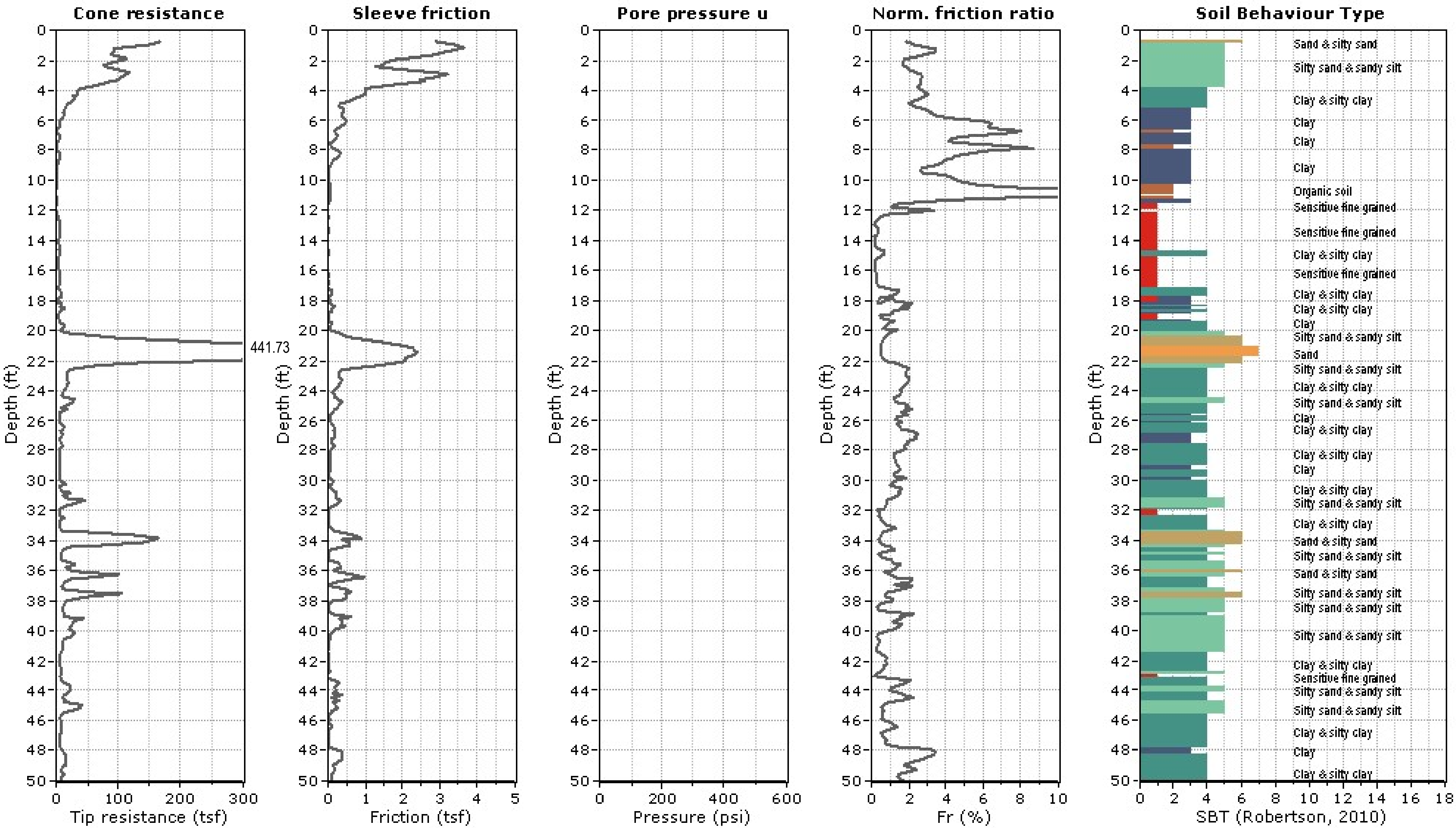
801.566.6399

Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-13
Total depth: 77.59 ft, Date: 4/27/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling



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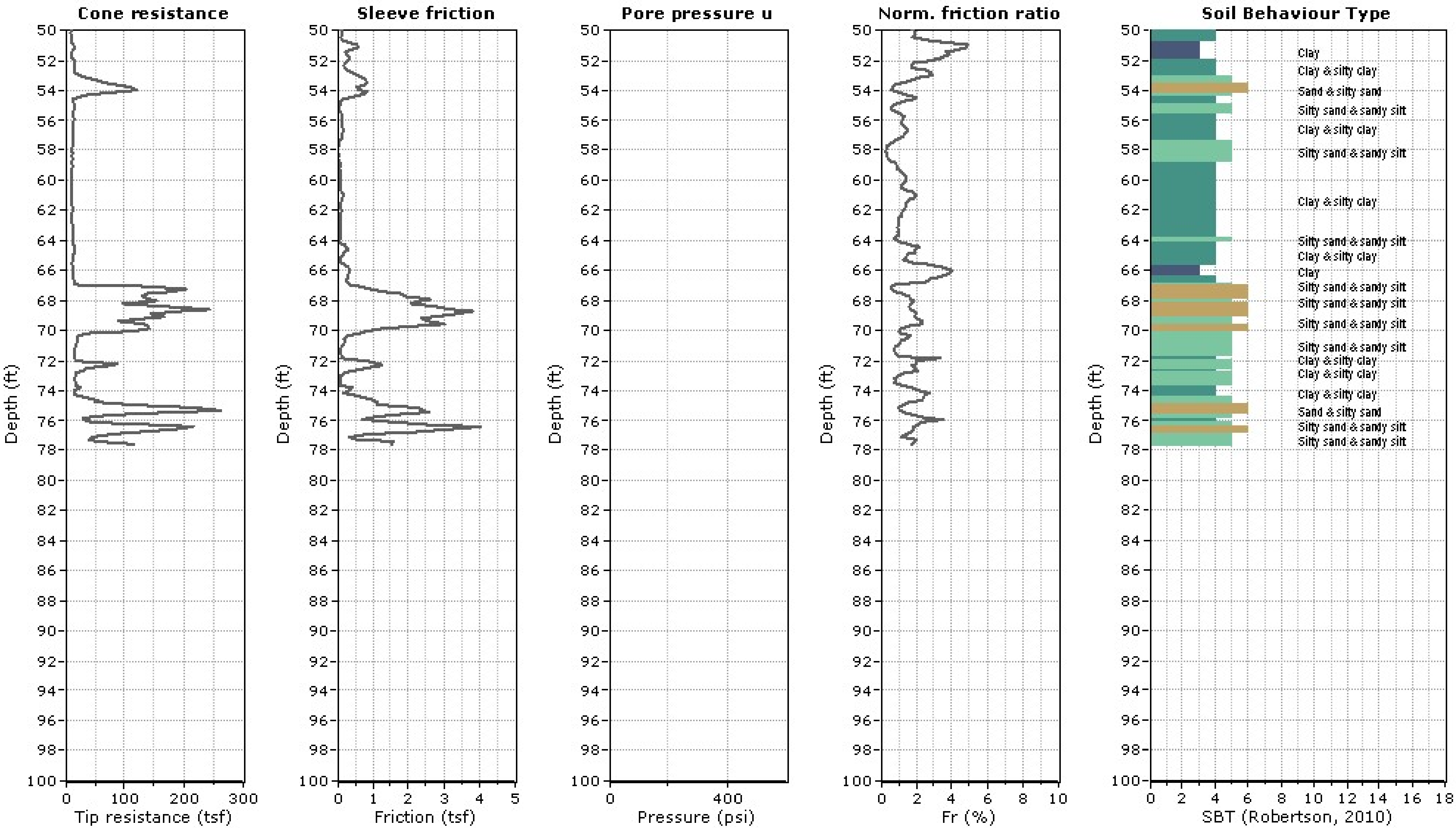
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-13
Total depth: 77.59 ft, Date: 4/27/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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600 W. Sandy Parkway
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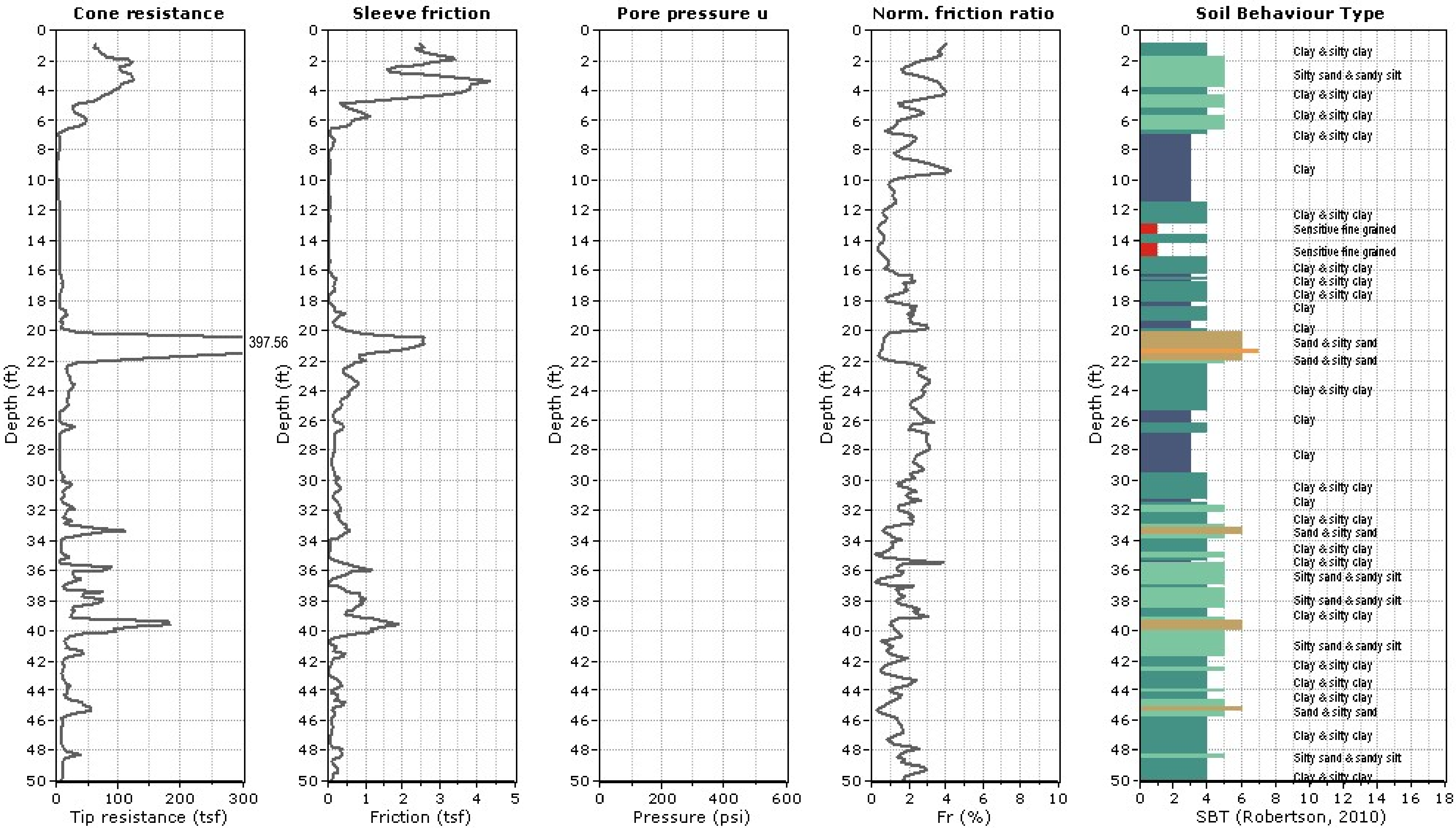
801.566.6399

CPT: L-14
Total depth: 77.43 ft, Date: 4/10/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

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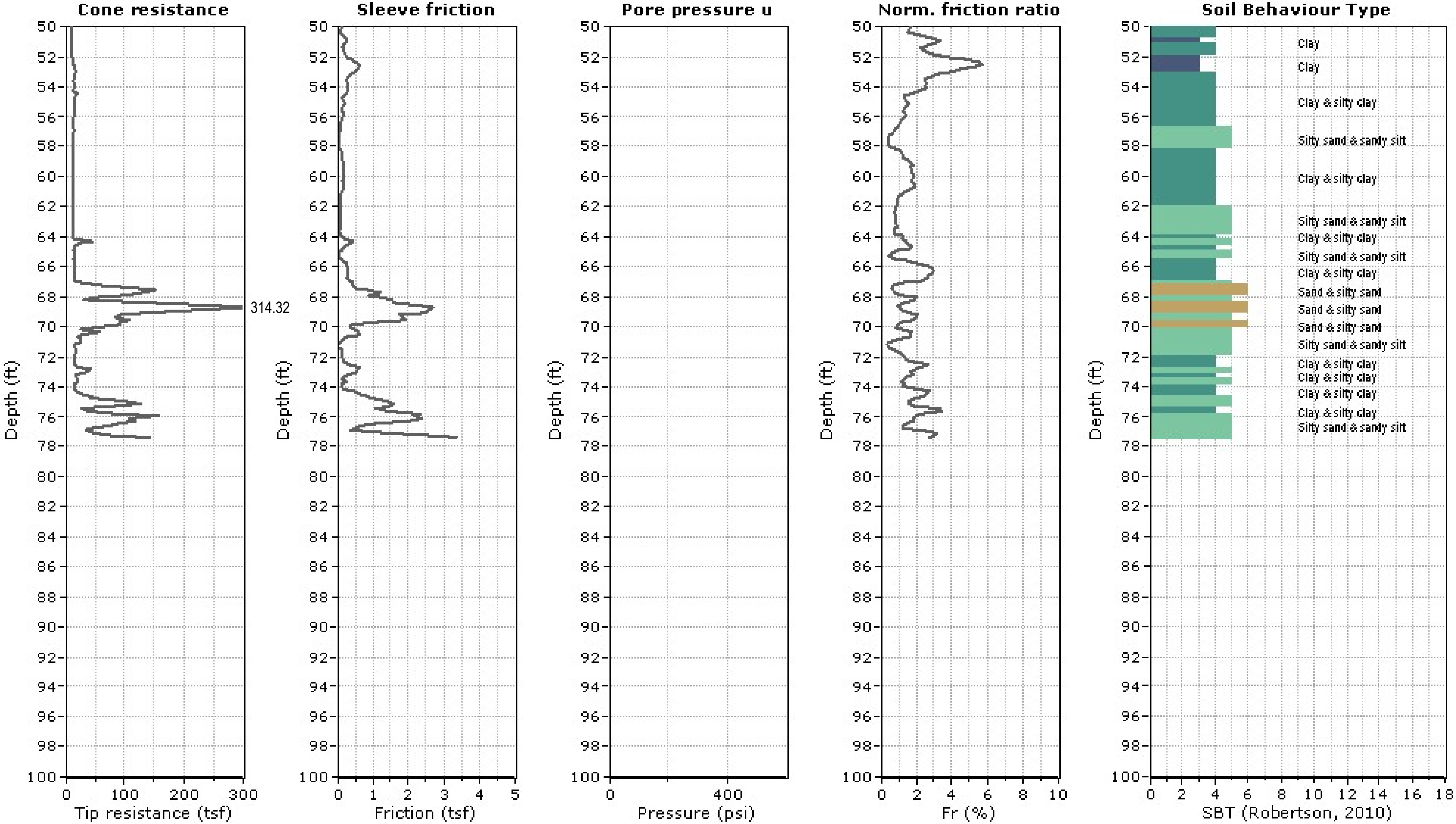
CPT: L-14
Total depth: 77.43 ft, Date: 4/10/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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600 W. Sandy Parkway
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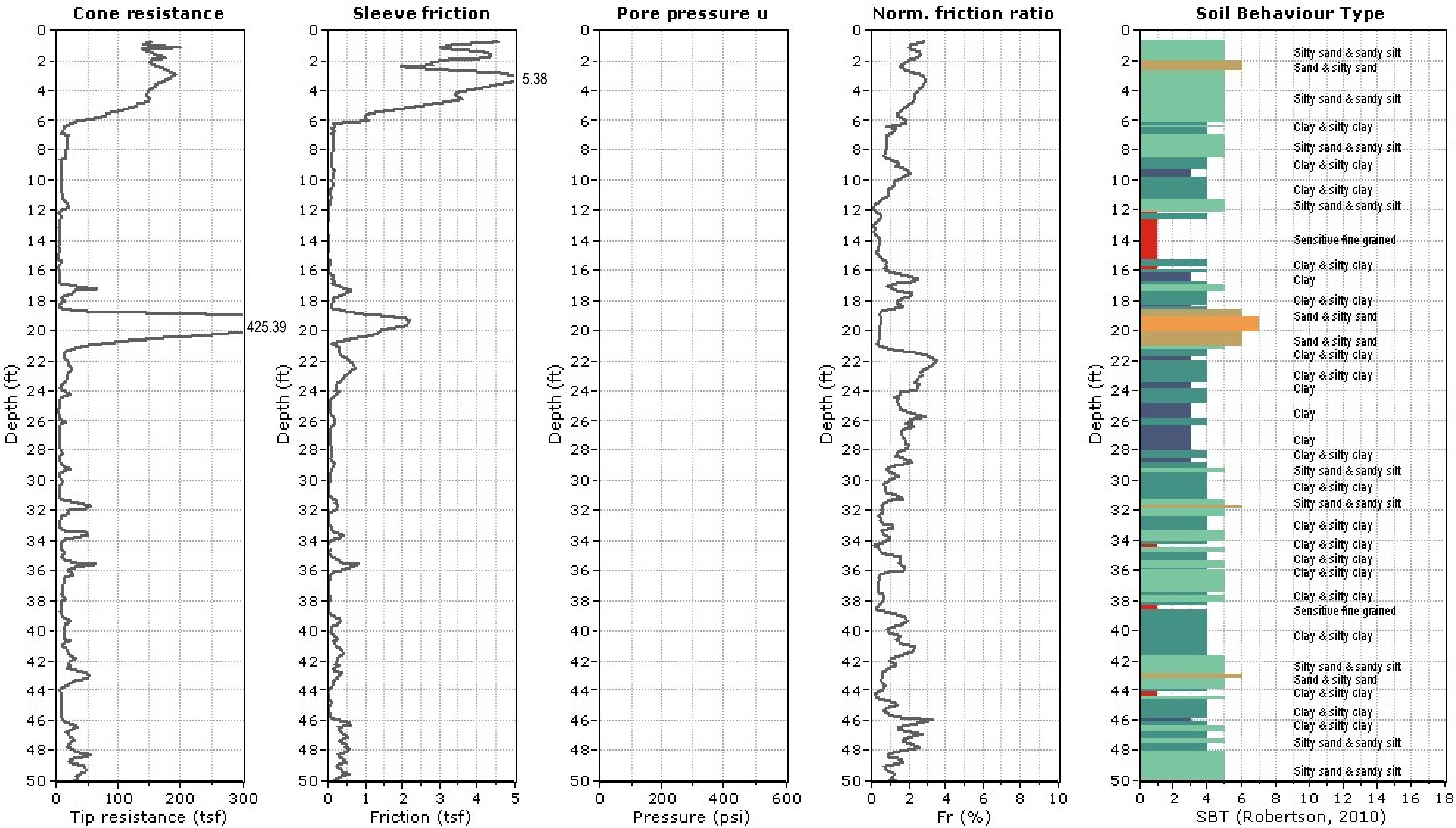
801.566.6399

CPT: L-16
Total depth: 81.36 ft, Date: 4/27/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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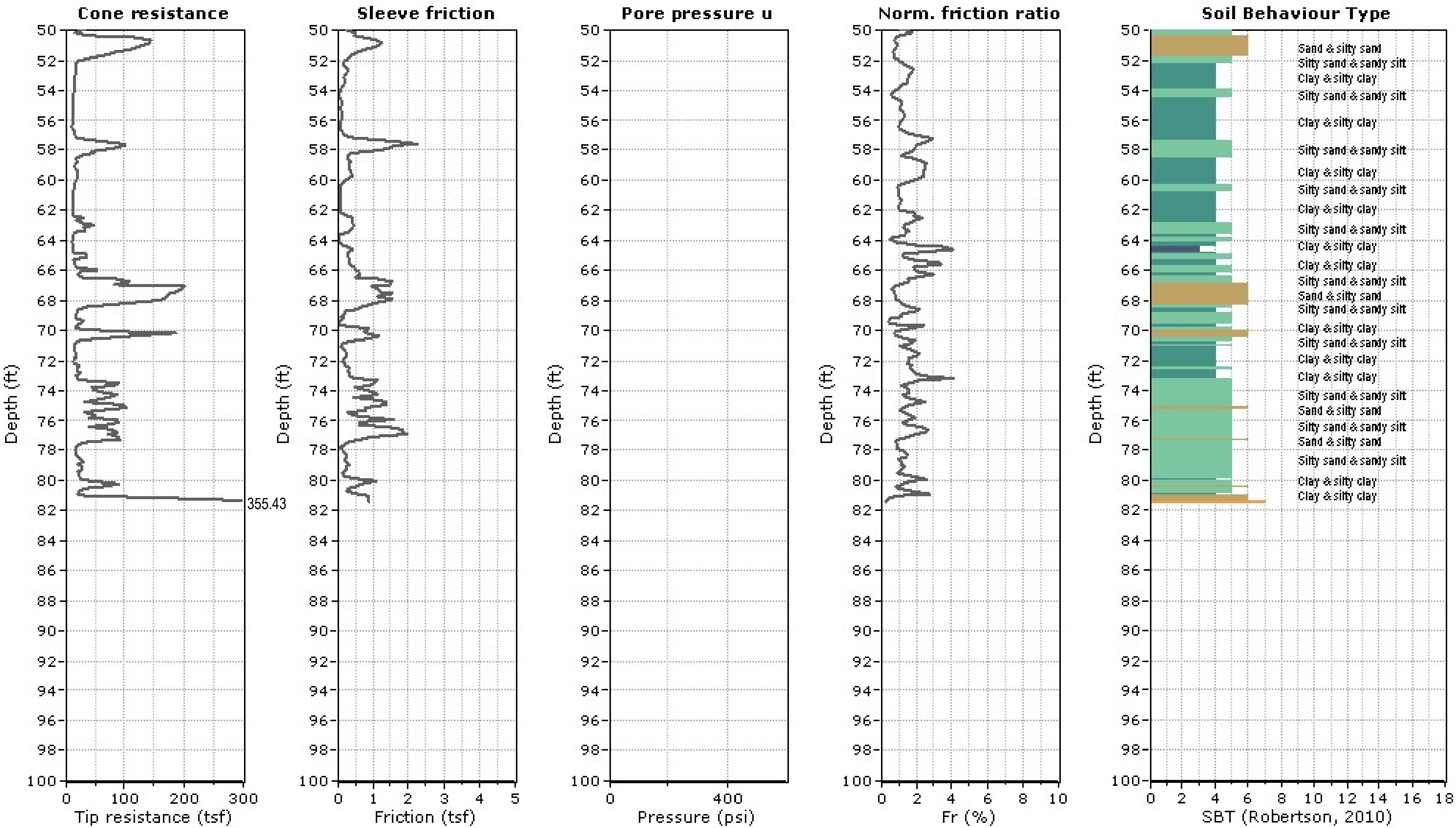
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

AGEC Applied GeoTech

CPT: L-16
Total depth: 81.36 ft, Date: 4/27/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

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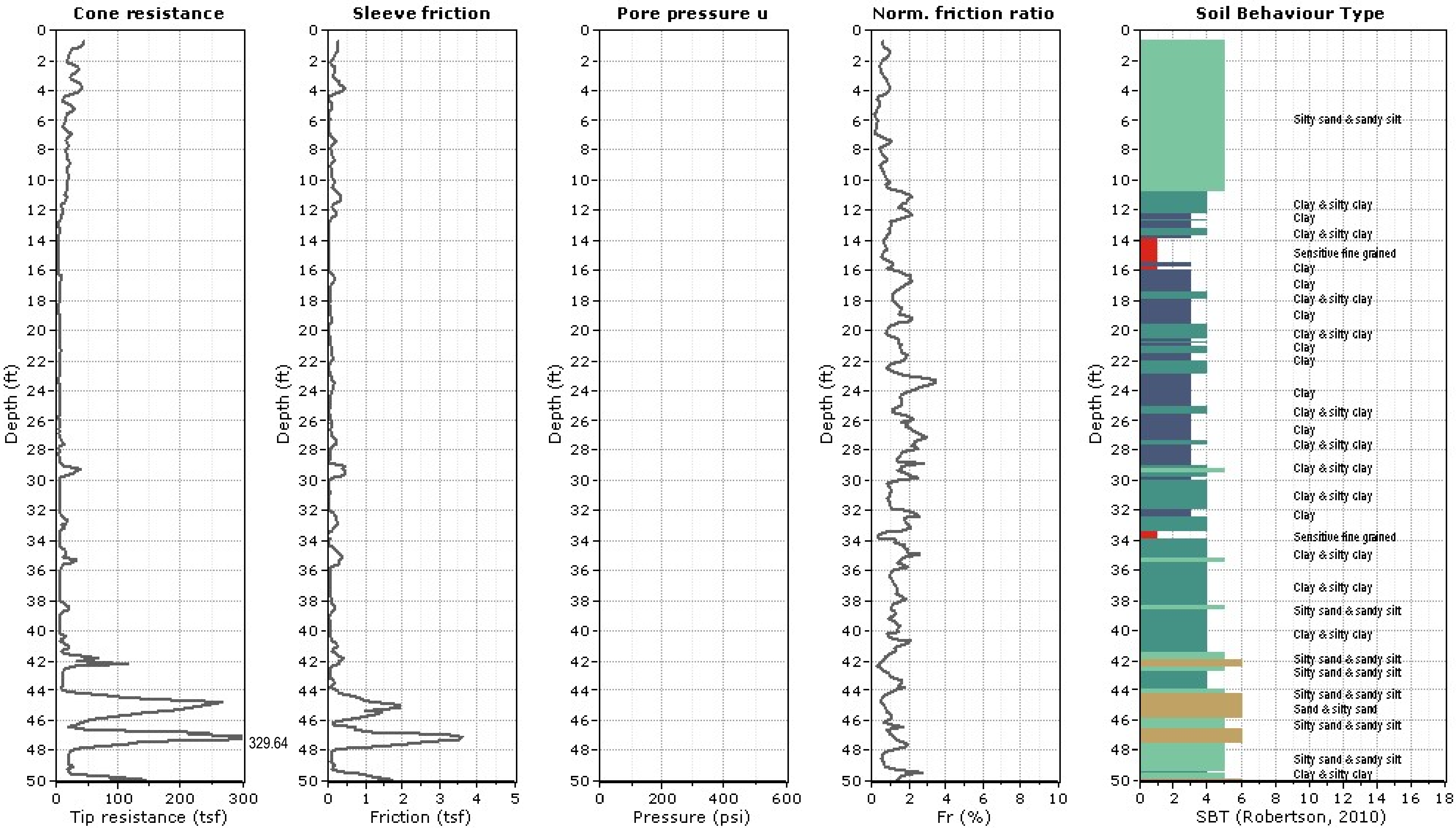
CPT: L-18
Total depth: 79.07 ft, Date: 7/23/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

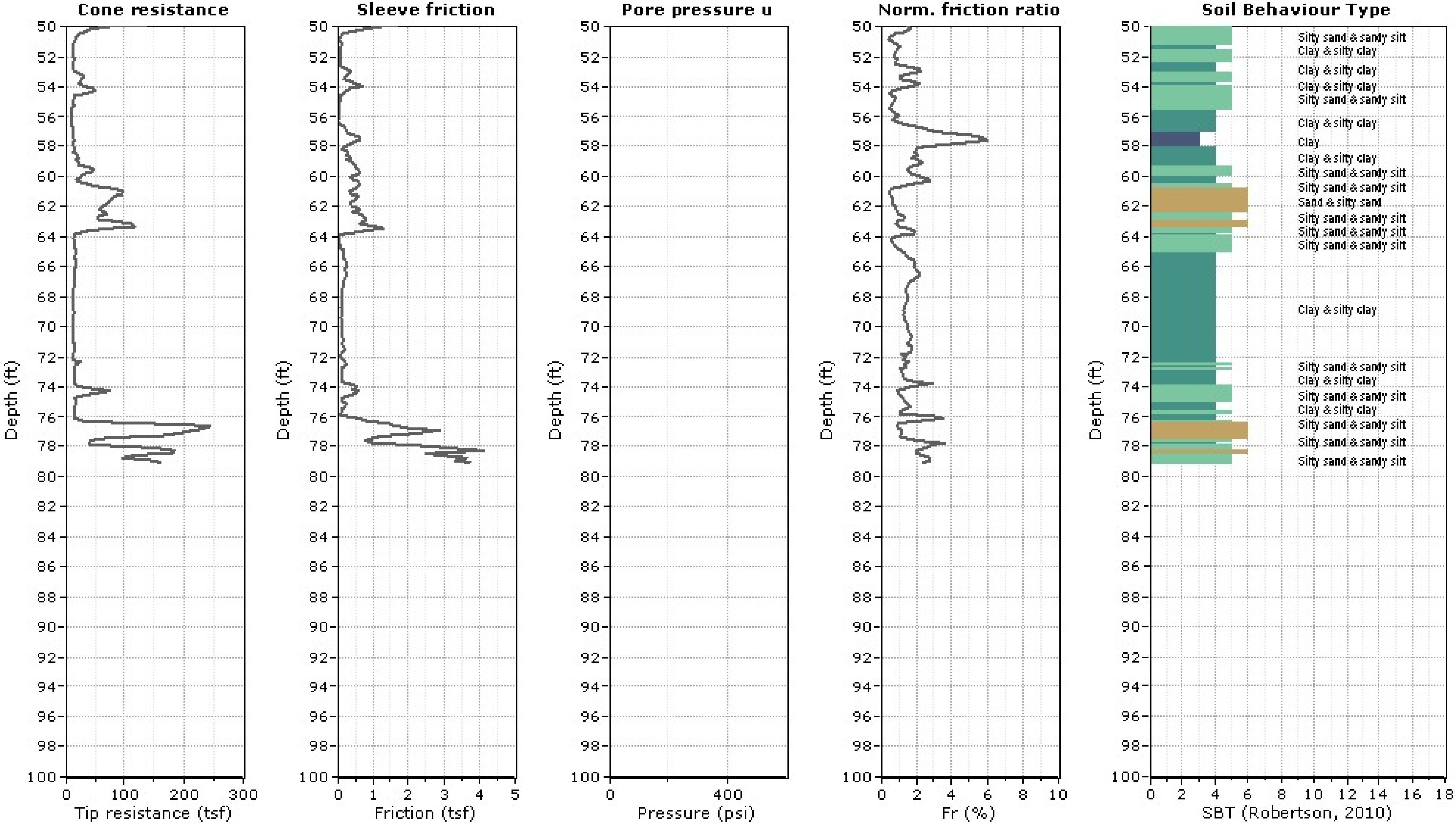
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



Applied GeoTech
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-18
Total depth: 79.07 ft, Date: 7/23/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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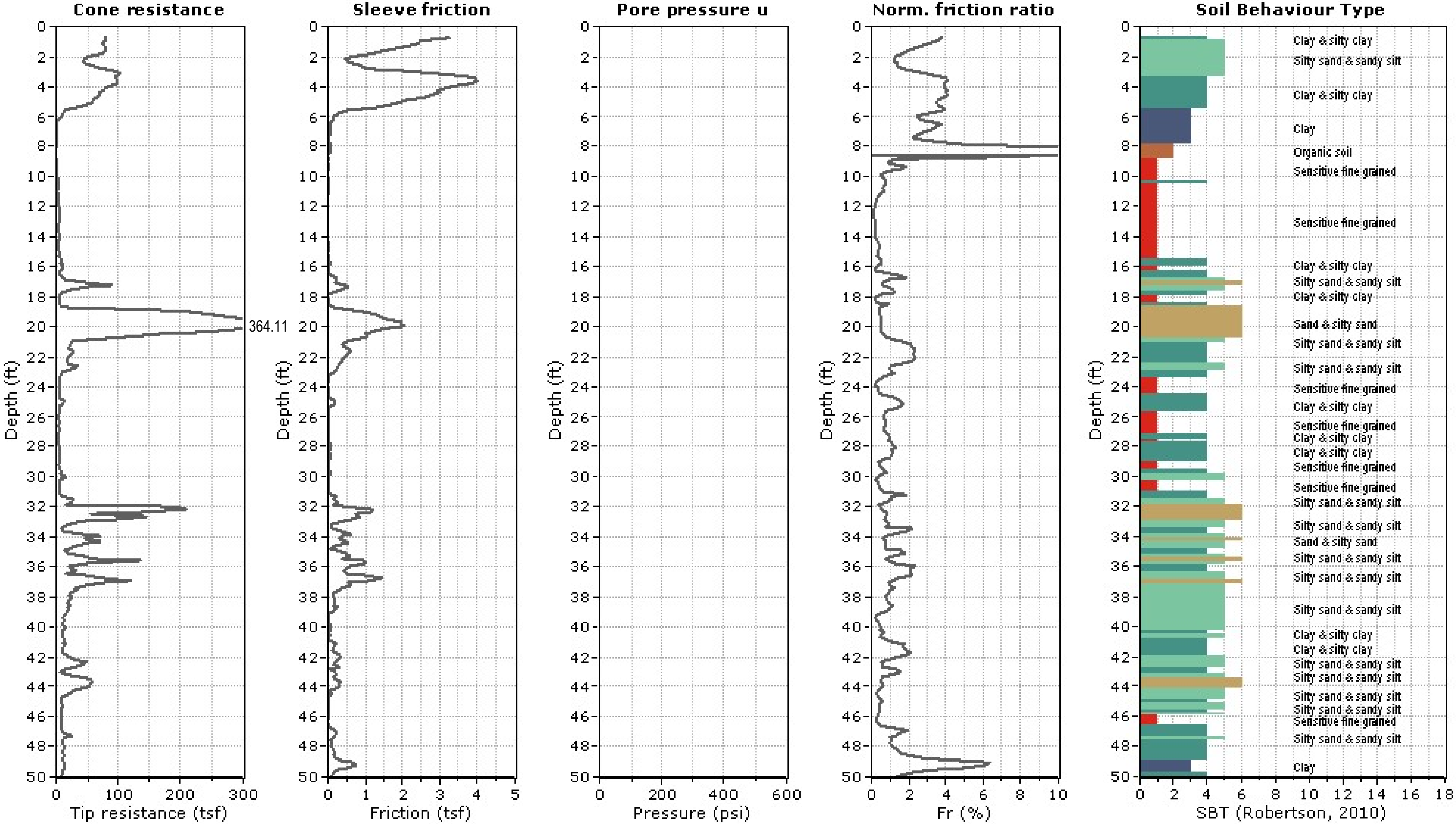
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-20
Total depth: 53.81 ft, Date: 4/28/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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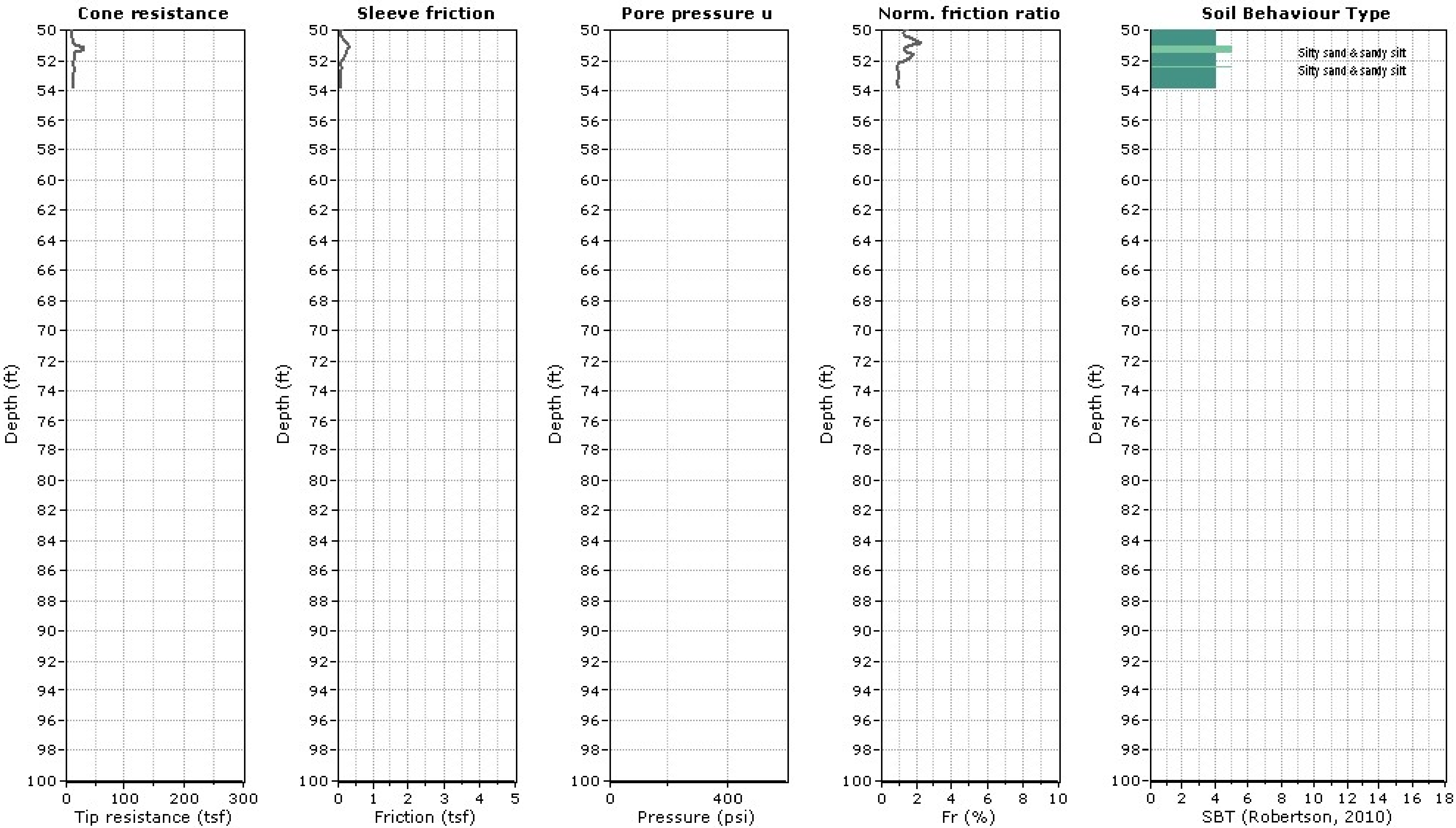
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-20
Total depth: 53.81 ft, Date: 4/28/1992
Surface Elevation: 0.00 ft
Cone Type: H215
Cone Operator: Earthtec Drilling

Project: 1160276 - Clean Harbors
Location: see Figure 1



600 W. Sandy Parkway
Sandy, UT 84070
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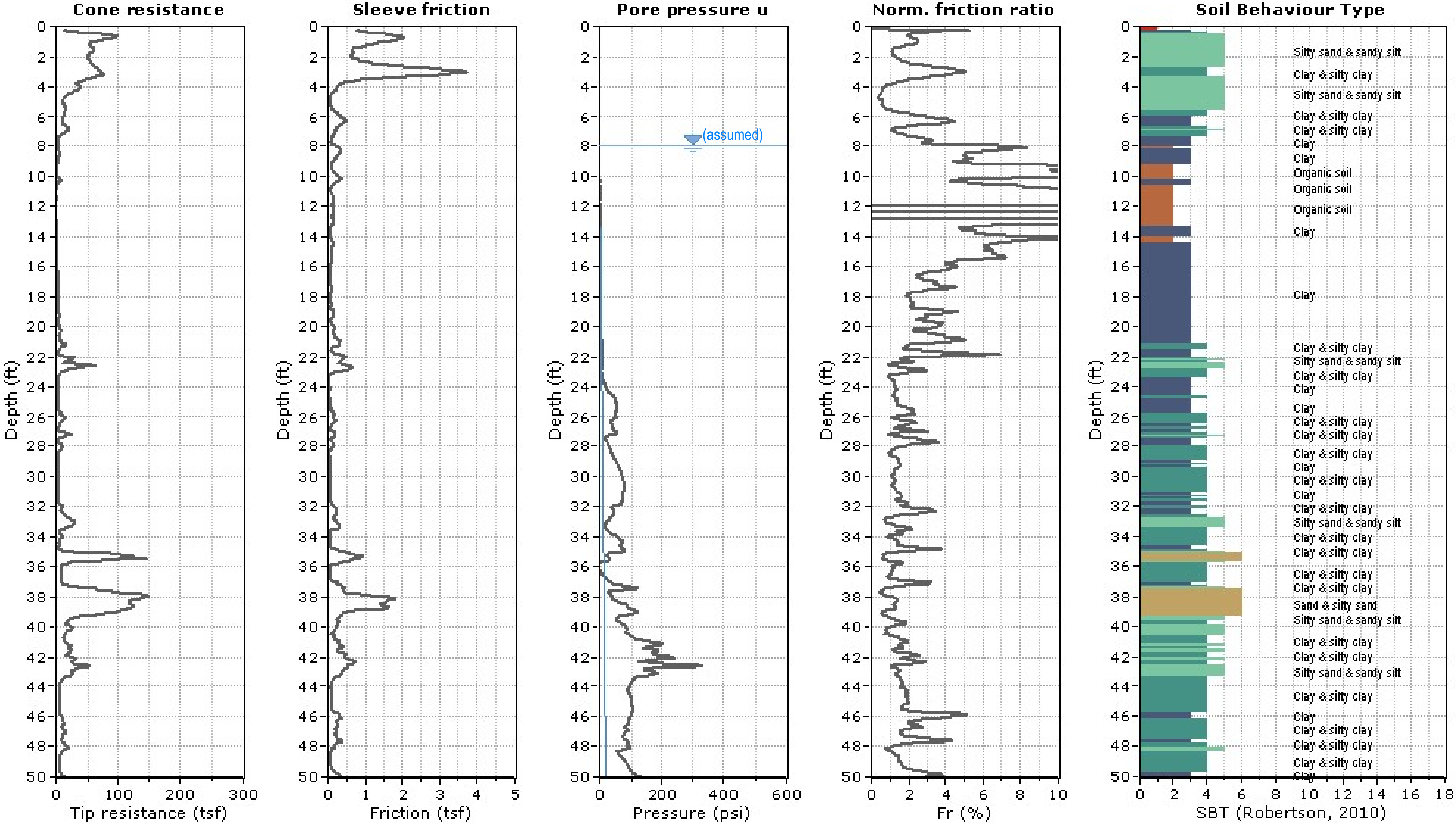
Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-31
Total depth: 124.54 ft, Date: 8/17/1995
Surface Elevation: 4240.80 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.



CPeT-IT v.2.0.1.16 - CPTU data presentation & interpretation software - Report created on: 9/20/2017, 4:13:05 PM
Project file: H:\AGEC Project Files\2016 Projects\1160276 GT - C Landfill (JEN)\CPT Data\Fugro CPT Data.cpt

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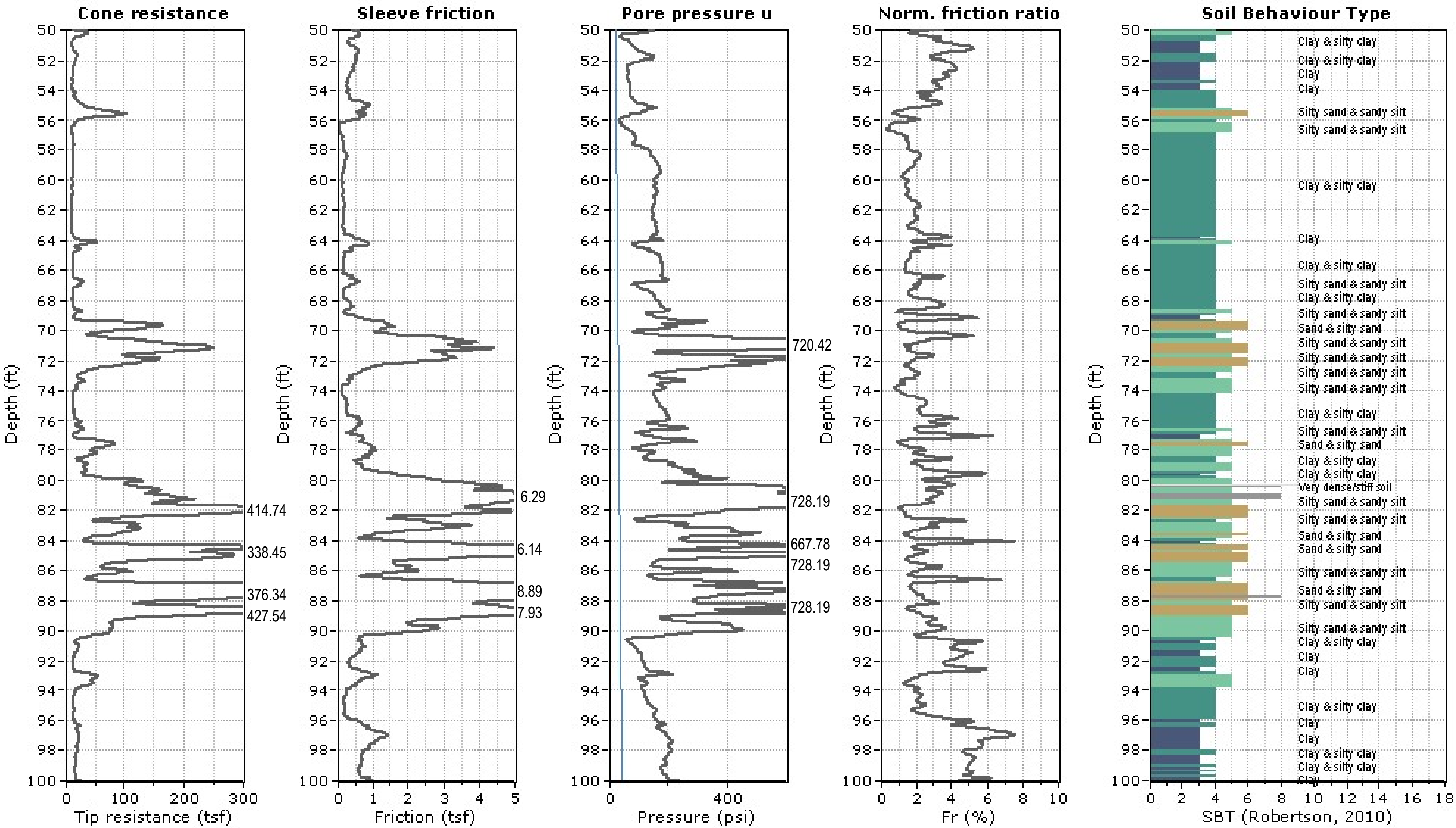
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-31
Total depth: 124.54 ft, Date: 8/17/1995
Surface Elevation: 4240.80 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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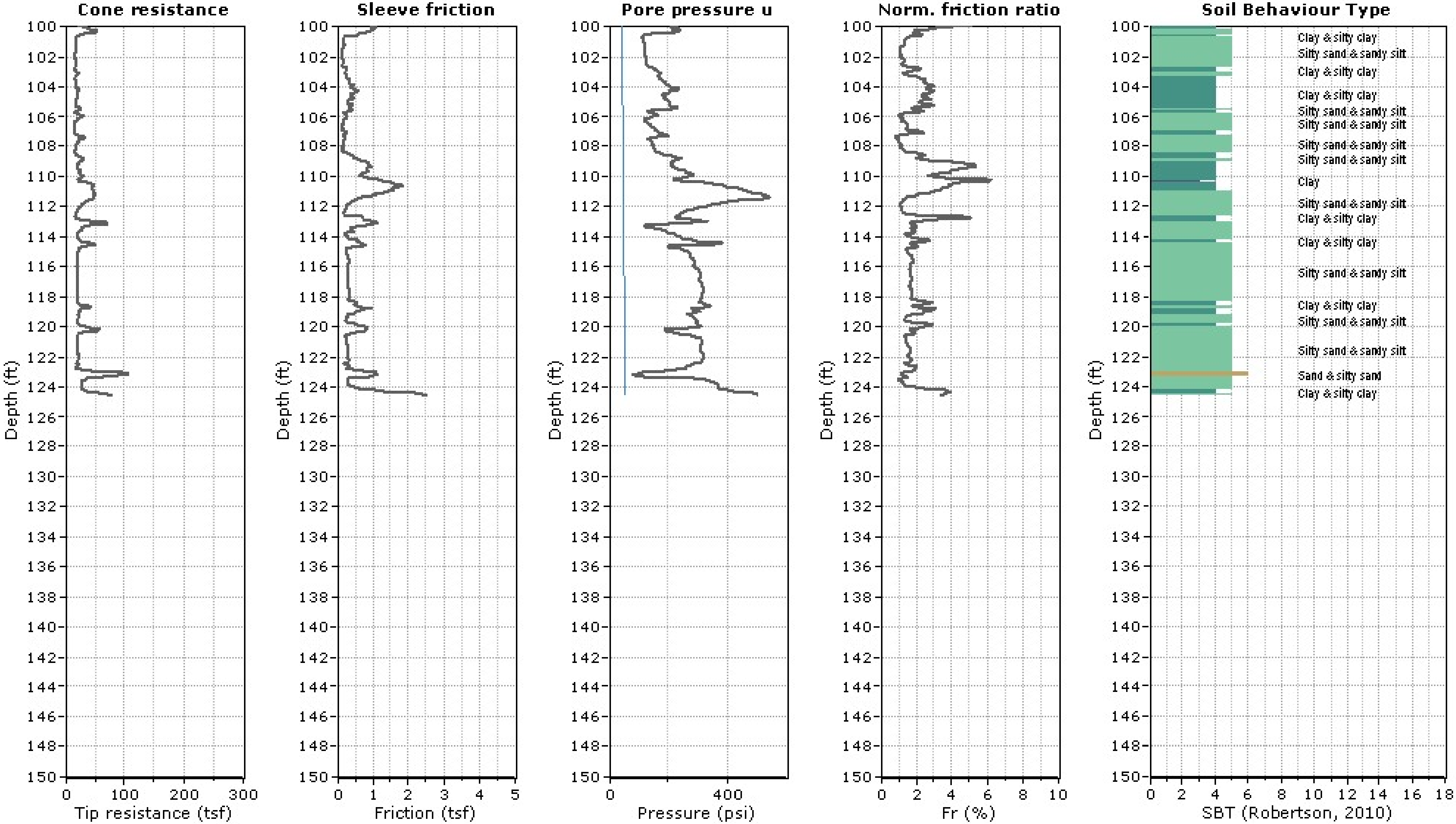
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-31
Total depth: 124.54 ft, Date: 8/17/1995
Surface Elevation: 4240.80 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.

Project: 1160276 - Clean Harbors
Location: see Figure 1



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600 W. Sandy Parkway
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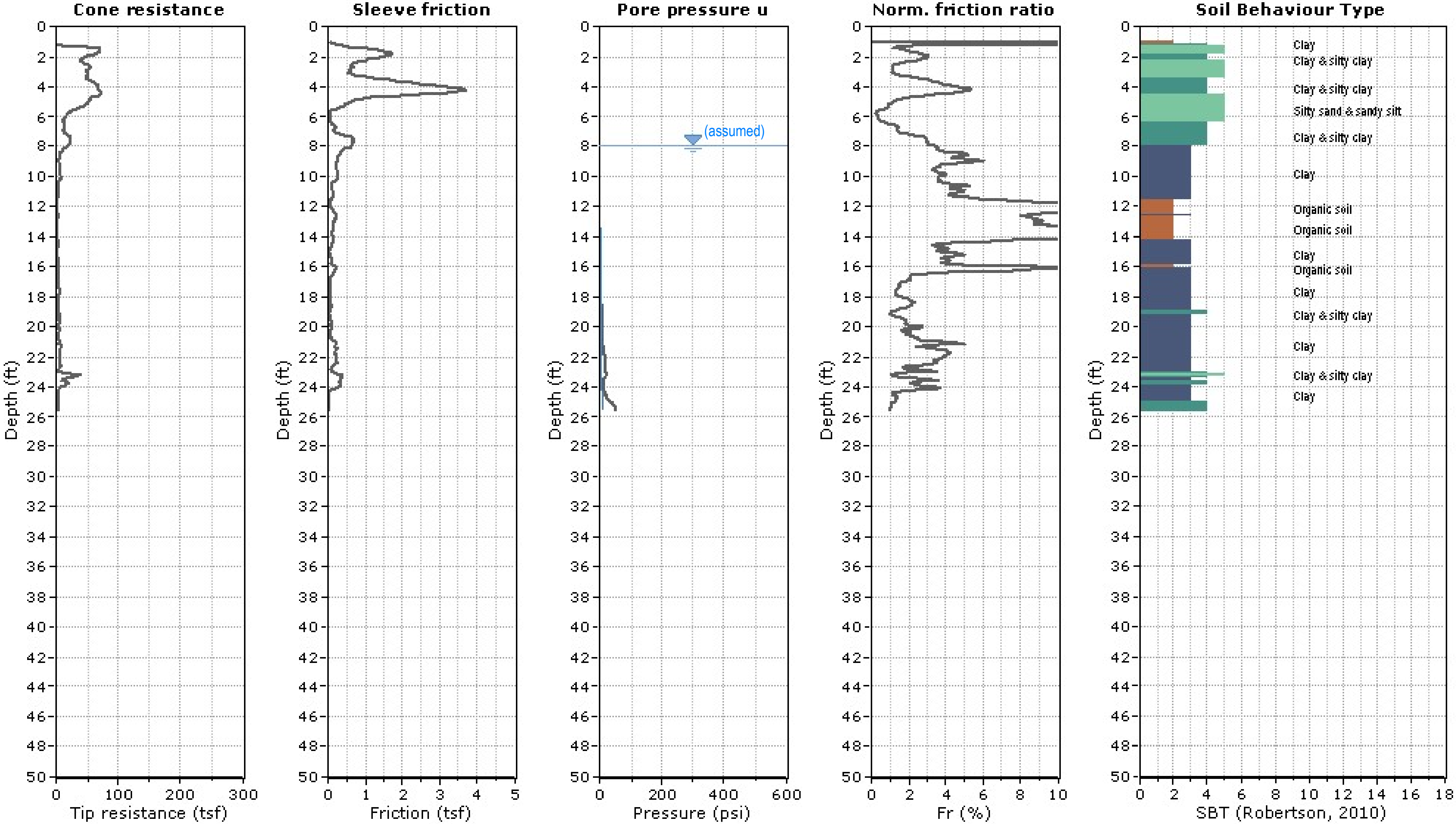
CPT: L-31B
Total depth: 25.52 ft, Date: 8/18/1995
Surface Elevation: 4240.80 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.

Project: 1160276 - Clean Harbors
Location: see Figure 1



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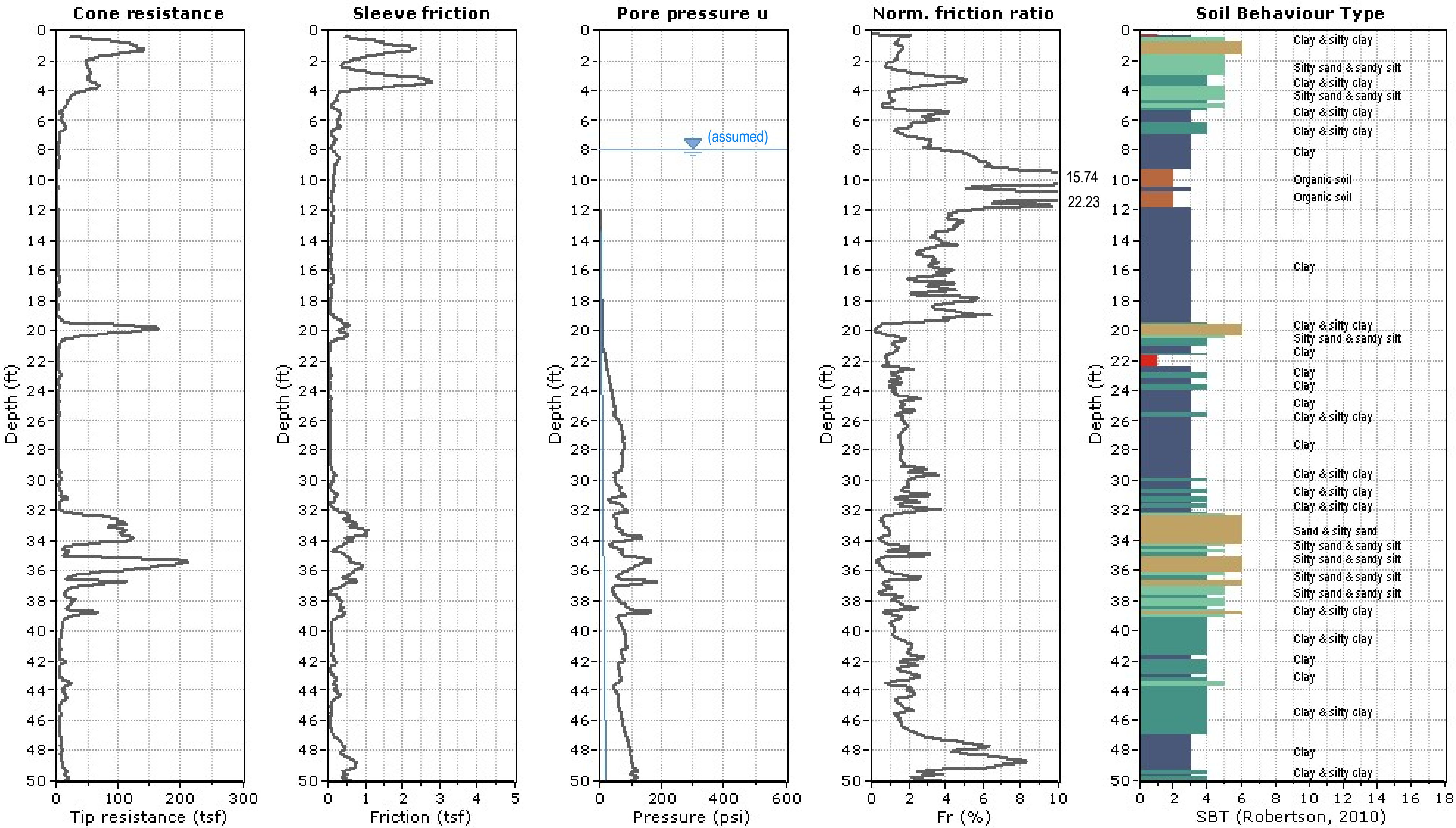
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-32
Total depth: 249.08 ft, Date: 8/17/1995
Surface Elevation: 4239.00 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.



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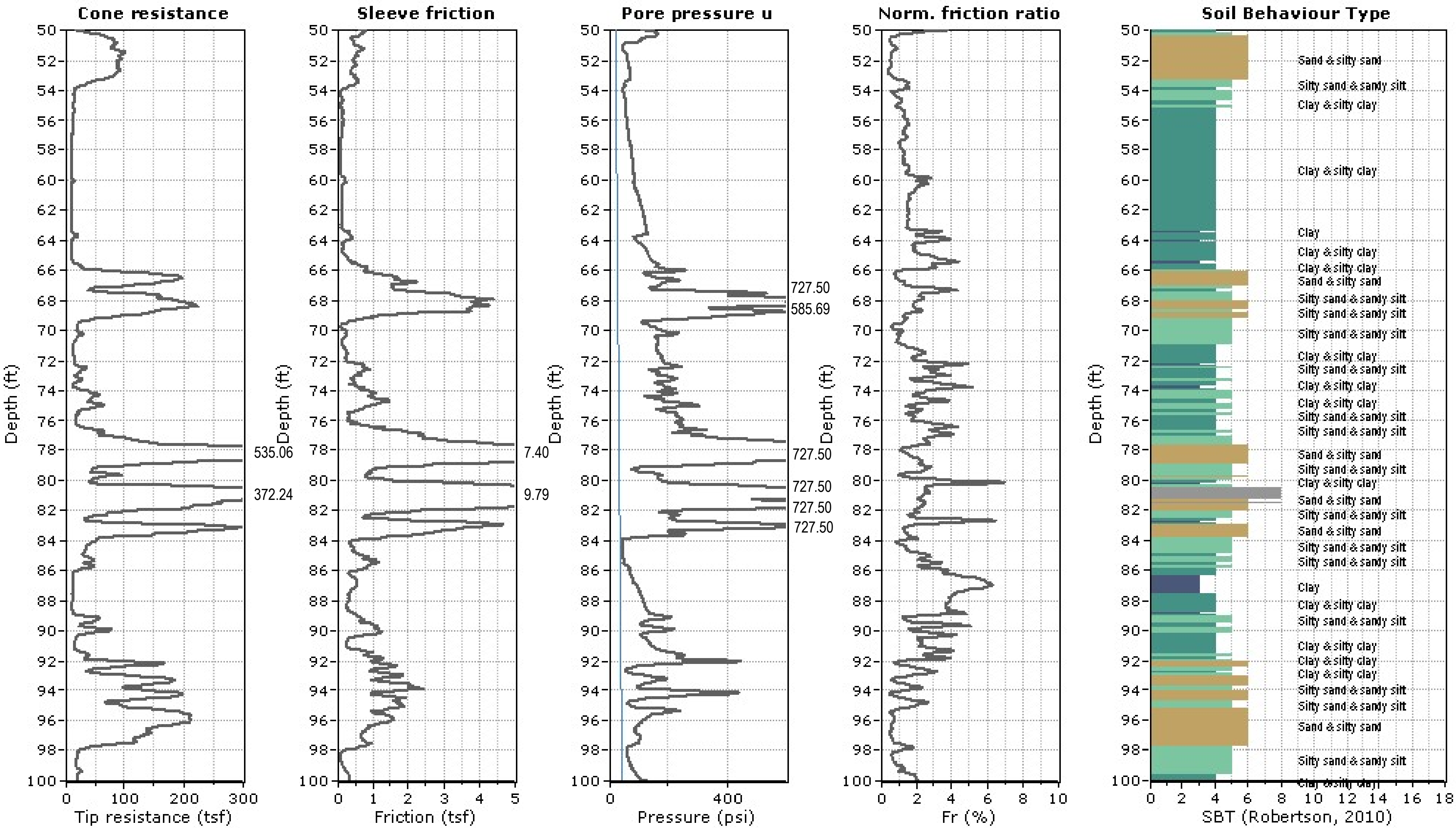
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-32

Total depth: 249.08 ft, Date: 8/17/1995
Surface Elevation: 4239.00 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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600 W. Sandy Parkway
Sandy, UT 84070
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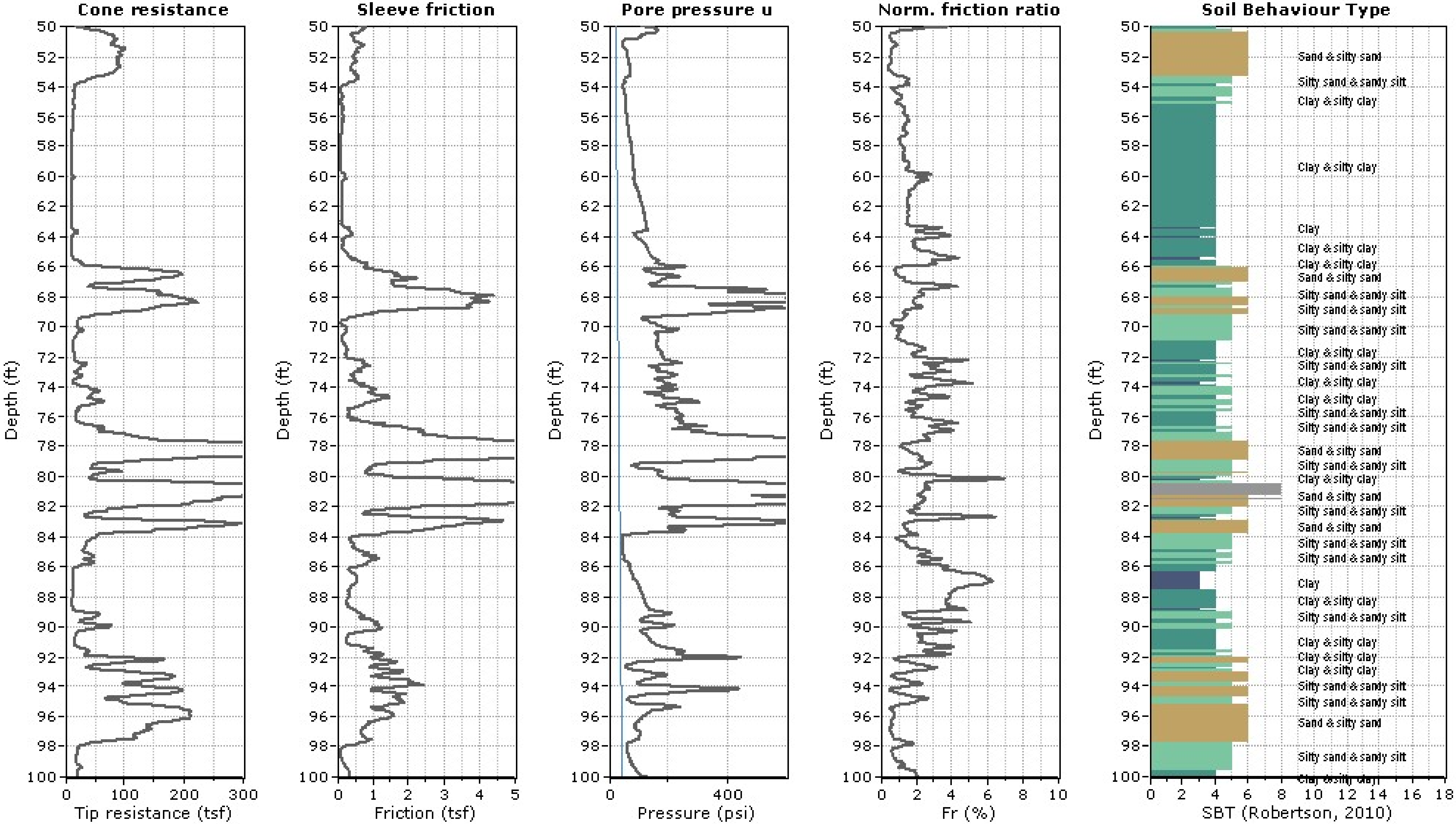
CPT: L-32
Total depth: 249.08 ft, Date: 8/17/1995
Surface Elevation: 4239.00 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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600 W. Sandy Parkway
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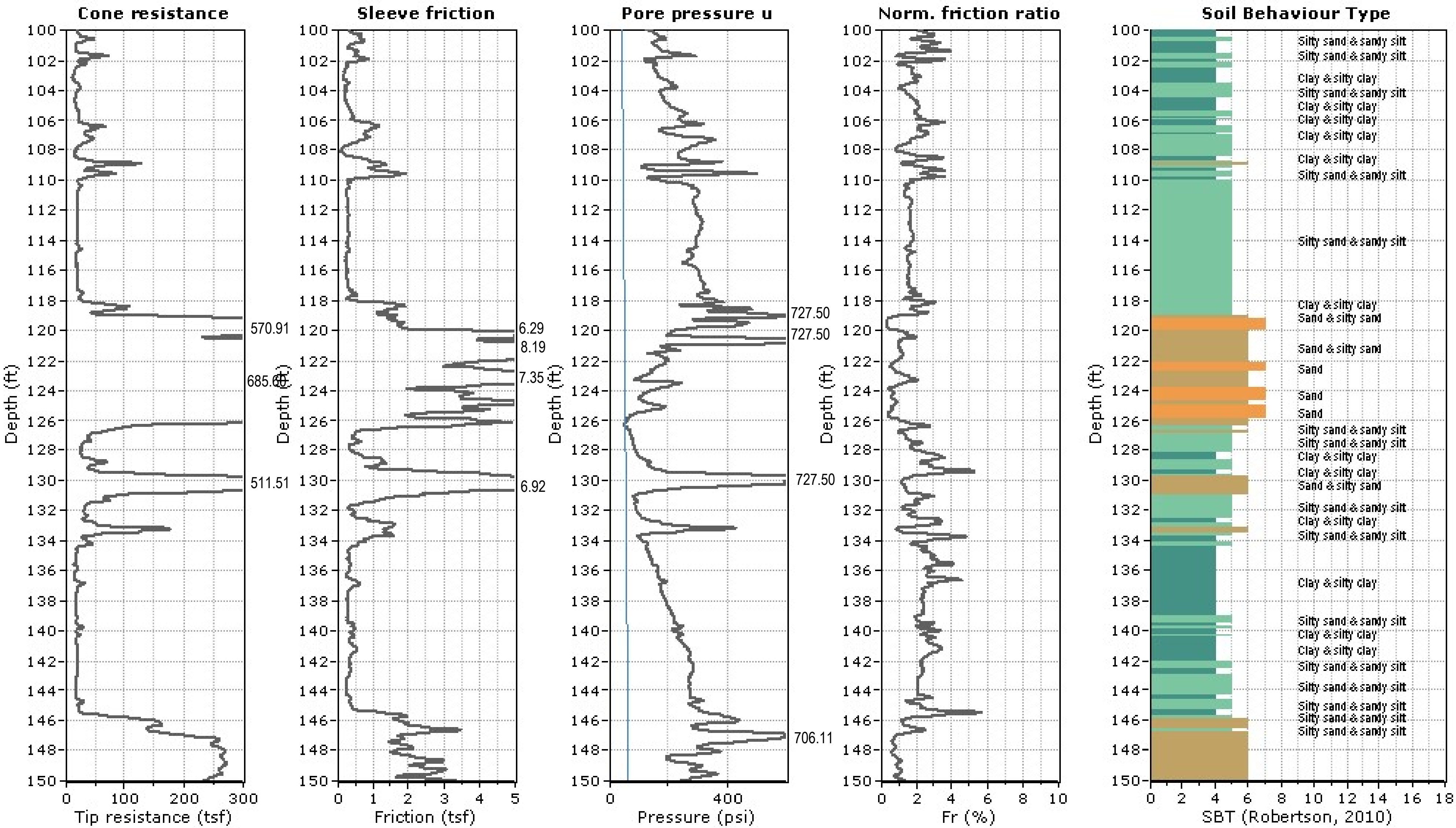
CPT: L-32
Total depth: 249.08 ft, Date: 8/17/1995
Surface Elevation: 4239.00 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



600 W. Sandy Parkway
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801.566.6399

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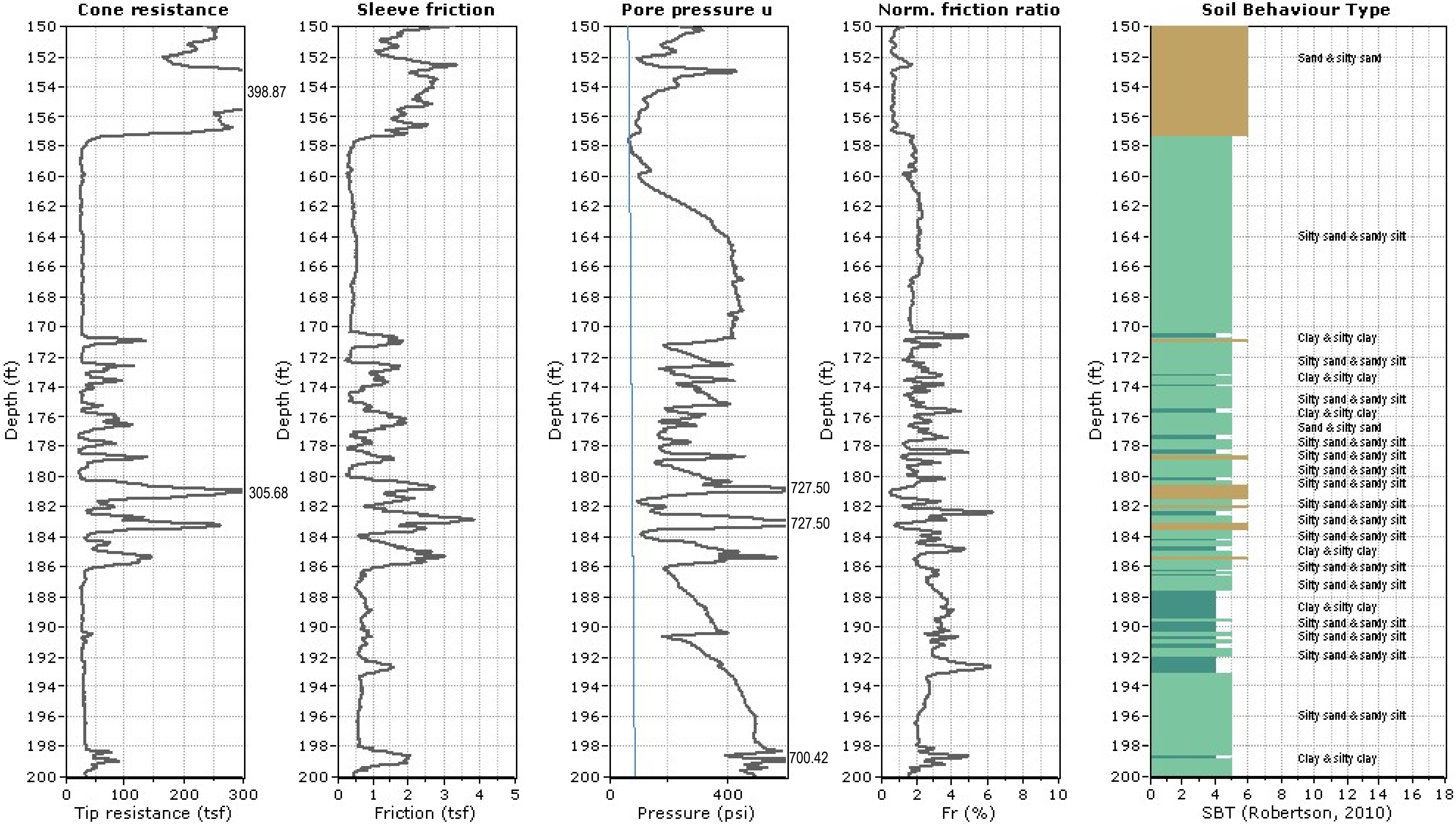
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-32
Total depth: 249.08 ft, Date: 8/17/1995
Surface Elevation: 4239.00 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.



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600 W. Sandy Parkway
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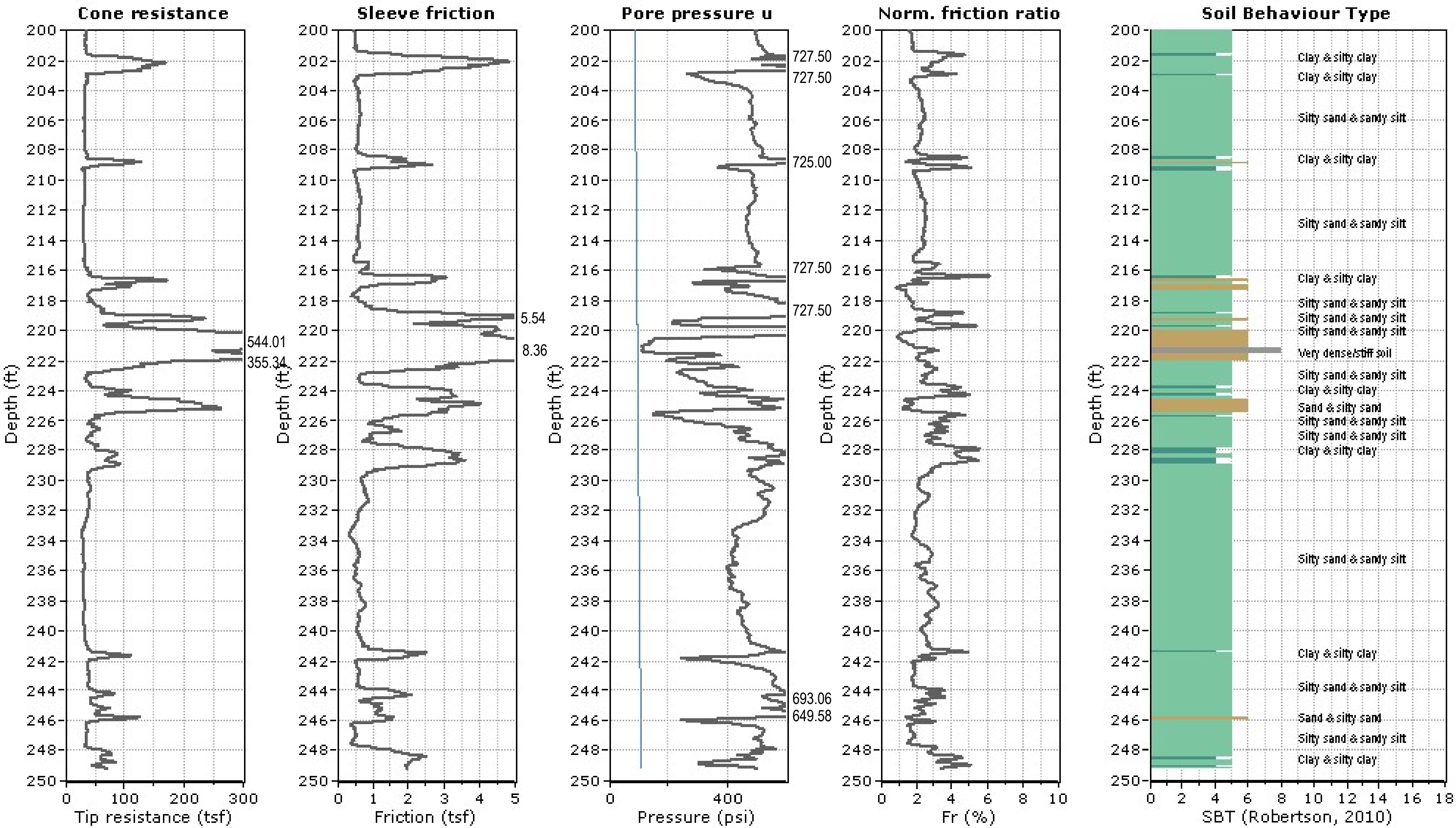
801.566.6399

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-32
Total depth: 249.08 ft, Date: 8/17/1995
Surface Elevation: 4239.00 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.



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600 W. Sandy Parkway
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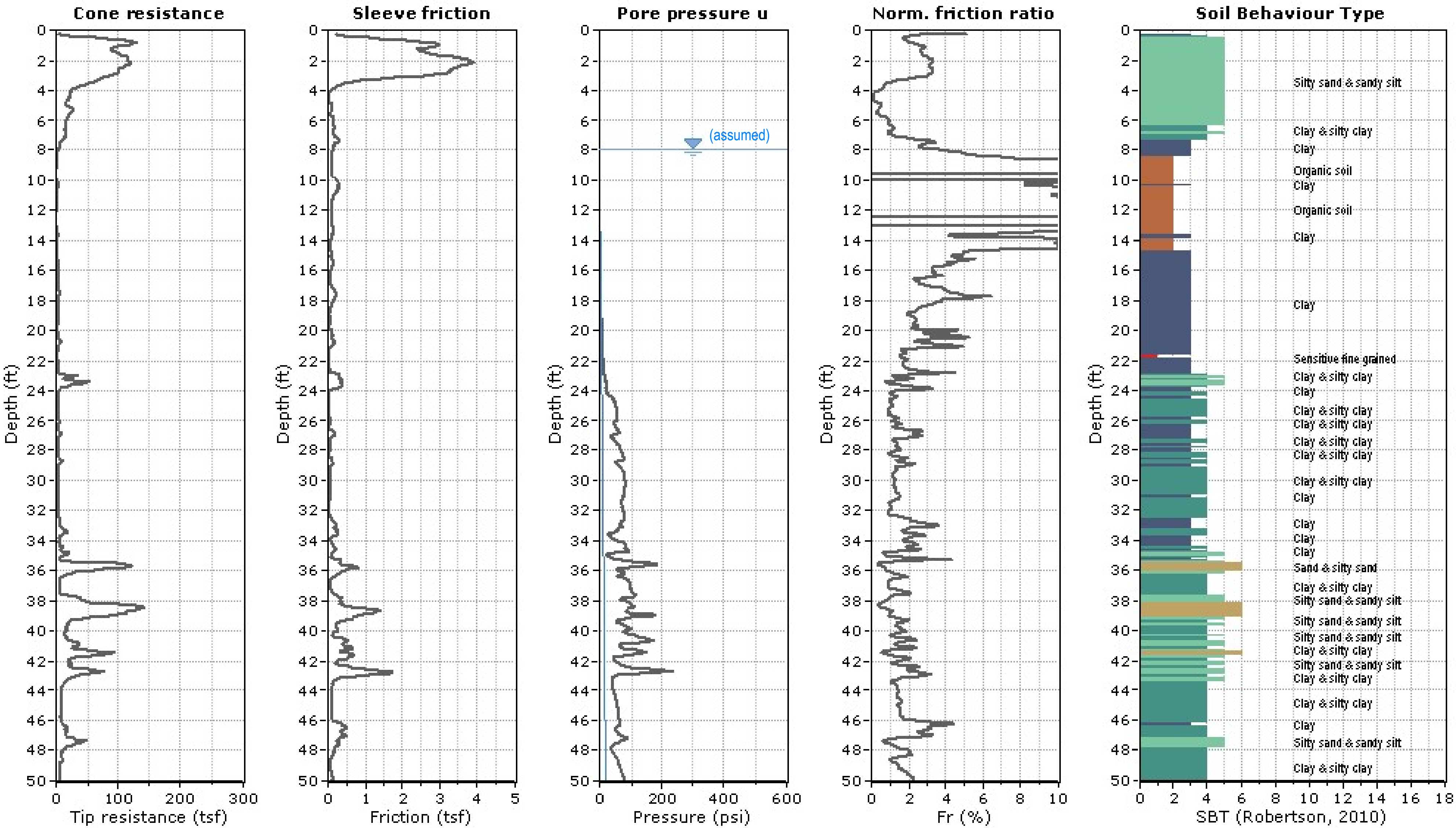
801.566.6399

CPT: L-33

Total depth: 122.11 ft, Date: 8/17/1995
Surface Elevation: 4241.30 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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600 W. Sandy Parkway
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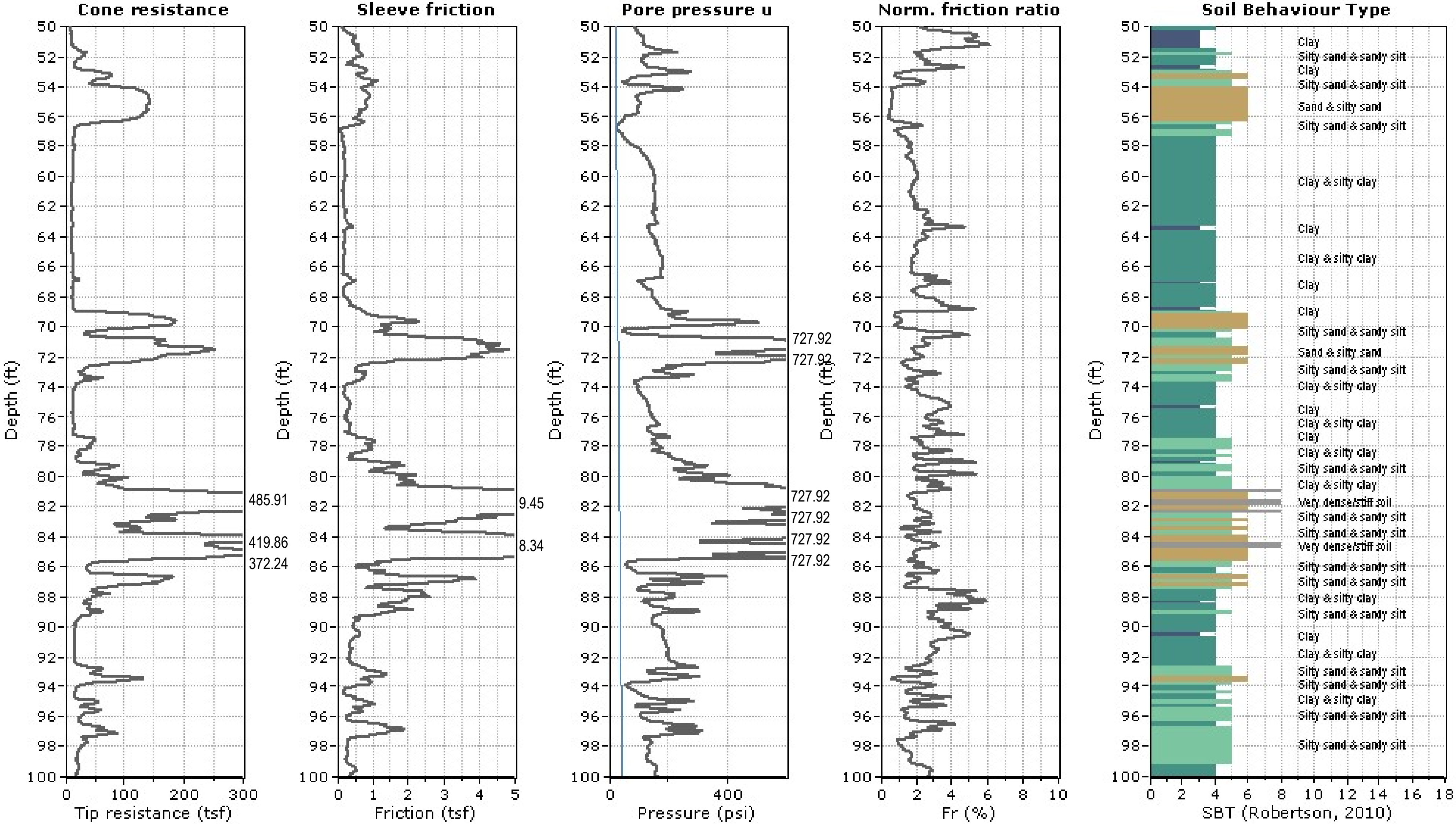
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-33
Total depth: 122.11 ft, Date: 8/17/1995
Surface Elevation: 4241.30 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.



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600 W. Sandy Parkway
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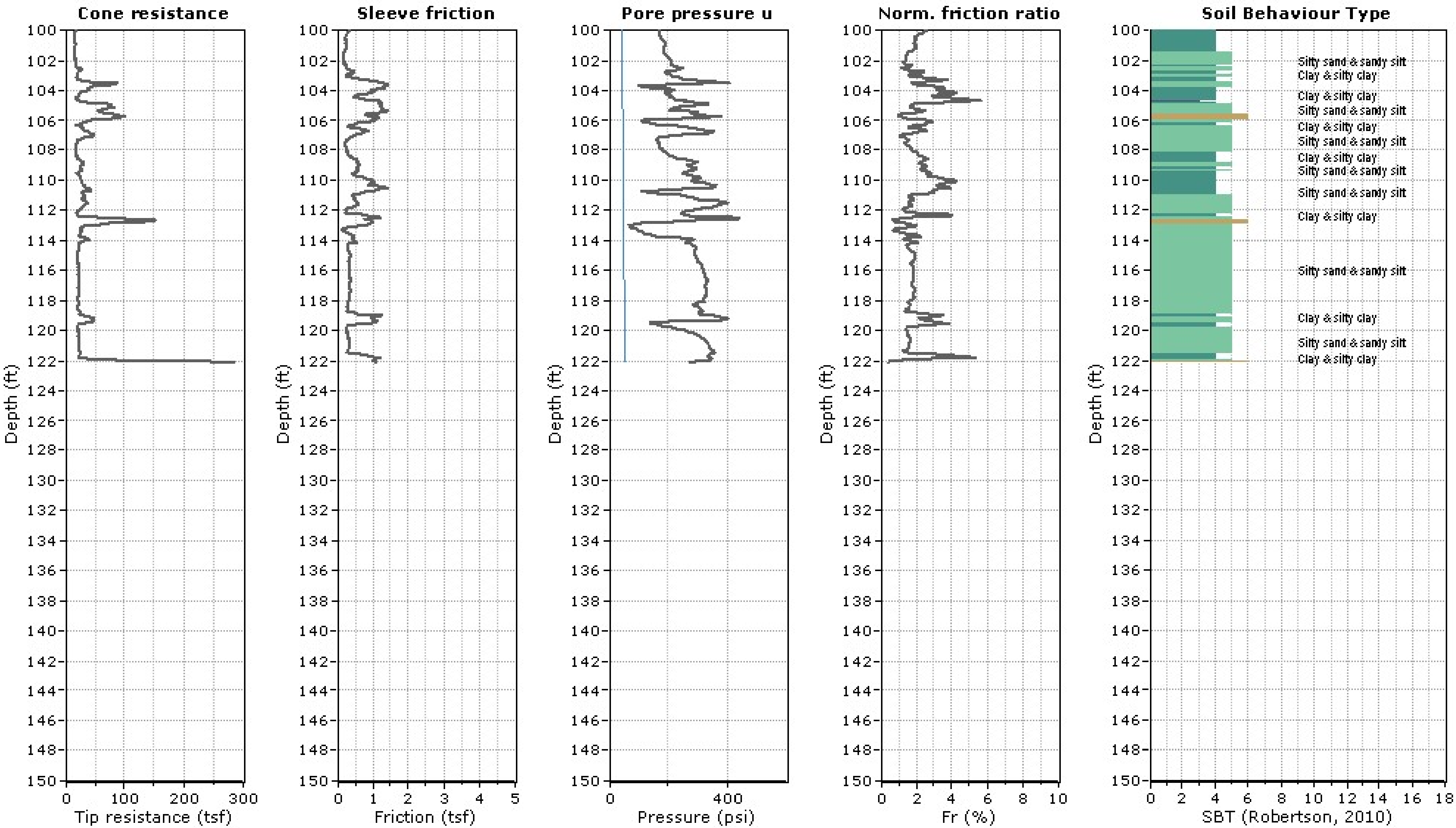
801.566.6399

CPT: L-33

Total depth: 122.11 ft, Date: 8/17/1995
Surface Elevation: 4241.30 ft
Cone Type: # F7.5CKEW852
Cone Operator: Fugro Geosciences, Inc.

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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600 W. Sandy Parkway
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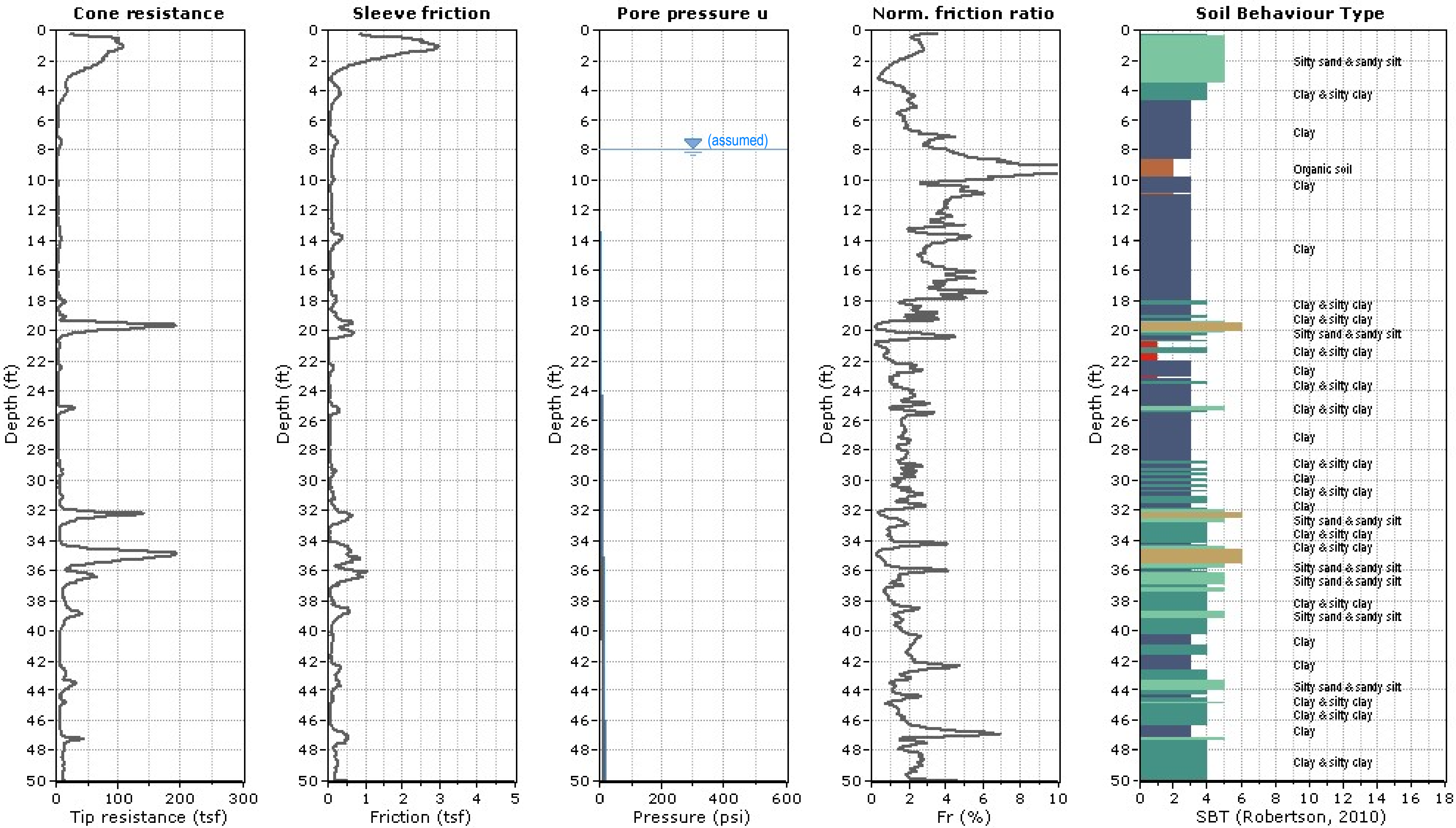
801.566.6399

CPT: L-34
Total depth: 118.05 ft, Date: 8/18/1995
Surface Elevation: 4238.80 ft
Cone Type: # F7.5CEW852
Cone Operator: Fugro Geosciences, Inc.

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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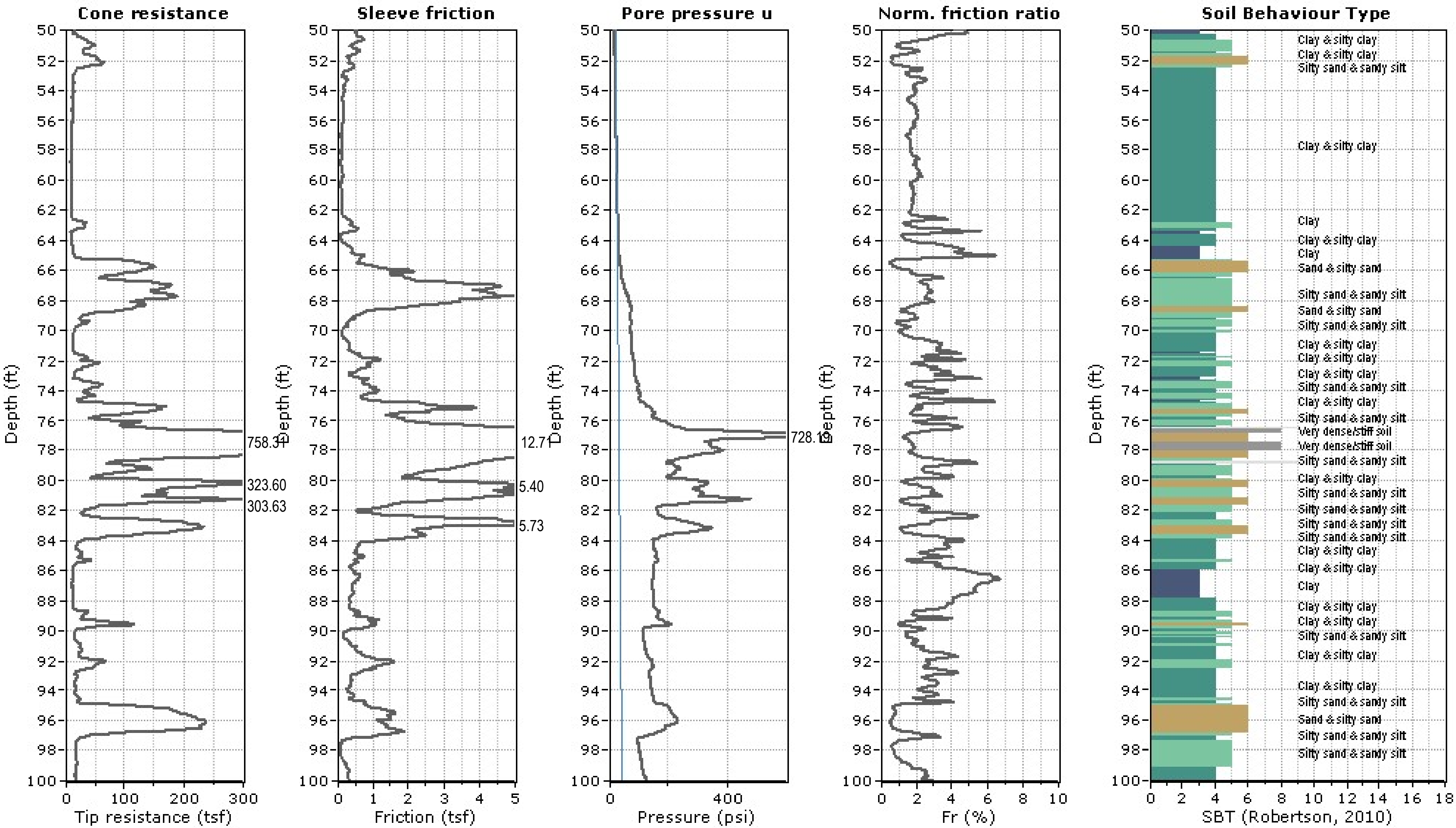
600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-34
Total depth: 118.05 ft, Date: 8/18/1995
Surface Elevation: 4238.80 ft
Cone Type: # F7.5CEW852
Cone Operator: Fugro Geosciences, Inc.

Project: 1160276 - Clean Harbors
Location: see Figure 1



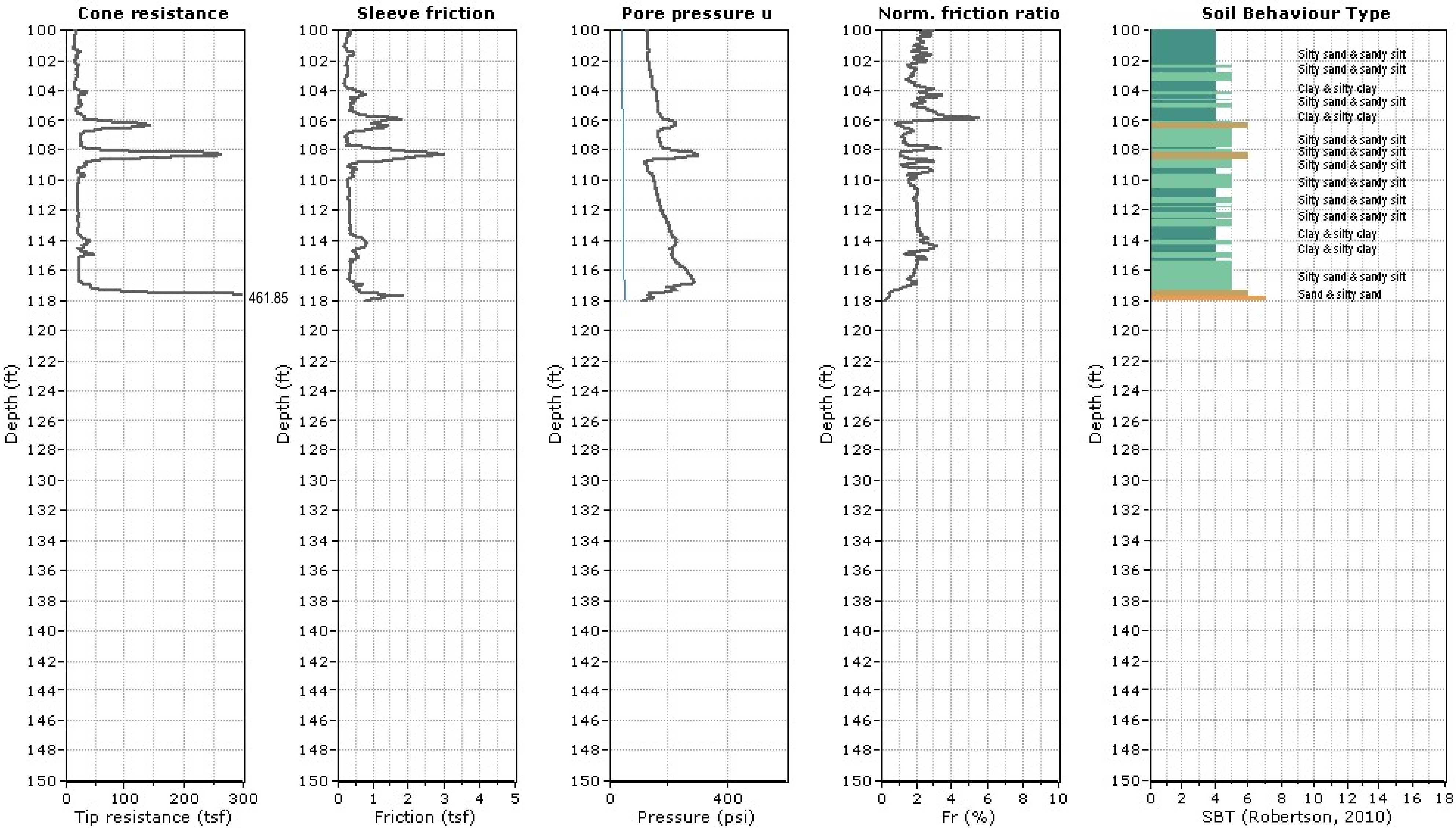
Applied GeoTech

600 W. Sandy Parkway
Sandy, UT 84070
801.566.6399

CPT: L-34

Total depth: 118.05 ft, Date: 8/18/1995
Surface Elevation: 4238.80 ft
Cone Type: # F7.5CEW852
Cone Operator: Fugro Geosciences, Inc.

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**



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600 W. Sandy Parkway
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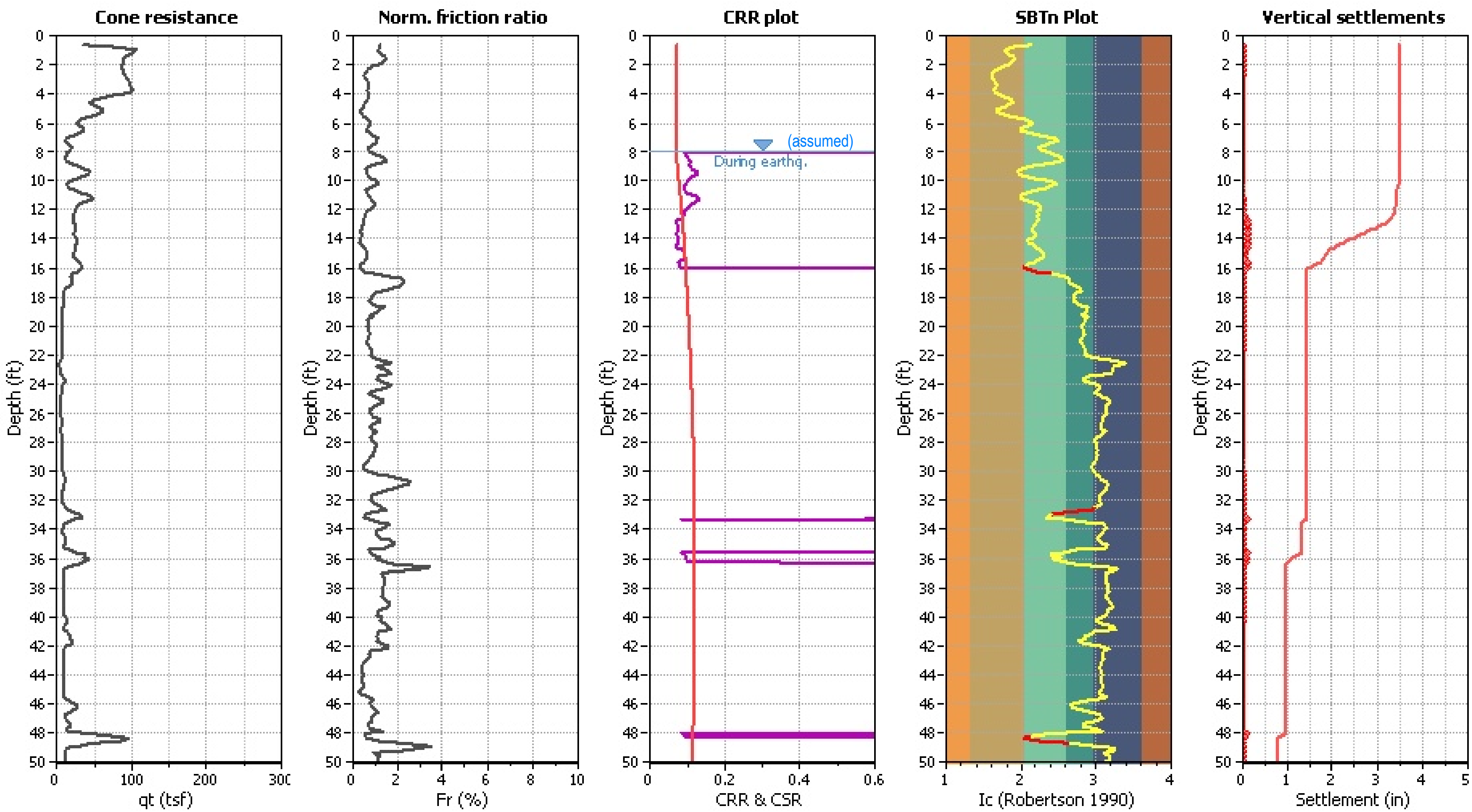
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-1
Total depth: 91.37 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9999.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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600 W. Sandy Parkway
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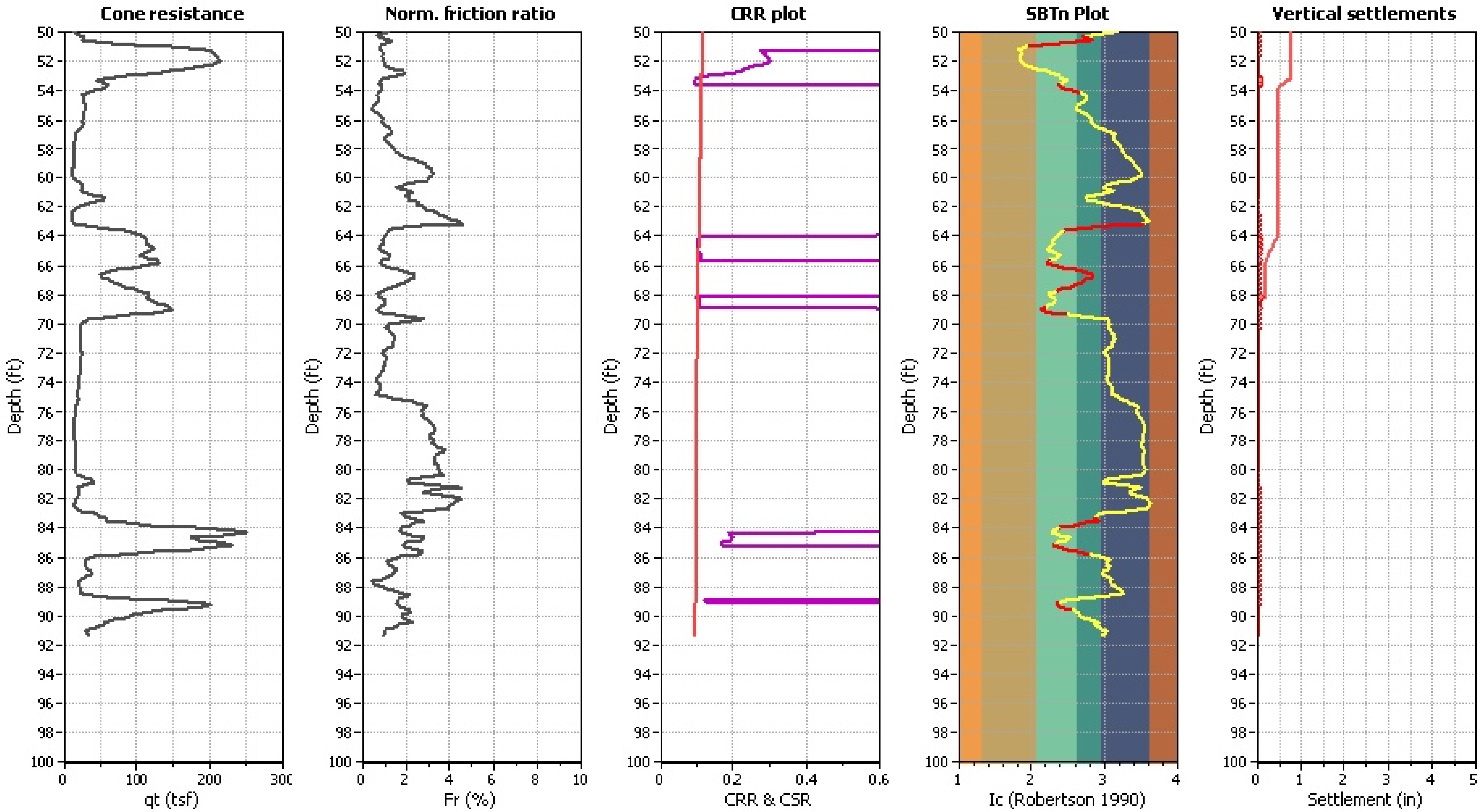
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-1
Total depth: 91.37 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9999.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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600 W. Sandy Parkway
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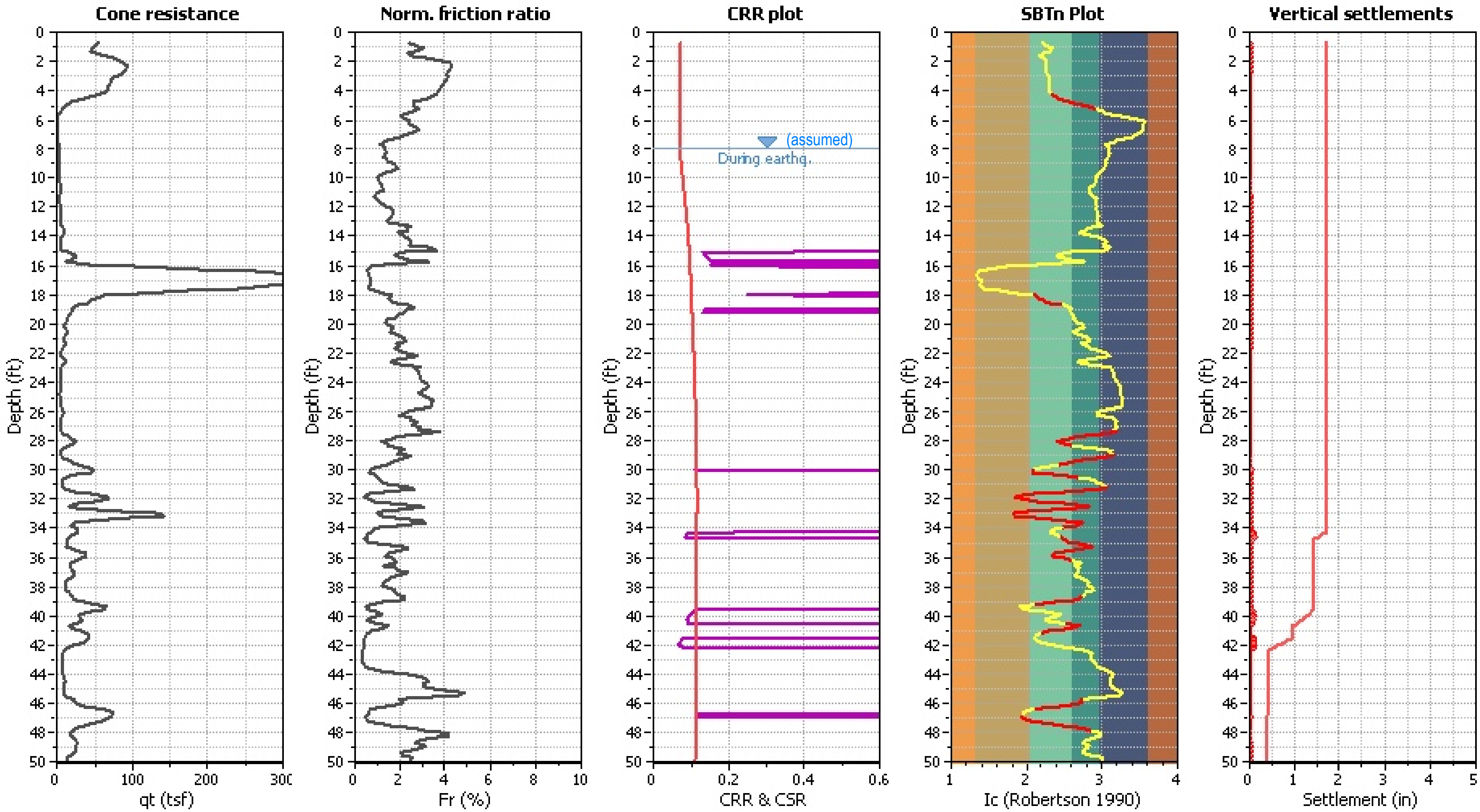
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-3
Total depth: 91.54 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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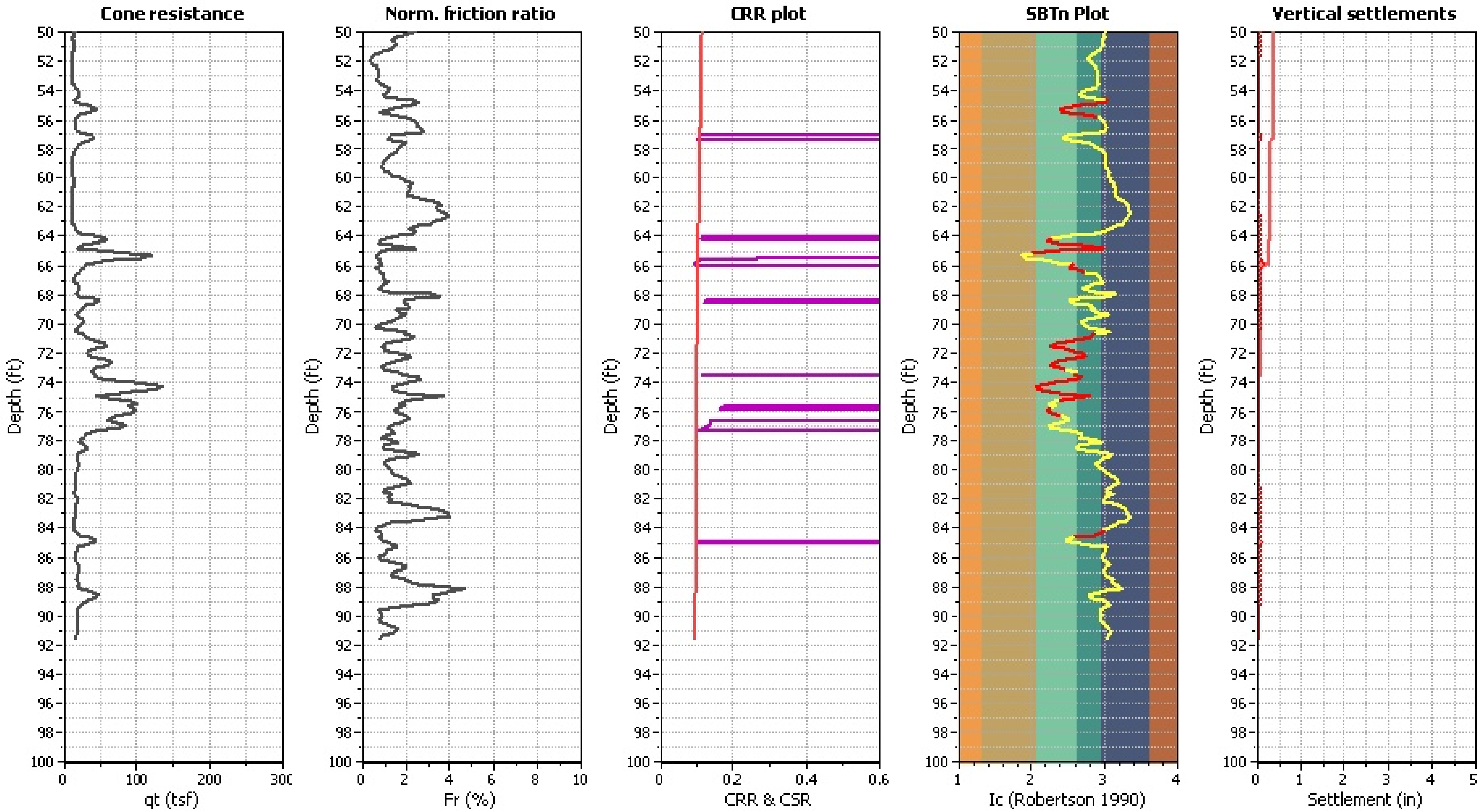
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-3
Total depth: 91.54 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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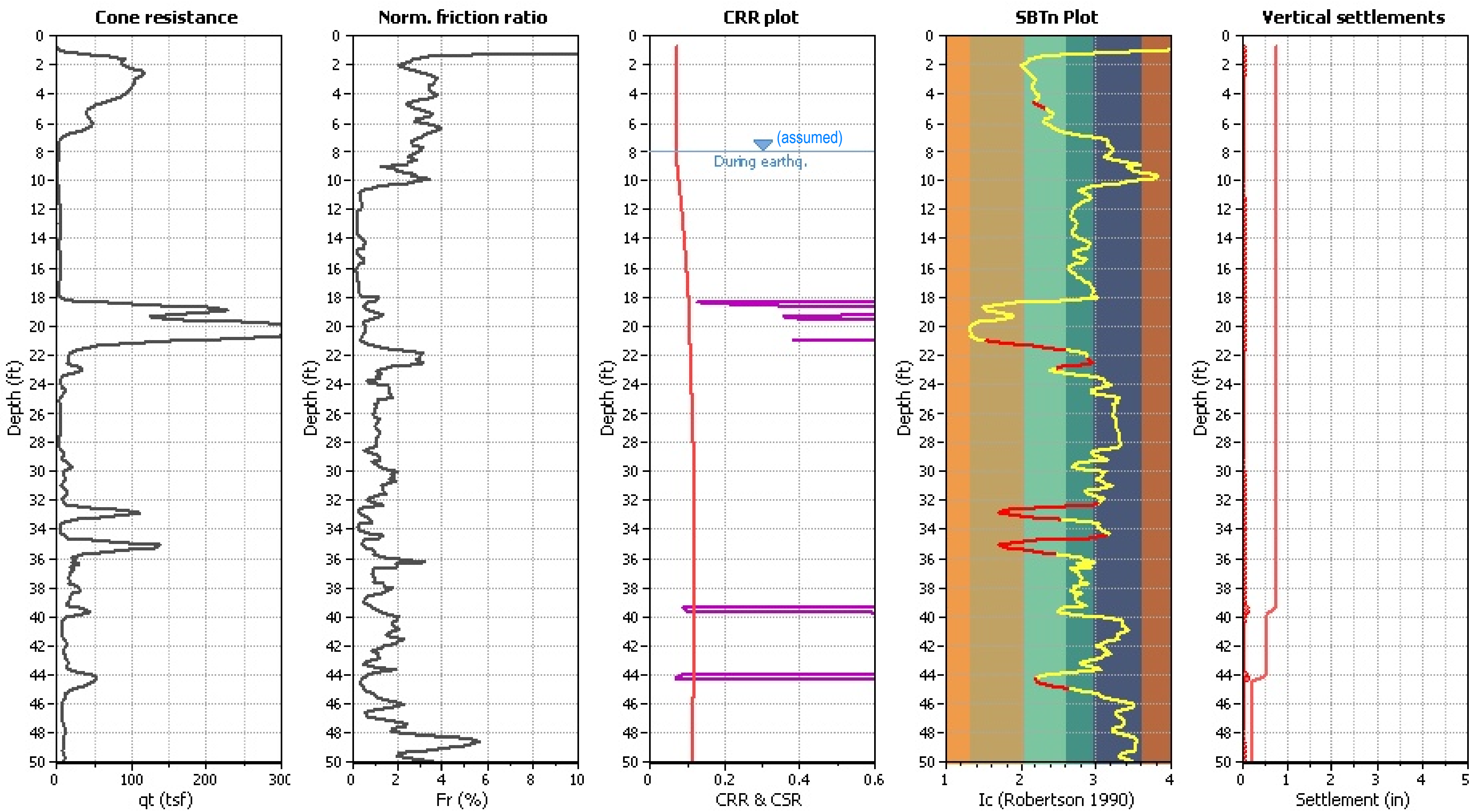
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-5
Total depth: 91.04 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9999.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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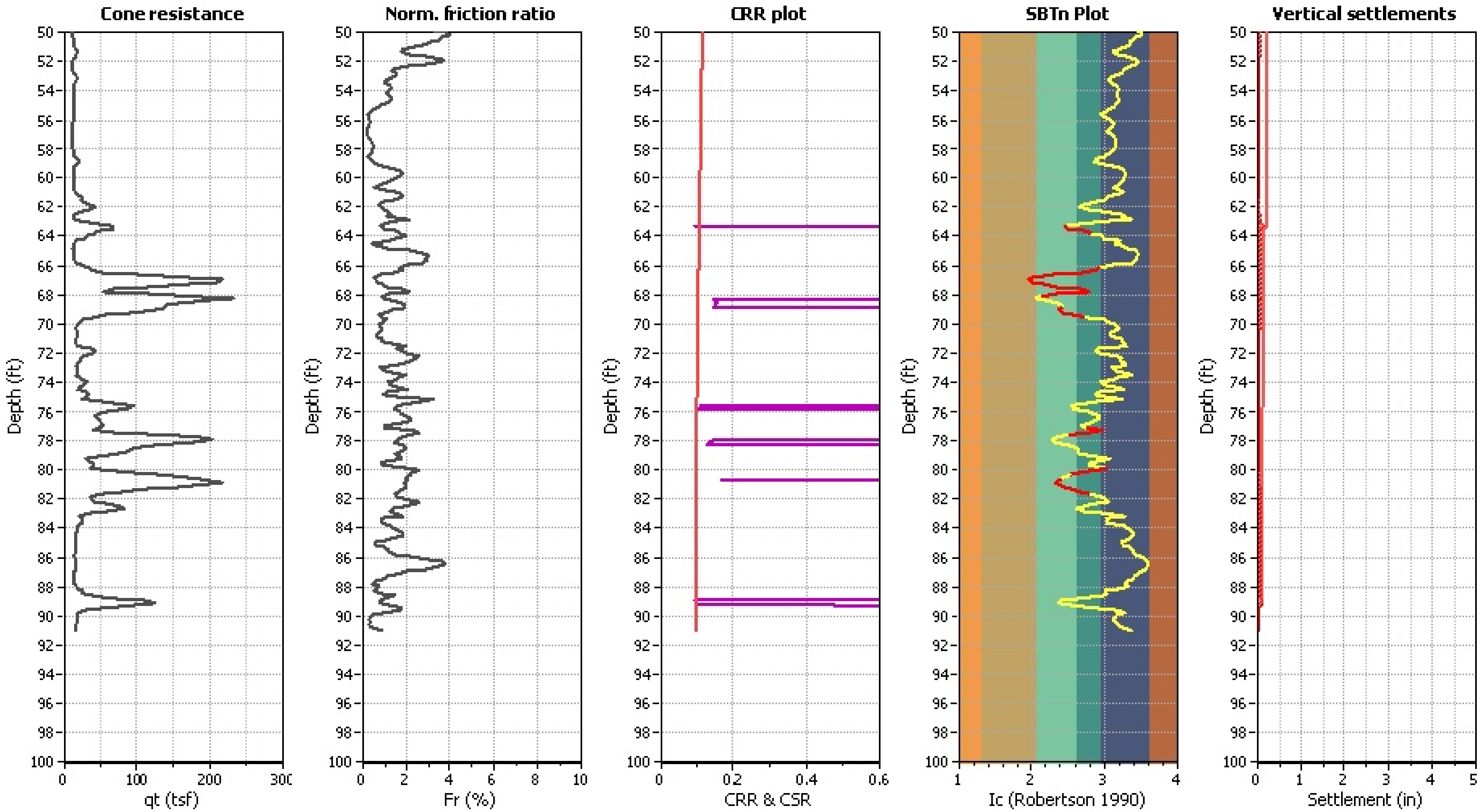
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-5
Total depth: 91.04 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9999.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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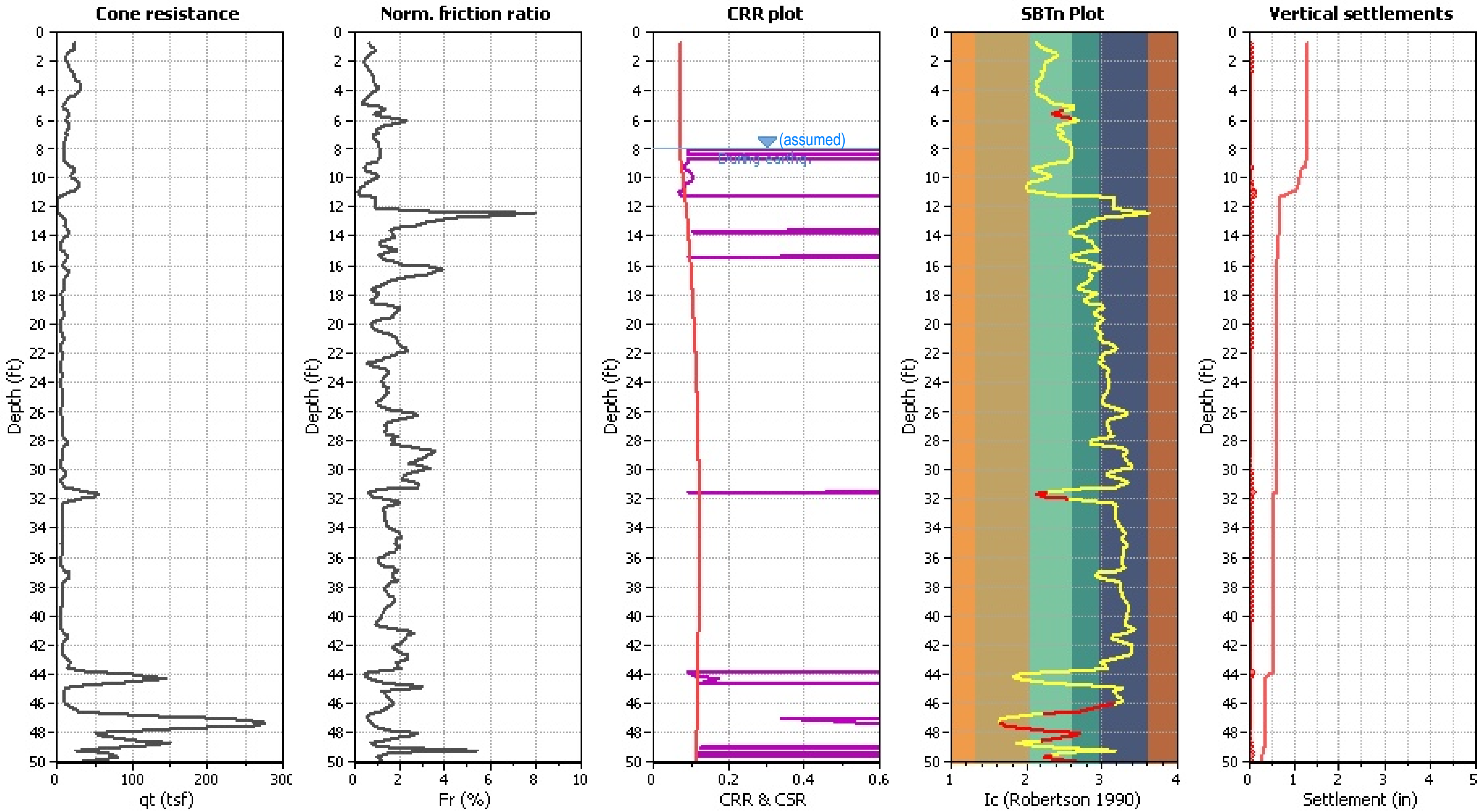
Project: **1160276 - Clean Harbors**

Location: **see Figure 1**

CPT: L-7

Total depth: 91.37 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9999.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	N/A
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

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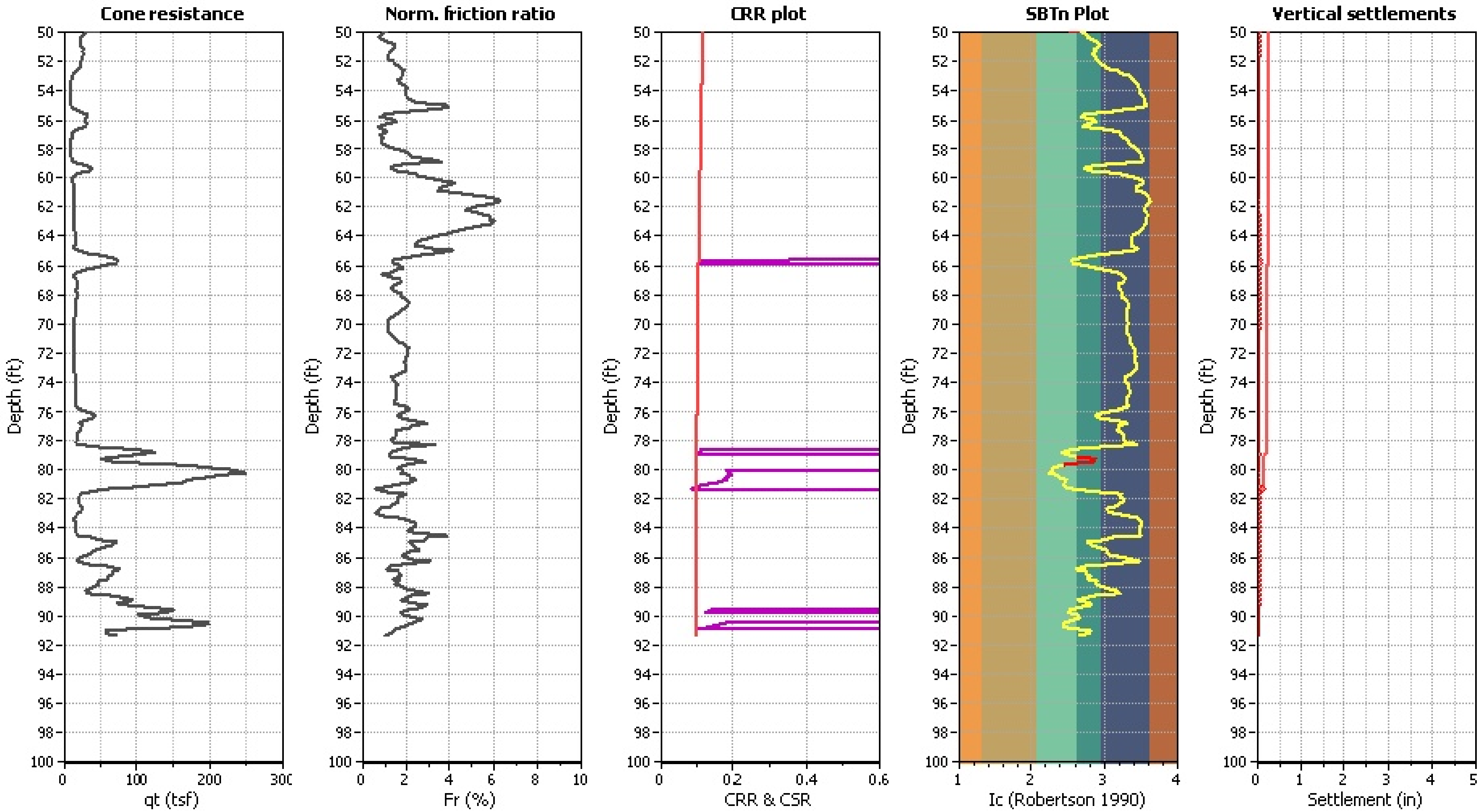
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-7
Total depth: 91.37 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	9999.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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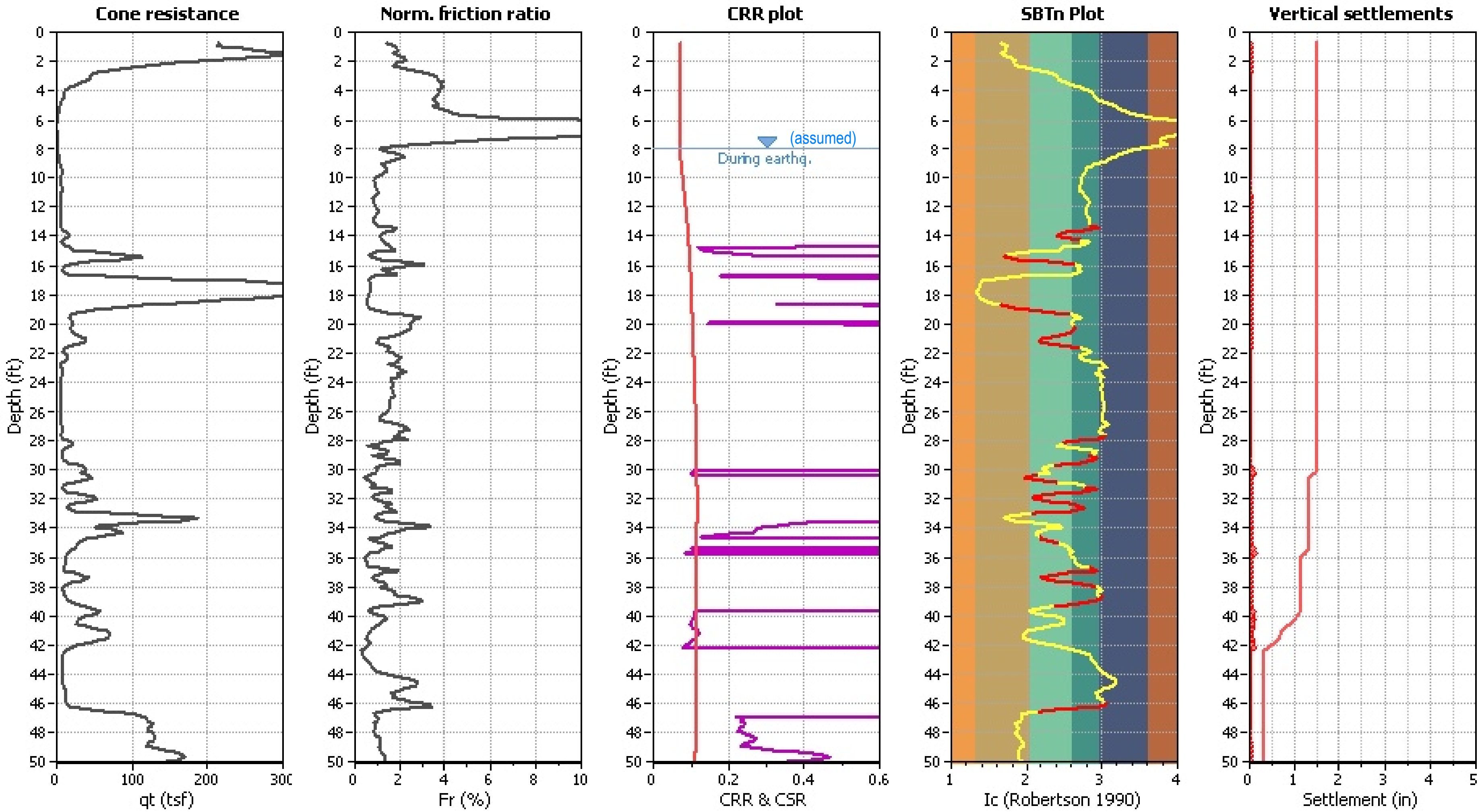
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-9
Total depth: 78.90 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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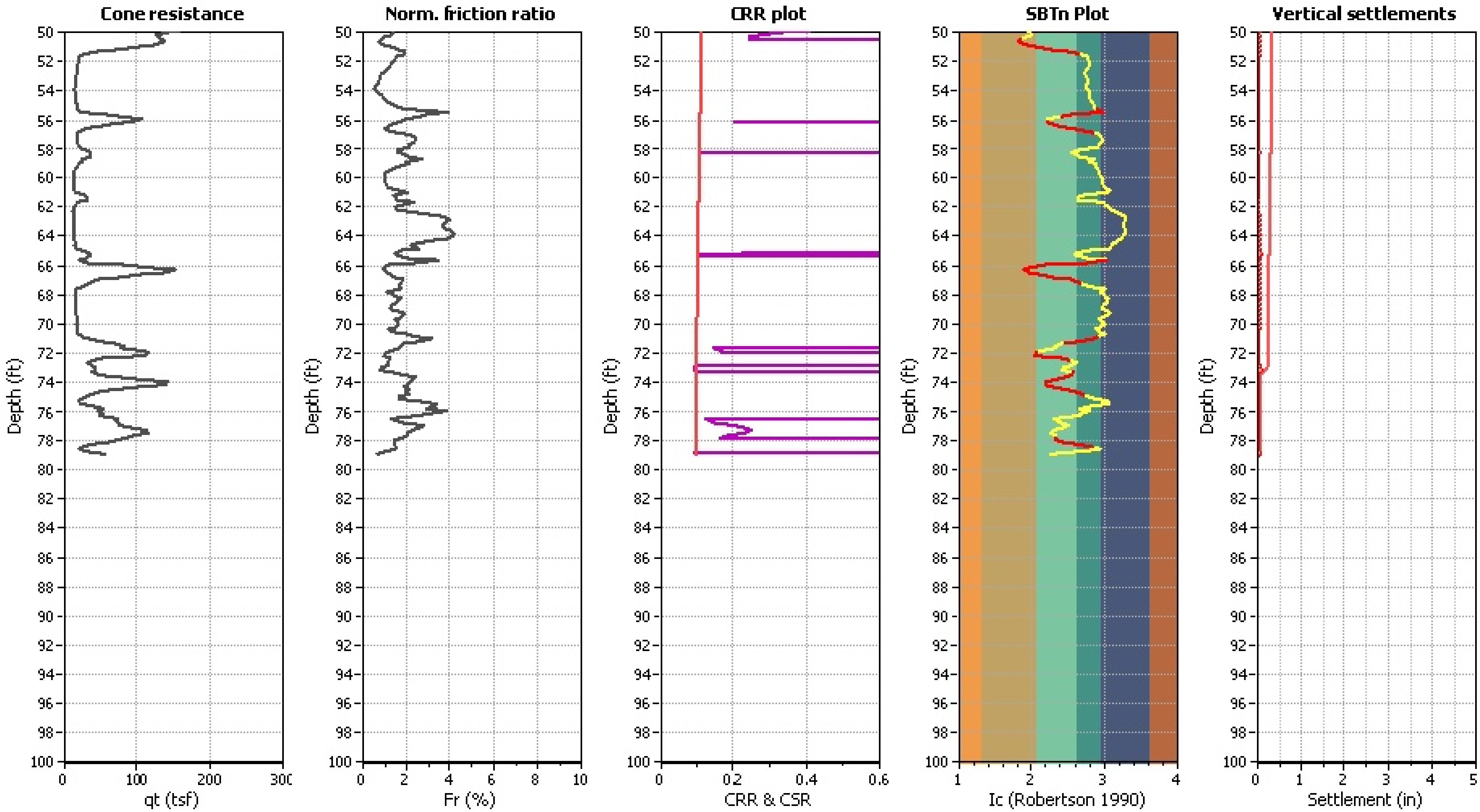
Project: **1160276 - Clean Harbors** | **CPT: L-9**

Location: **see Figure 1** | Total depth: 78.90 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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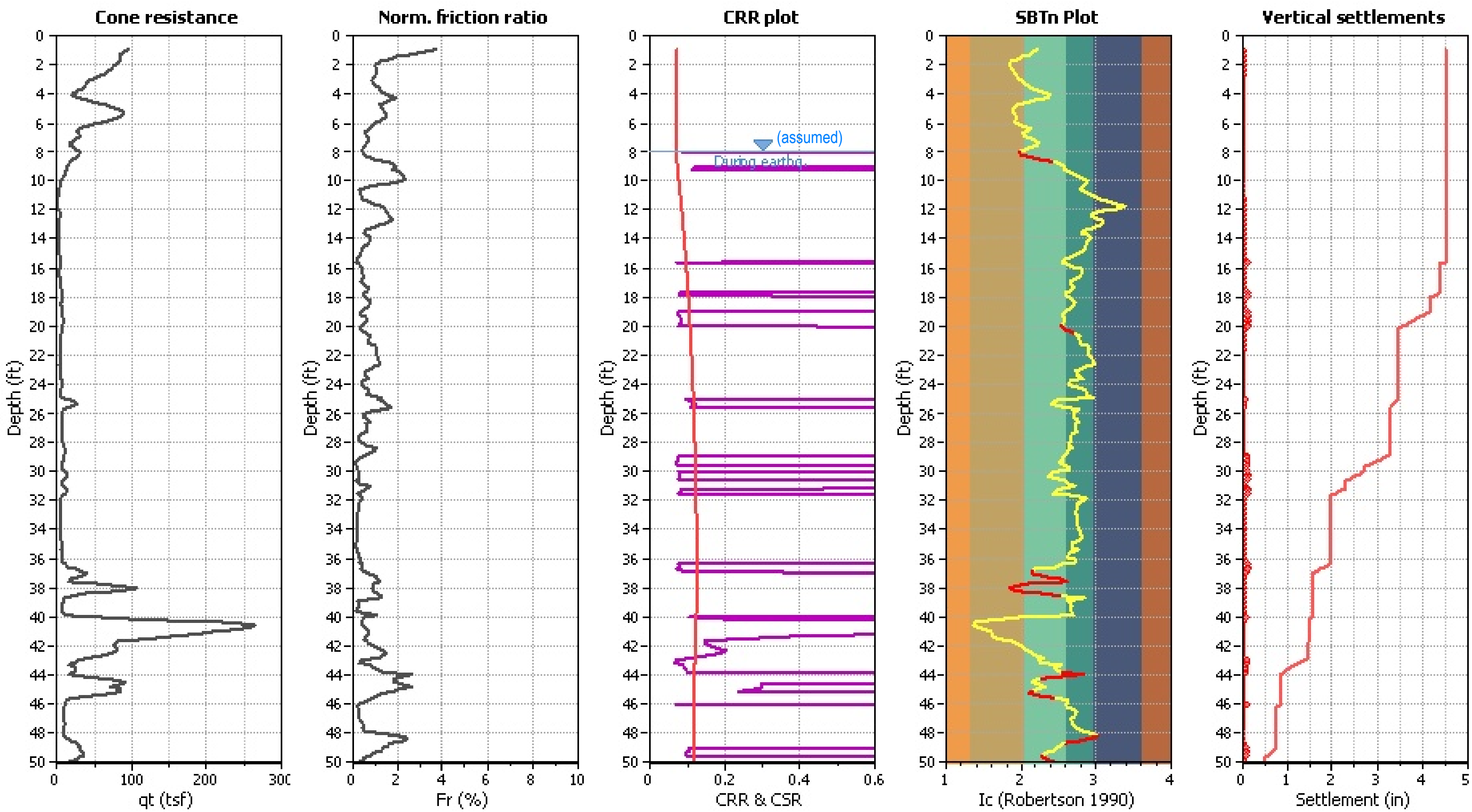
Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-11
Total depth: 84.15 ft



Analysis method: NCEER (1998)
Fines correction method: NCEER (1998)
Points to test: Based on Ic value
Earthquake magnitude M_w: 6.20
Peak ground acceleration: 0.18

G.W.T. (in-situ): 8.00 ft
G.W.T. (earthq.): 8.00 ft
Average results interval: 3
Ic cut-off value: 2.60
Unit weight calculation: Based on SBT

Use fill: No
Fill height: N/A
Fill weight: N/A
Trans. detect. applied: Yes
K_σ applied: Yes

Clay like behavior applied: Sands only
Limit depth applied: No
Limit depth: N/A
MSF method: Method based

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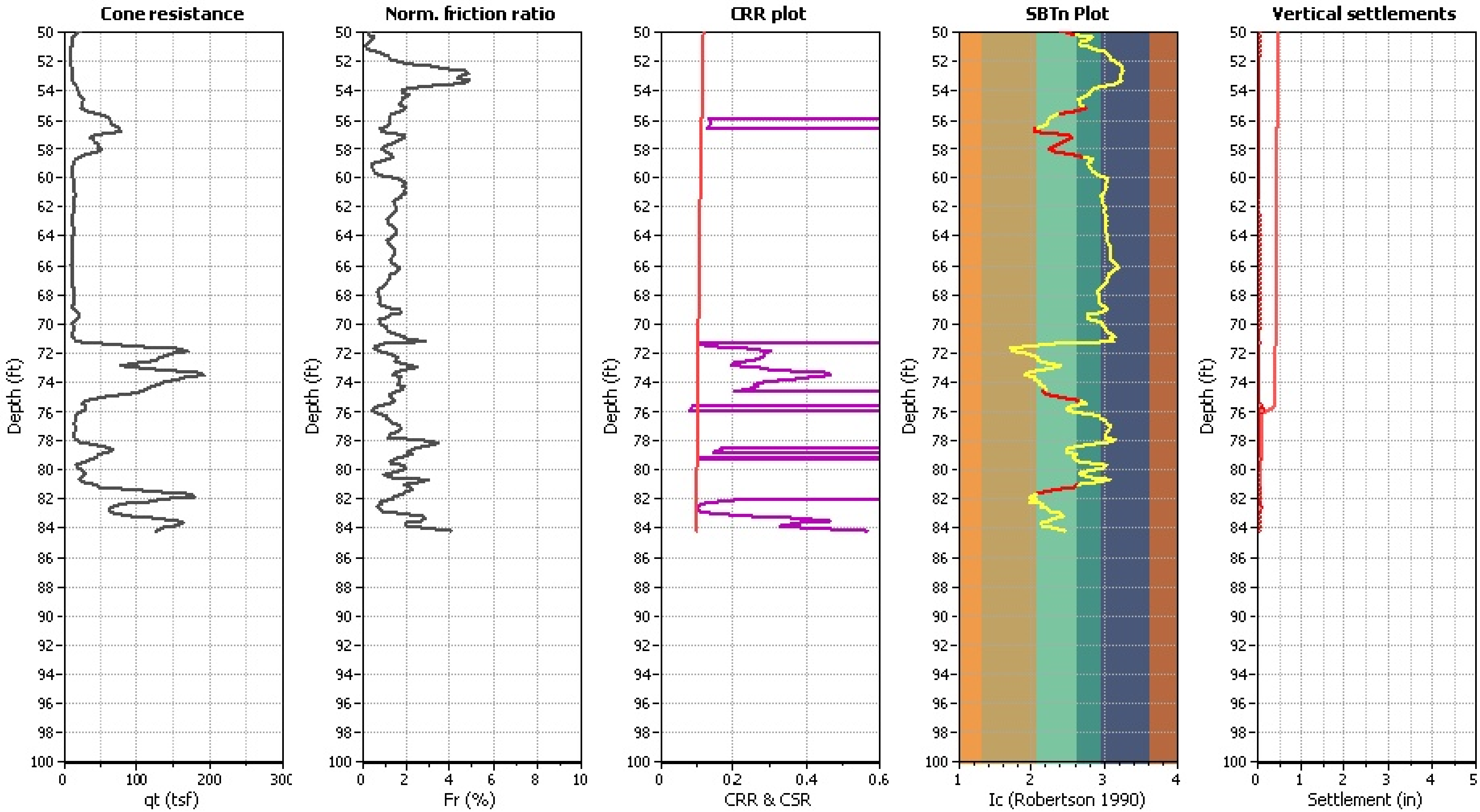
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-11
Total depth: 84.15 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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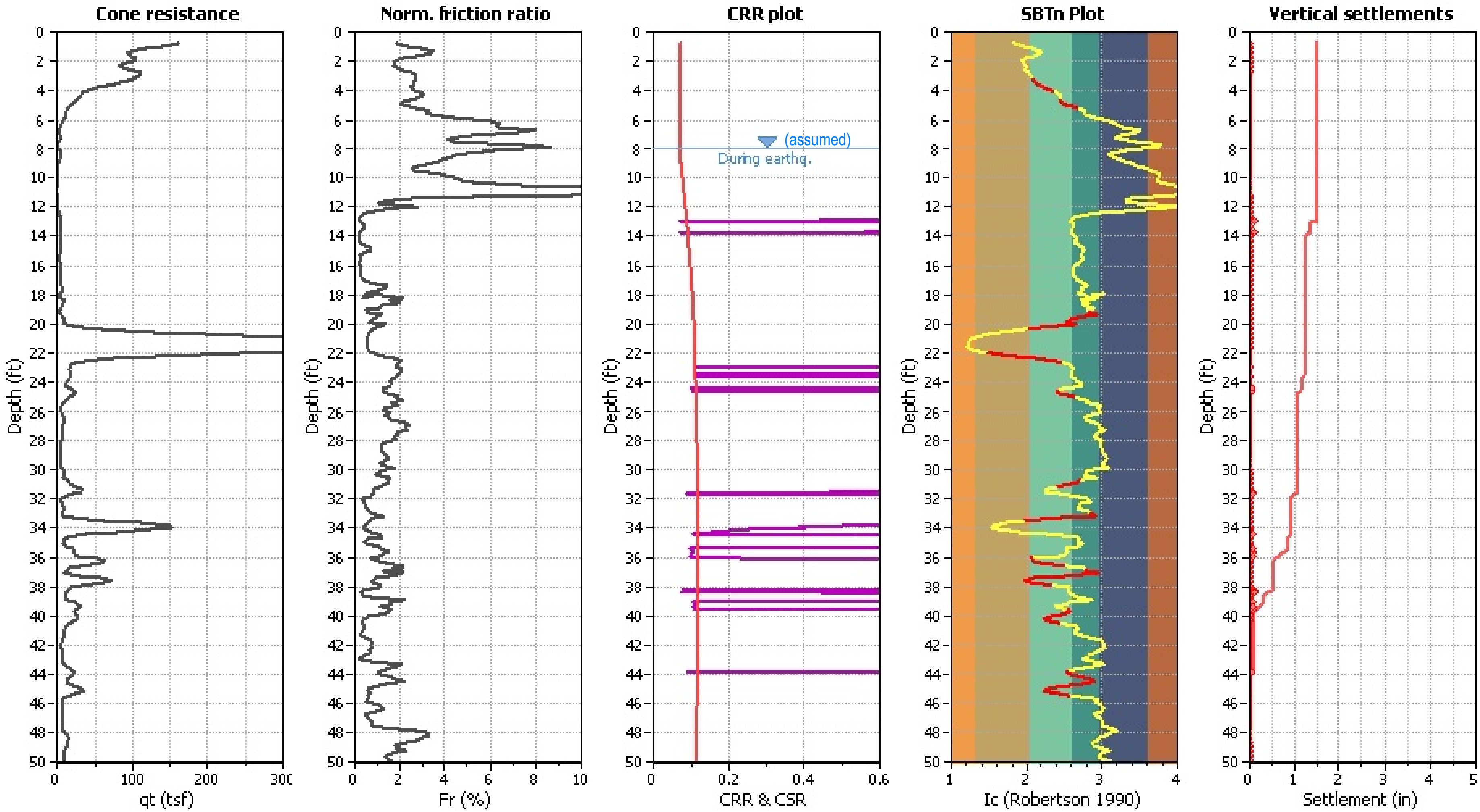
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-13
Total depth: 77.59 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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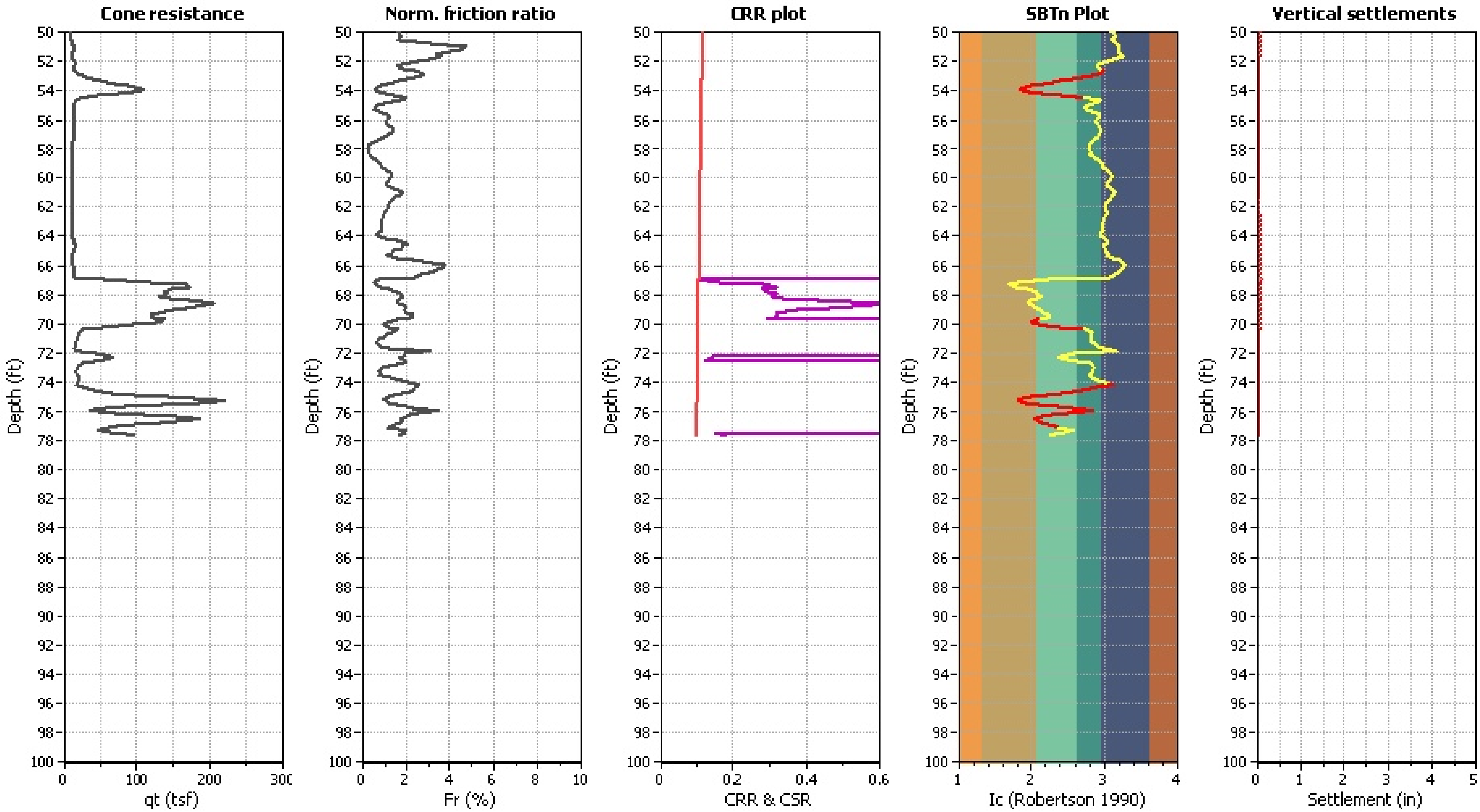
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-13
Total depth: 77.59 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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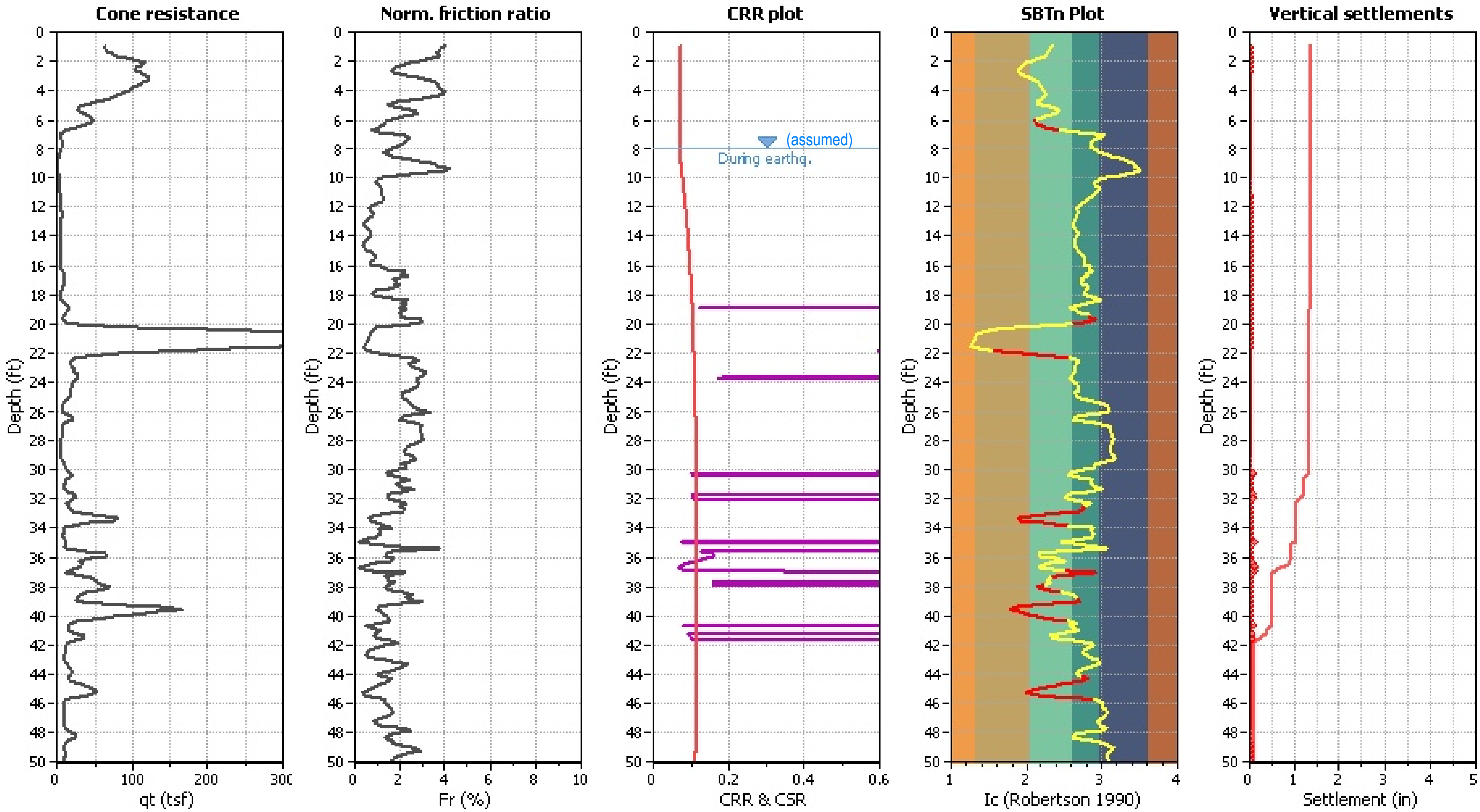
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-14
Total depth: 77.43 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

CPeT-IT v.2.0.6.83 - CPTU data presentation & interpretation software - Report created on: 9/29/2017, 5:00:23 PM
Project file: H:\AGEC Project Files\2016 Projects\1160276 GT - C Landfill (JEN)\CPT Data\Earthtec Liq Data.clq

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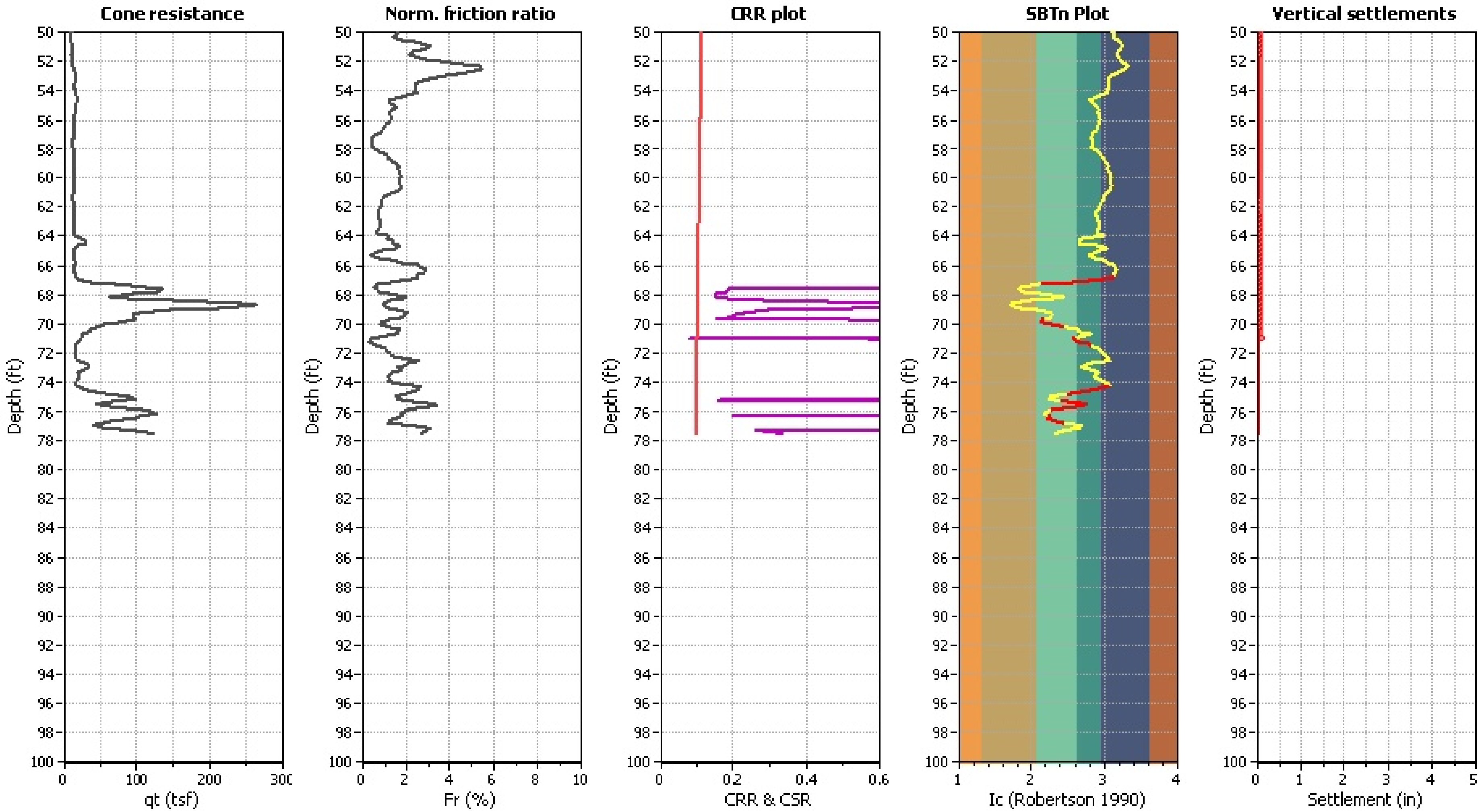
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-14
Total depth: 77.43 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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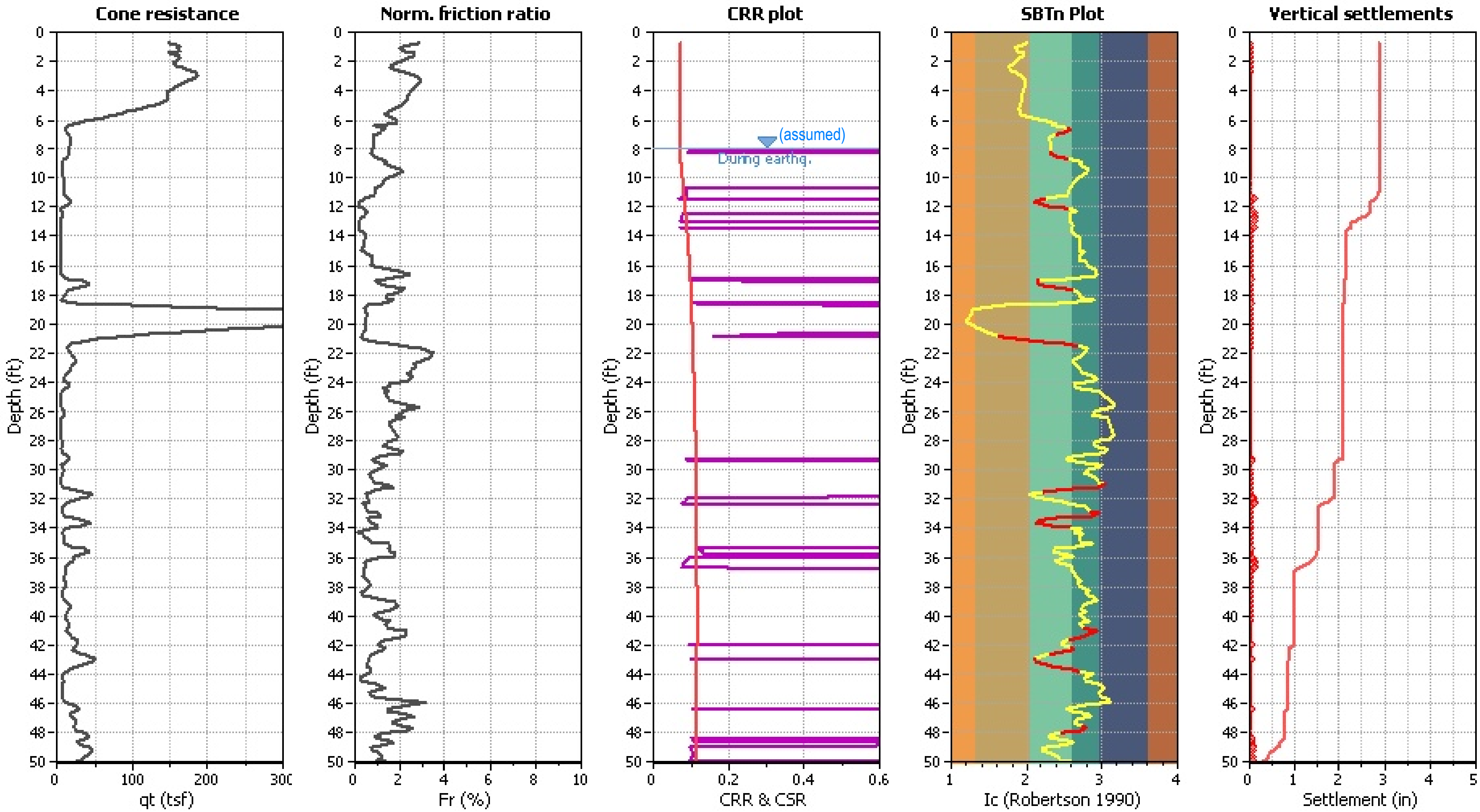
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-16
Total depth: 81.36 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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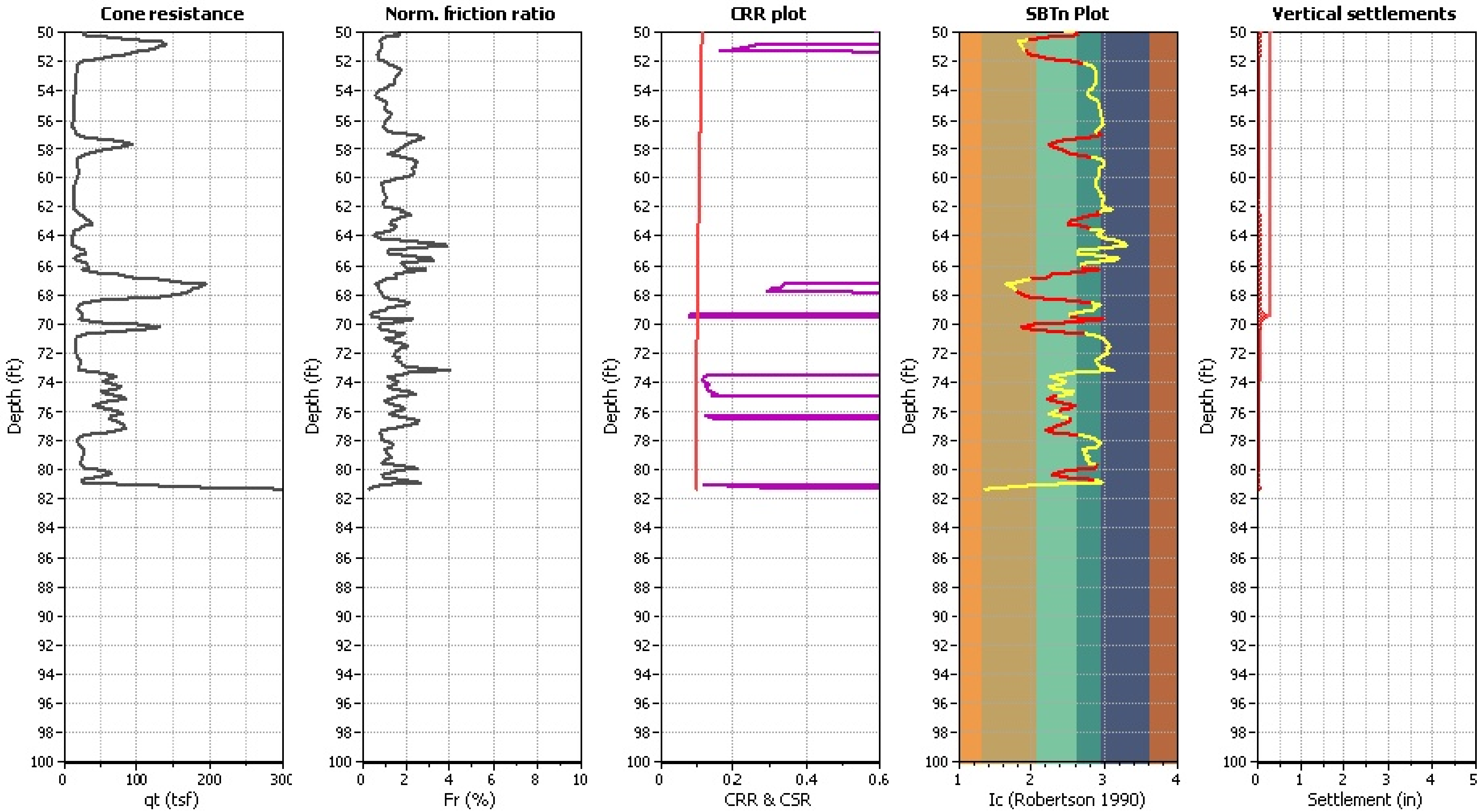
Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-16
Total depth: 81.36 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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600 W. Sandy Parkway
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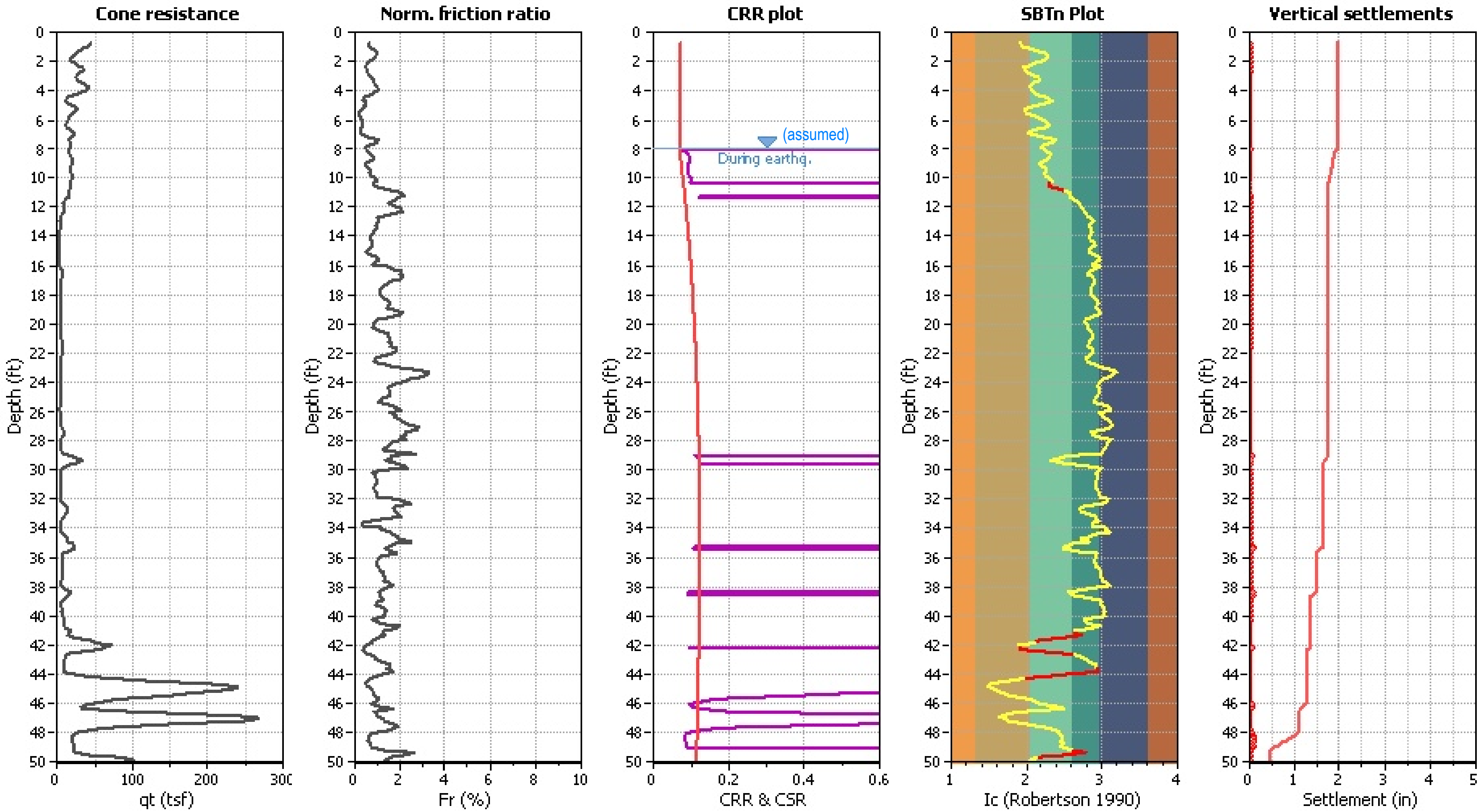
Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-18
Total depth: 79.07 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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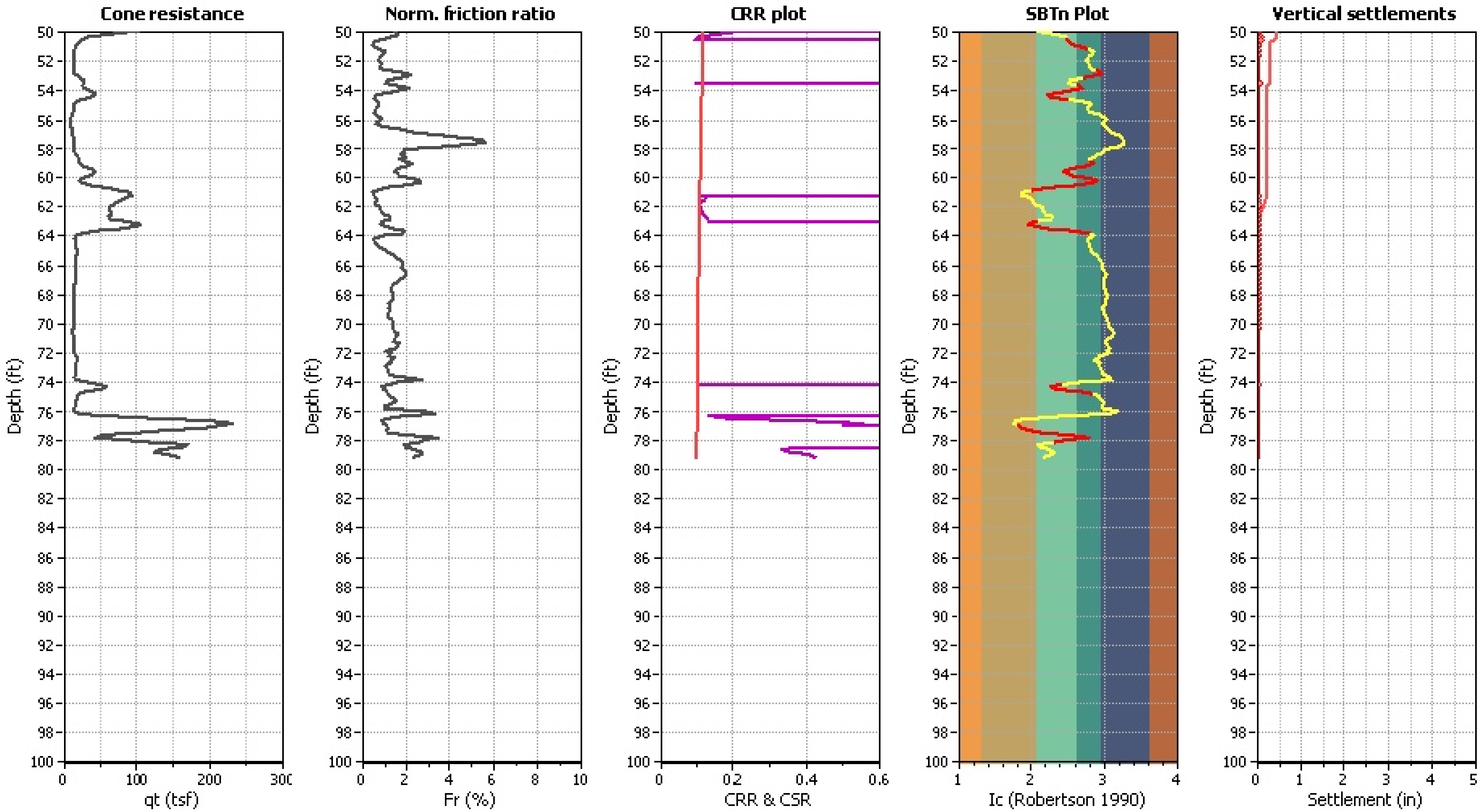
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-18
Total depth: 79.07 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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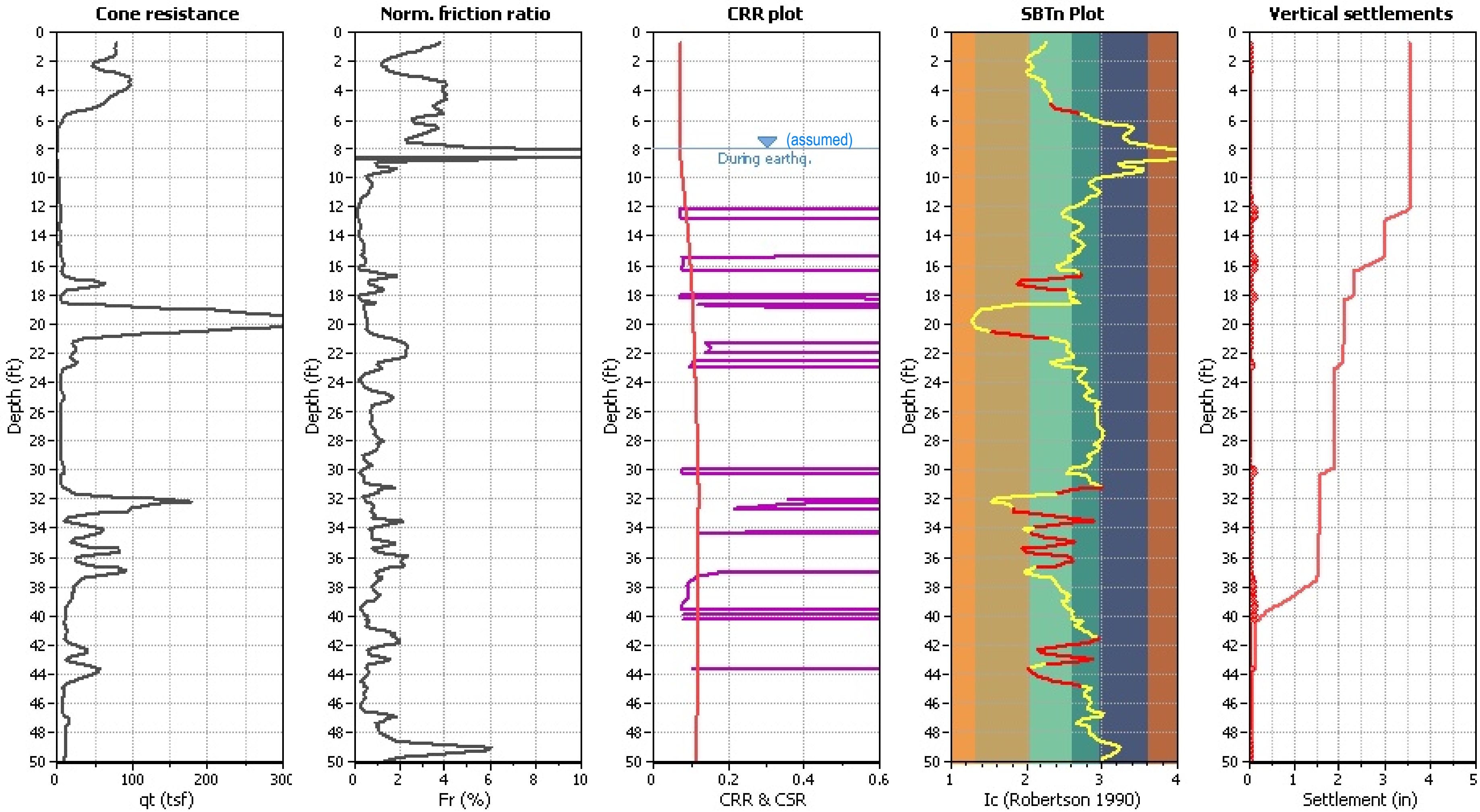
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-20
Total depth: 53.81 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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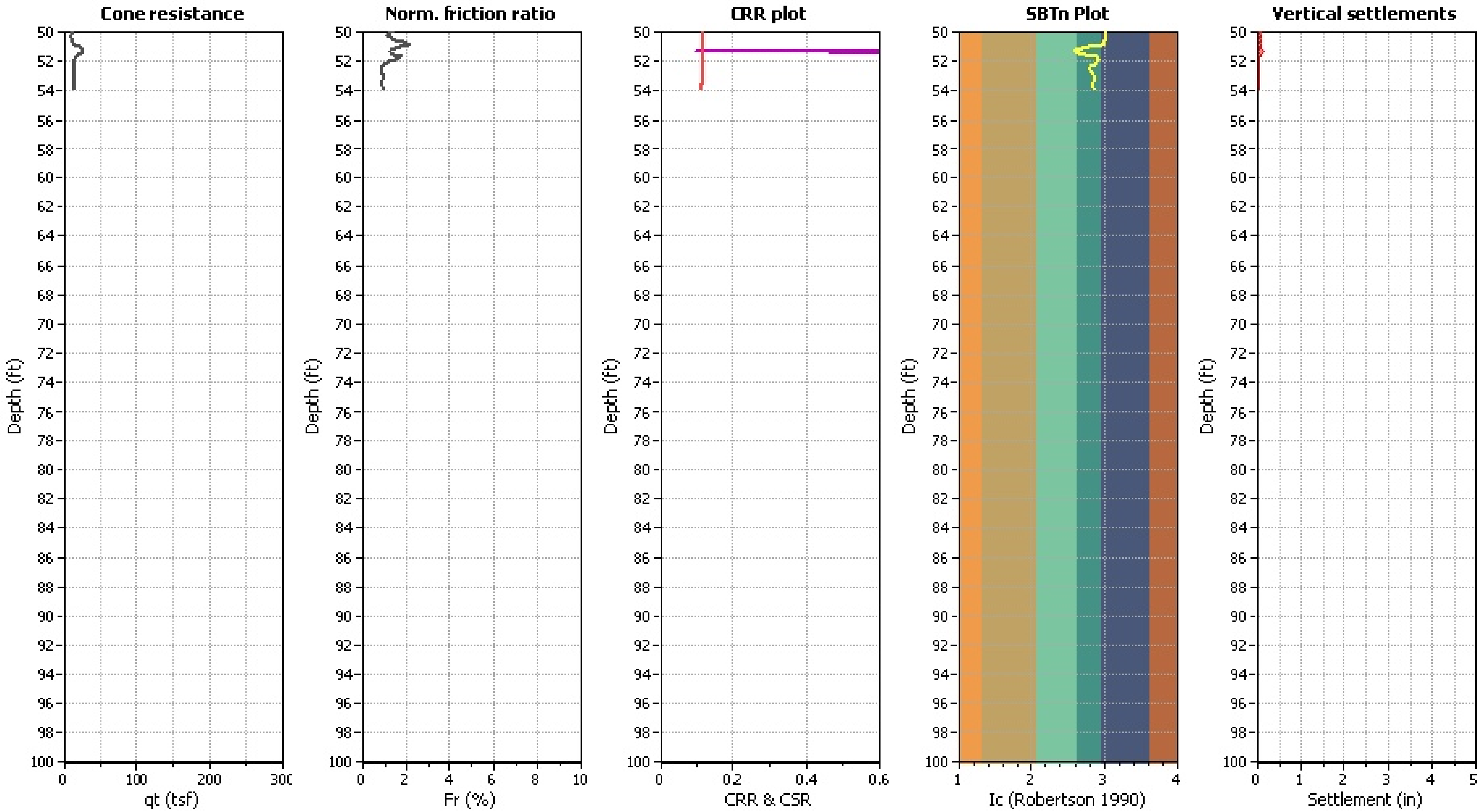
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-20
Total depth: 53.81 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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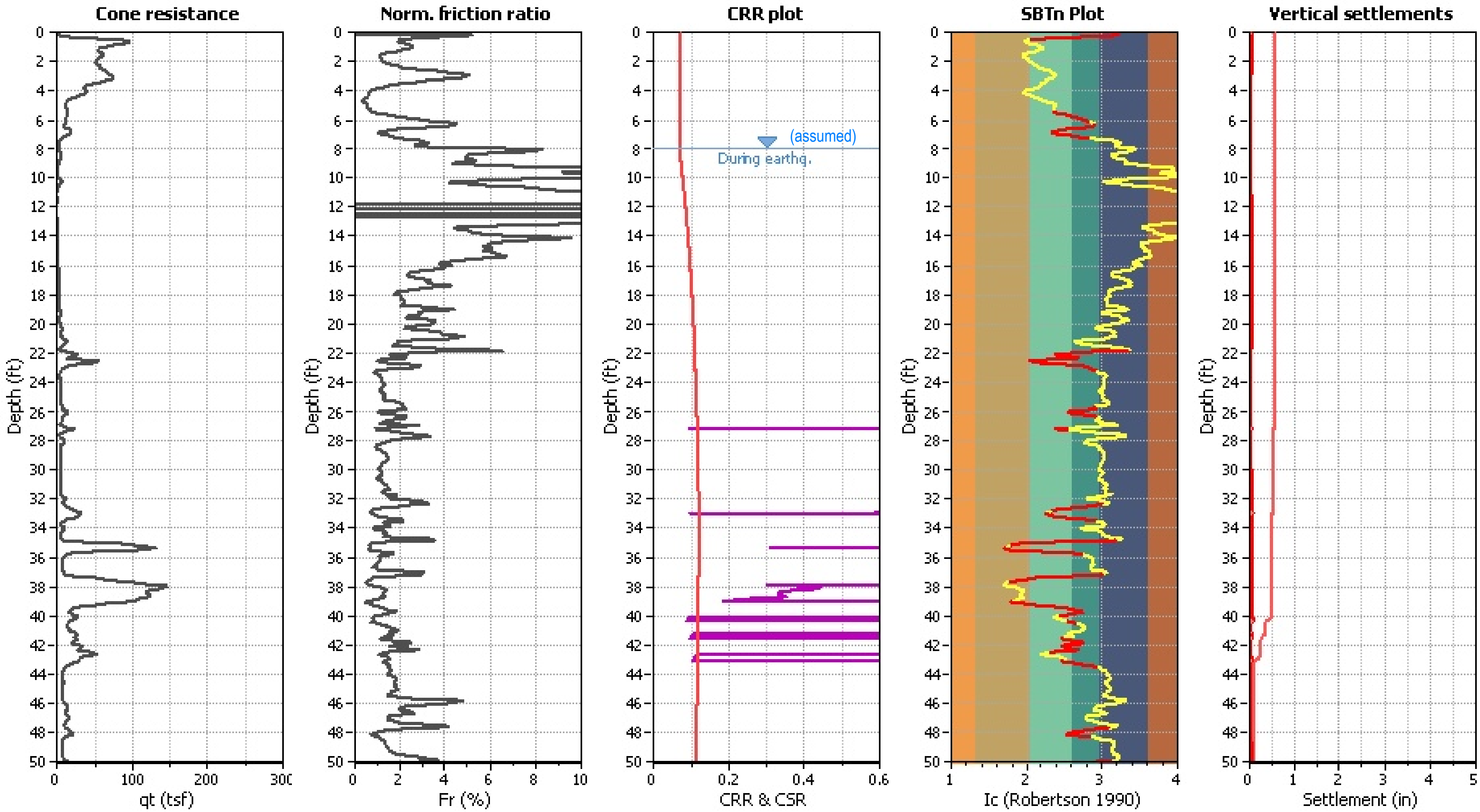
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-31
Total depth: 124.54 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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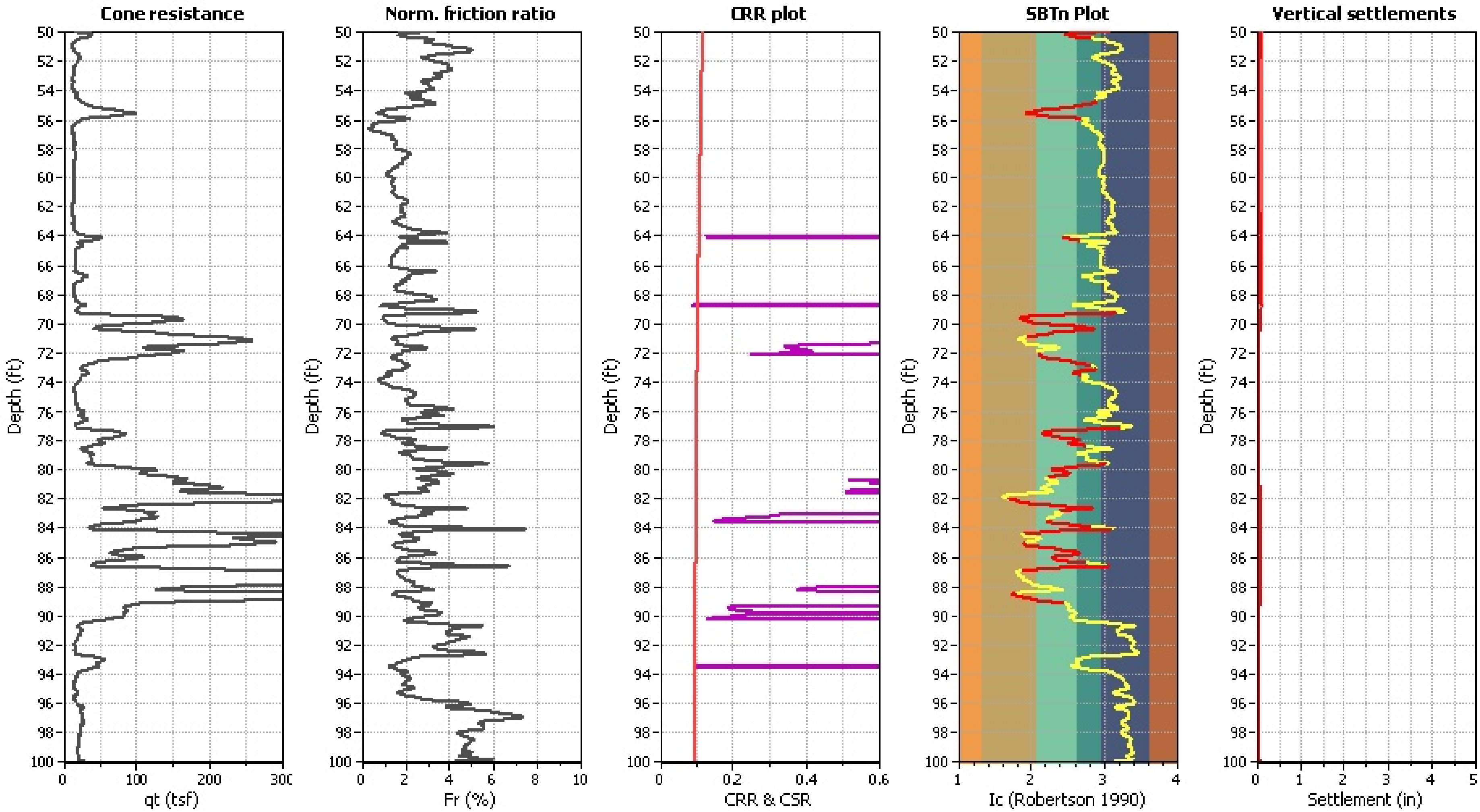
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-31
Total depth: 124.54 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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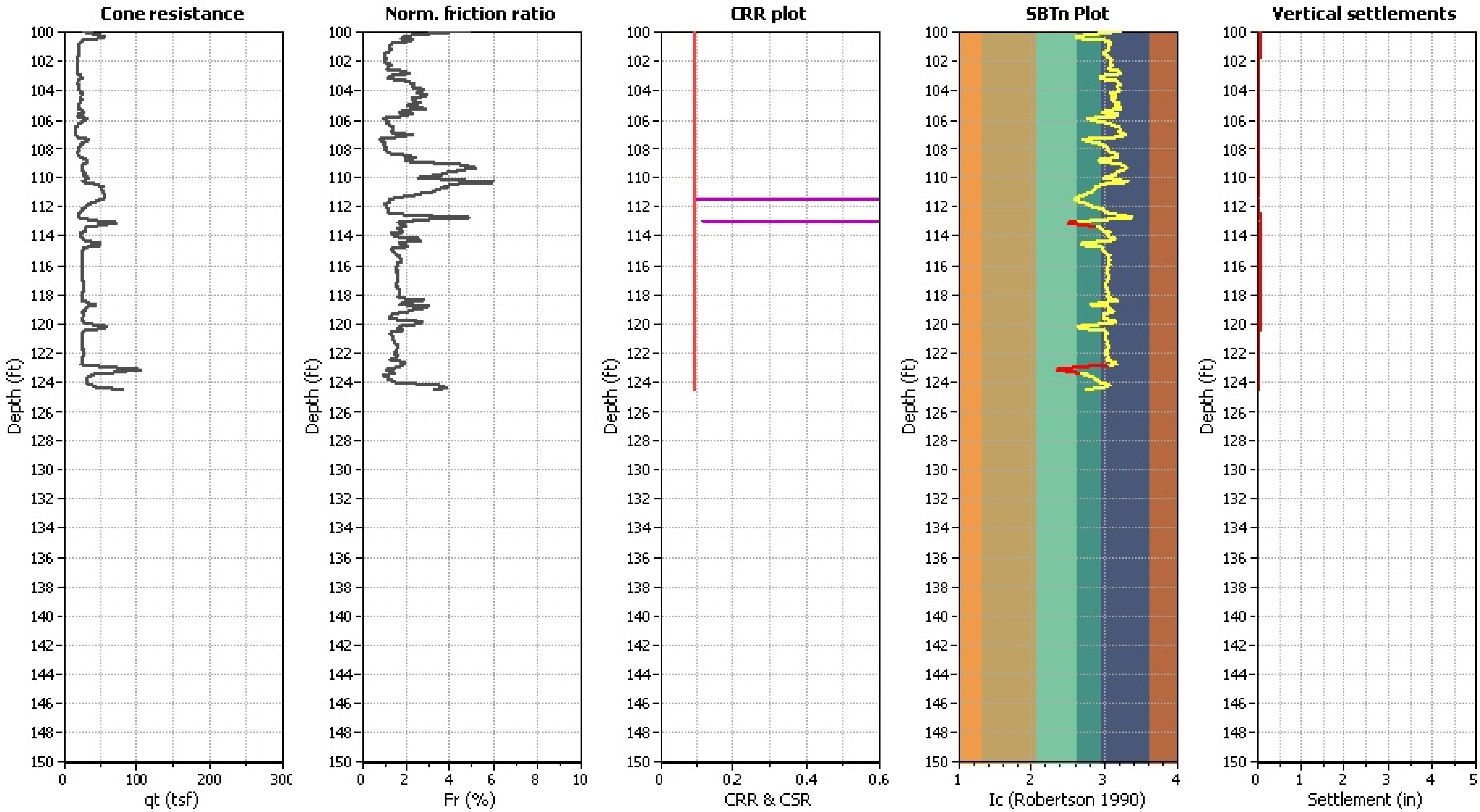
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-31
Total depth: 124.54 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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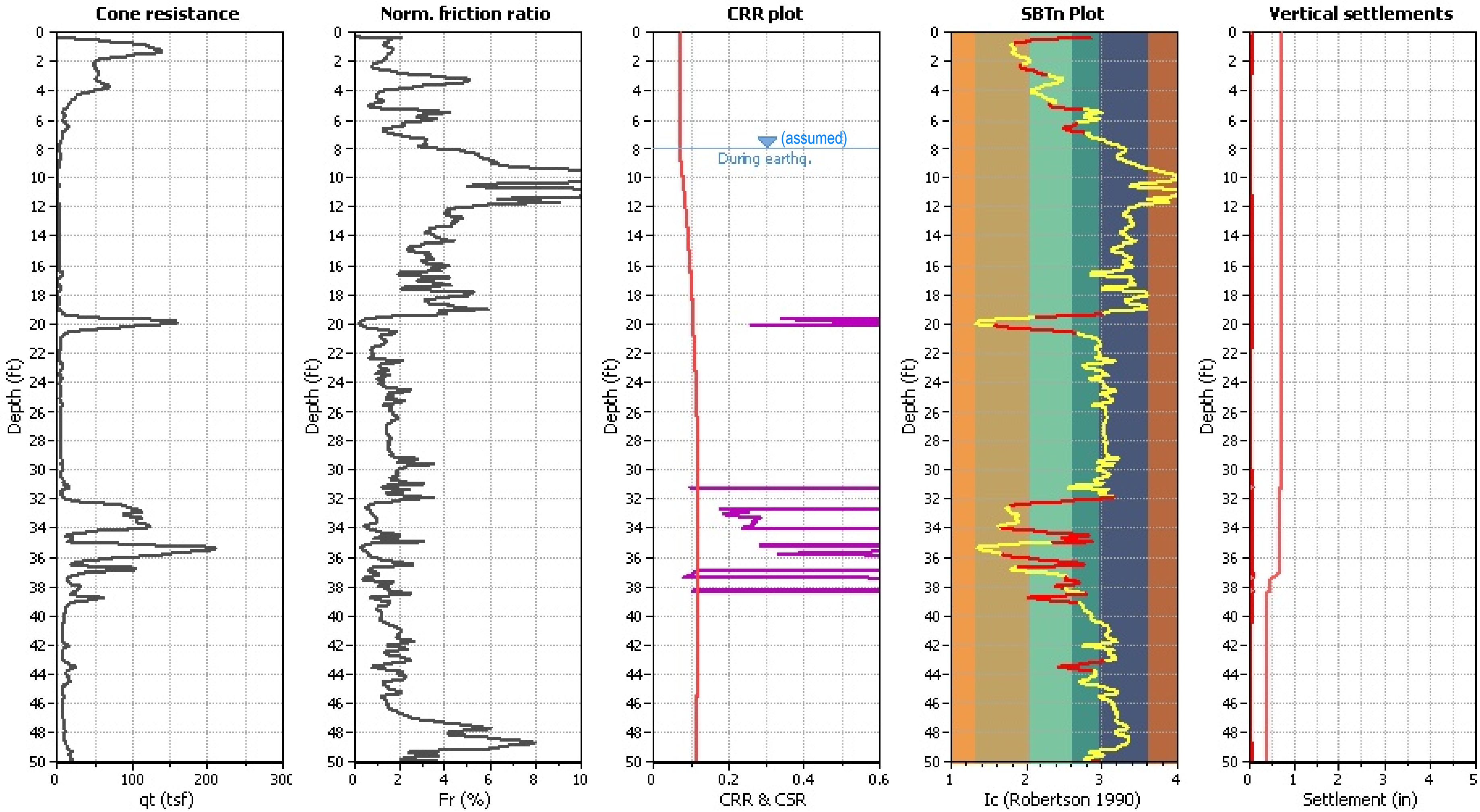
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-32
Total depth: 249.08 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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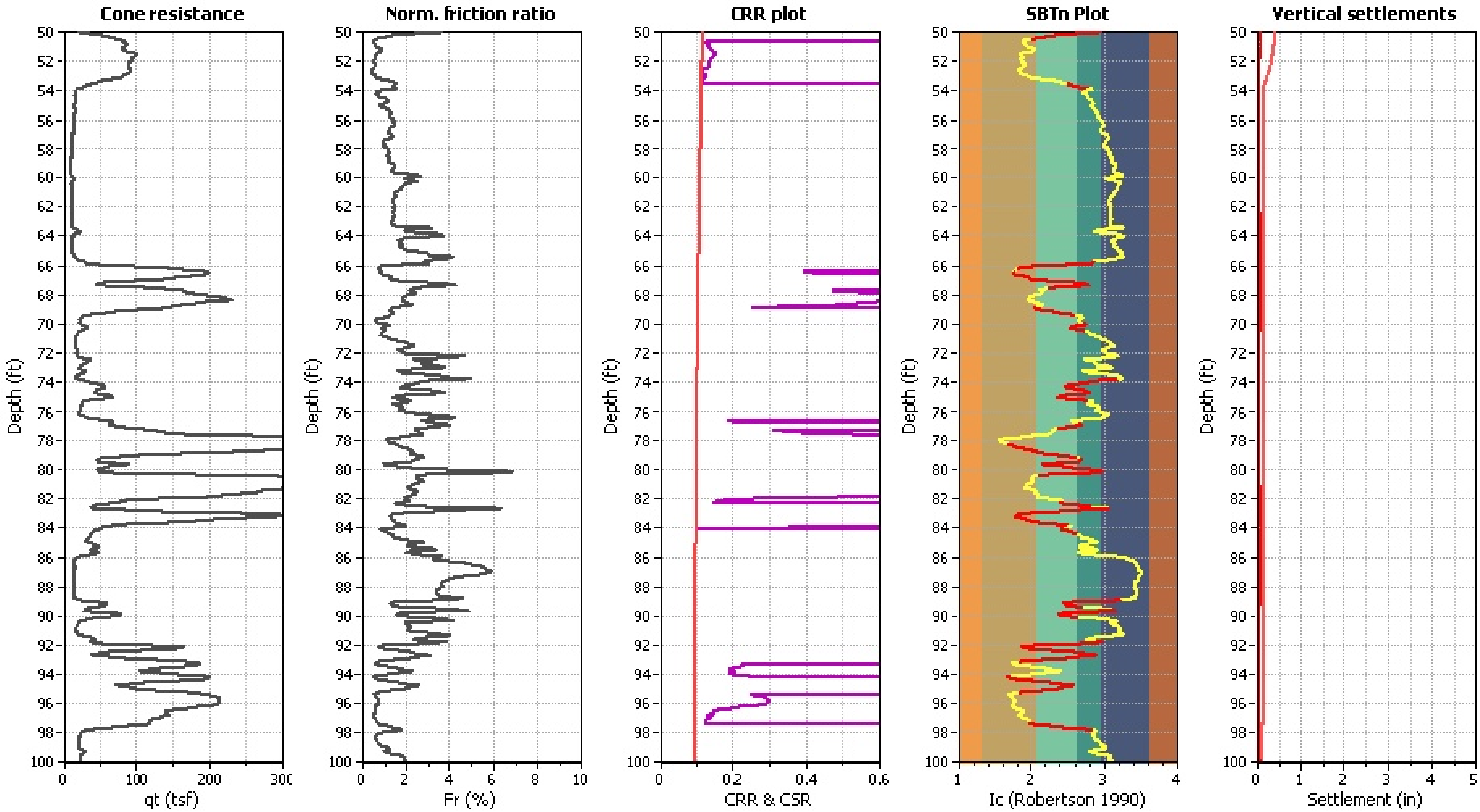
Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-32
Total depth: 249.08 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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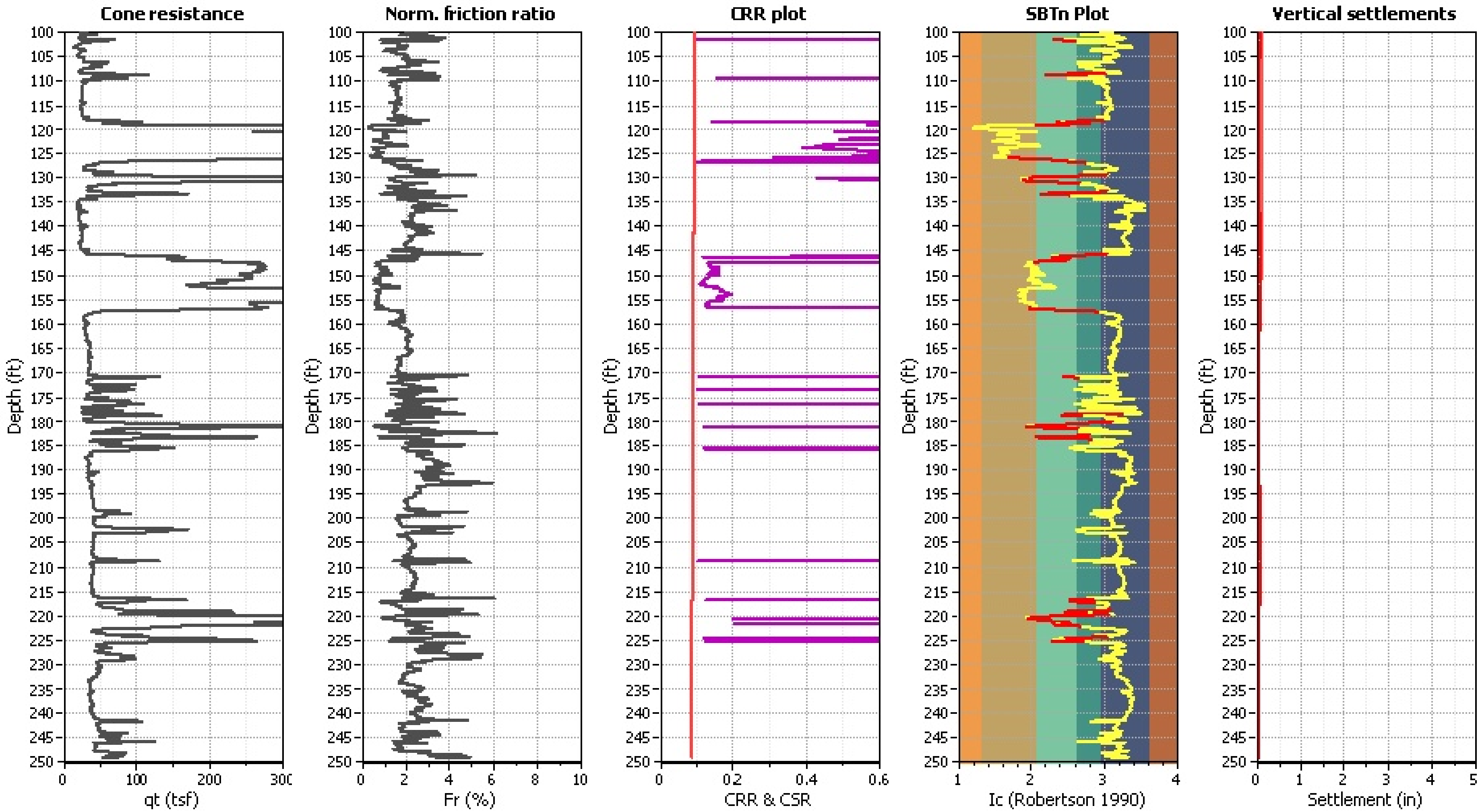
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-32
Total depth: 249.08 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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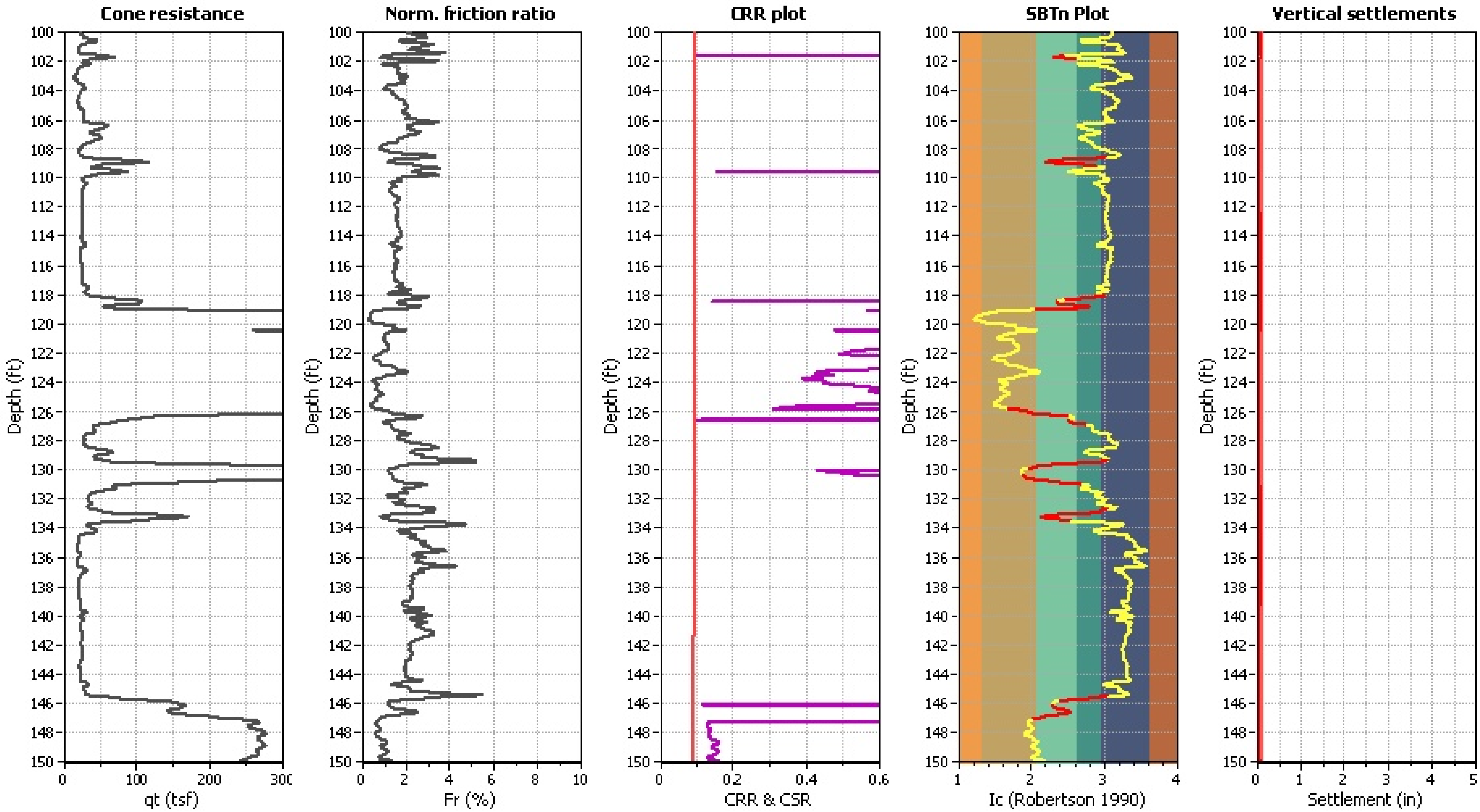
Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-32
Total depth: 249.08 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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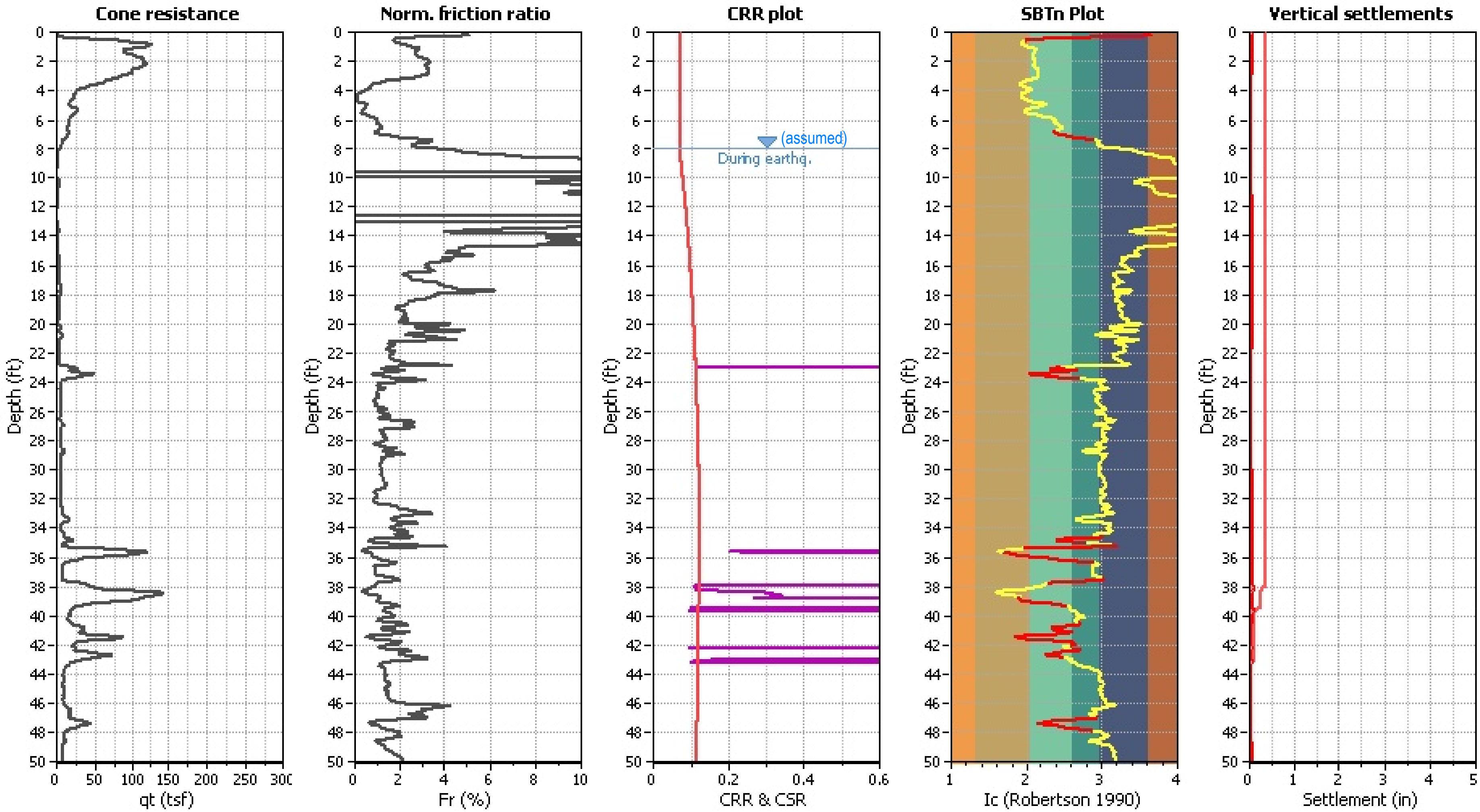
Project: 1160276 - Clean Harbors
Location: see Figure 1

CPT: L-33
Total depth: 122.11 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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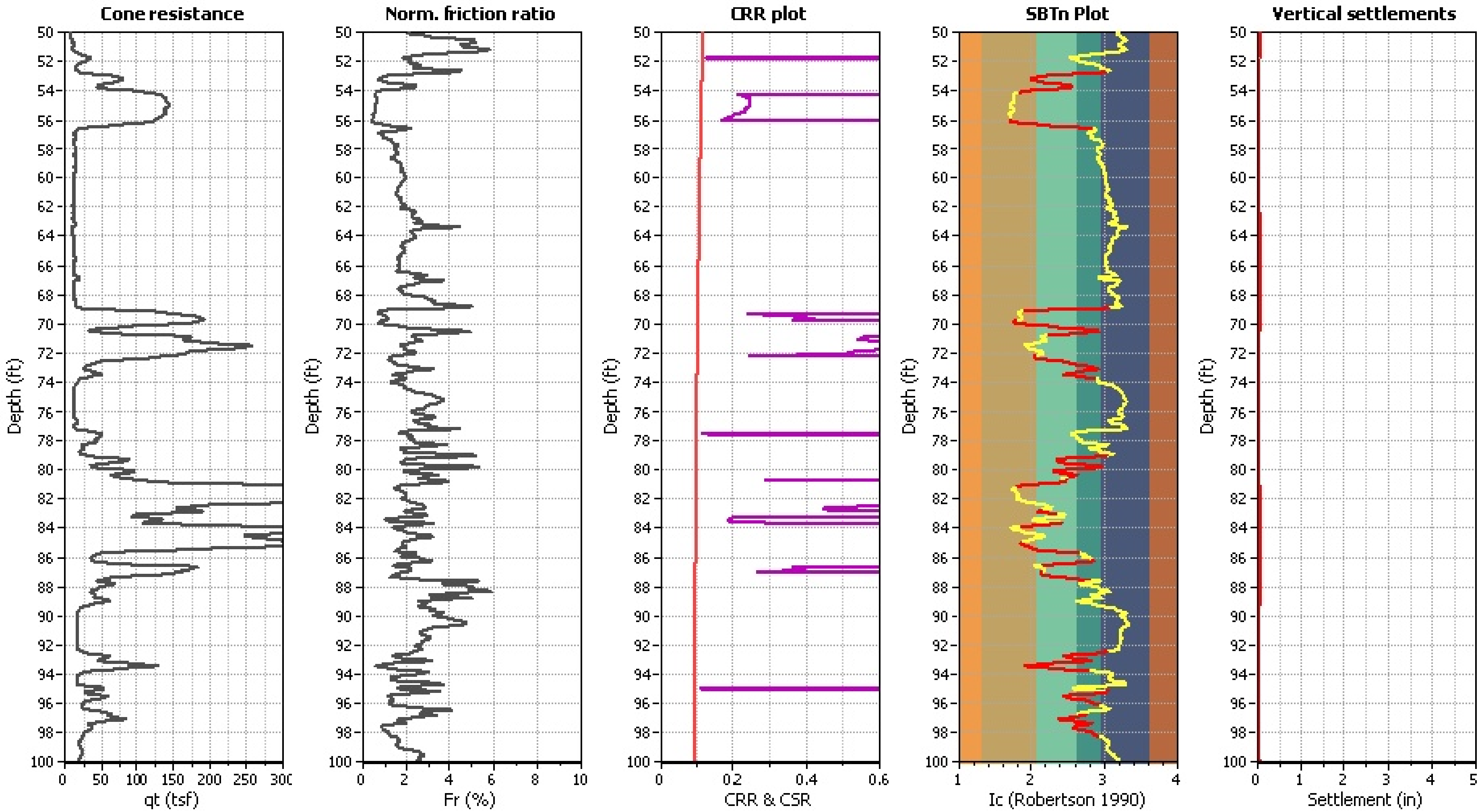
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-33
Total depth: 122.11 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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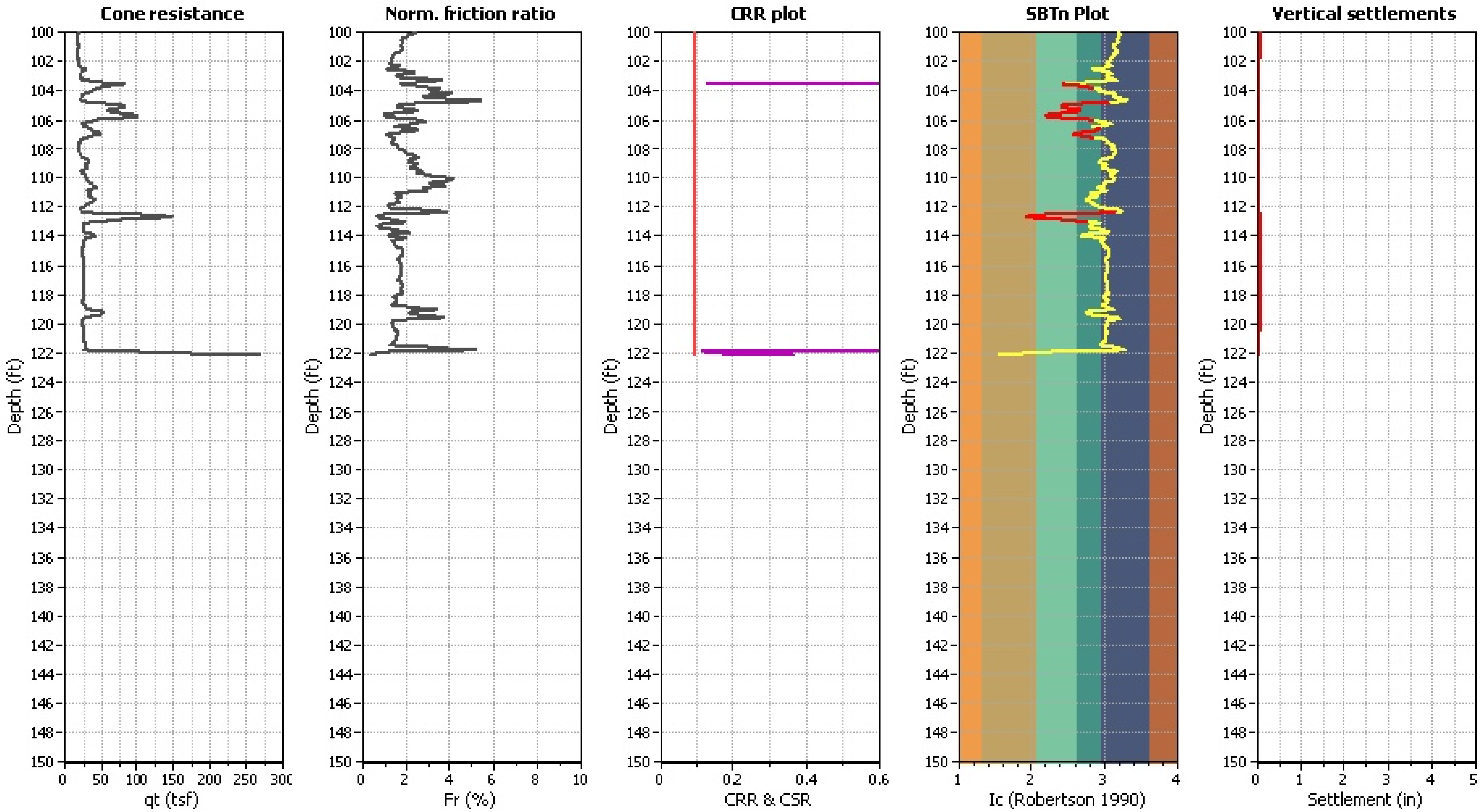
Sandy, UT 84070
801.566.6399

Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-33
Total depth: 122.11 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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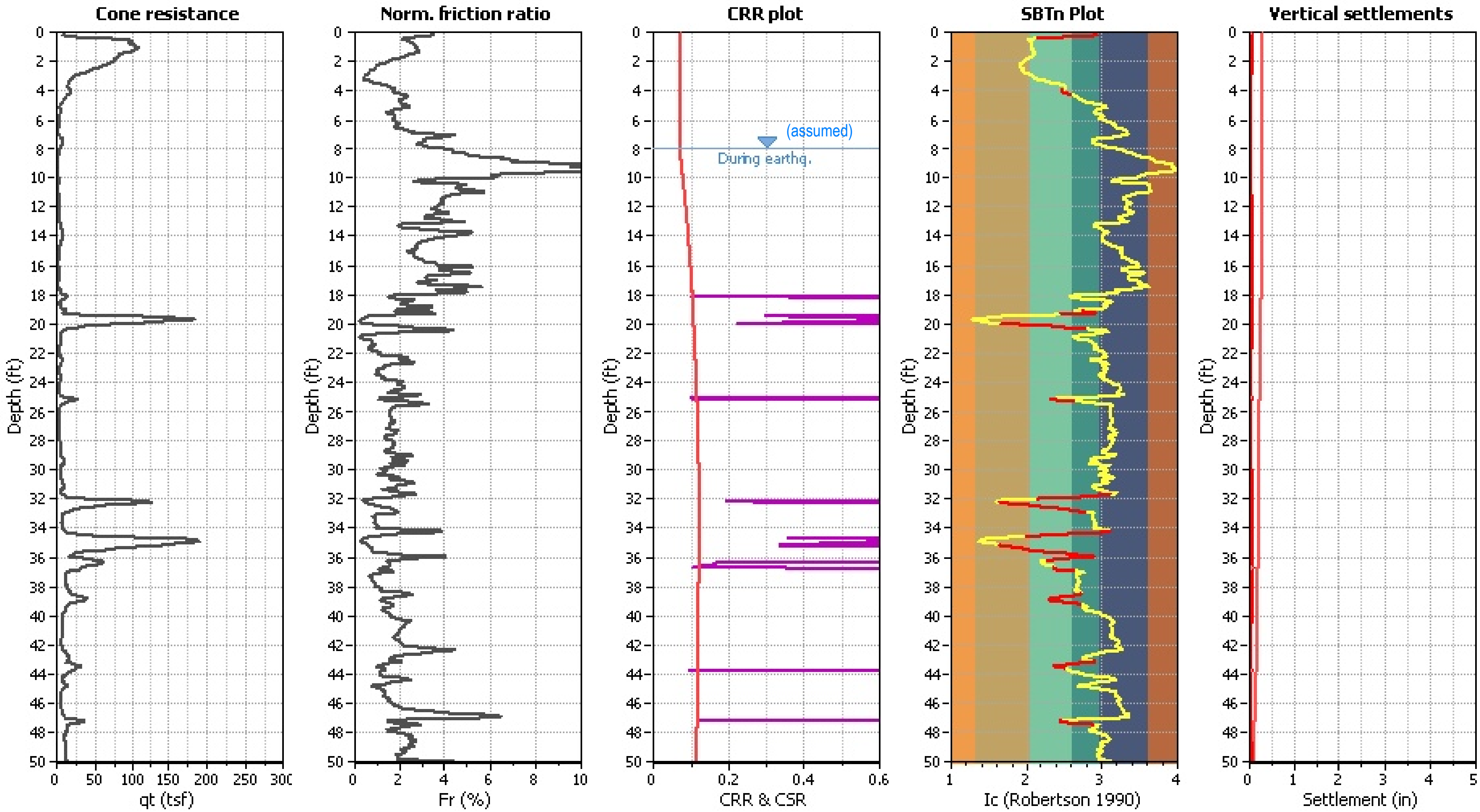
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-34
Total depth: 118.05 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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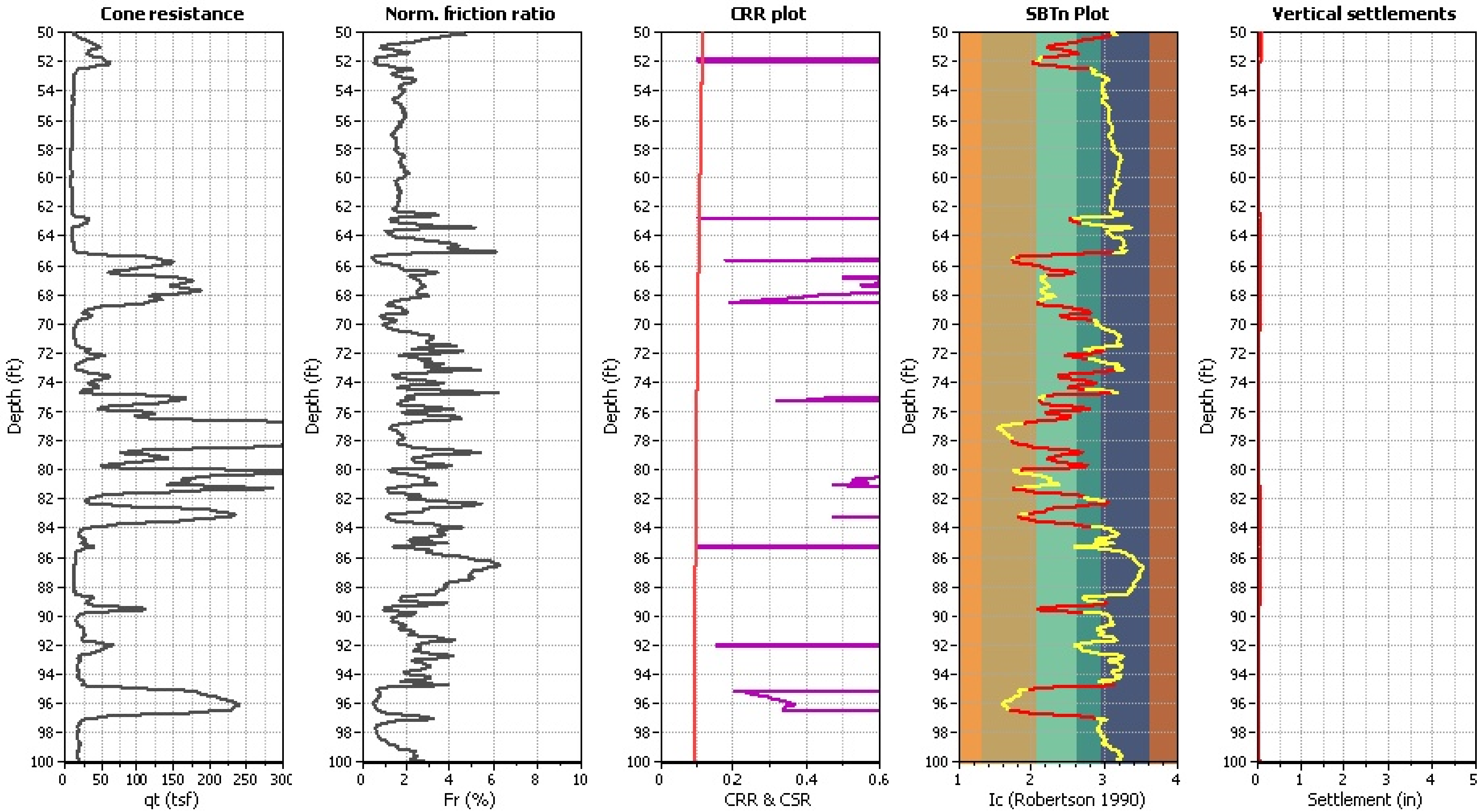
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-34
Total depth: 118.05 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.18	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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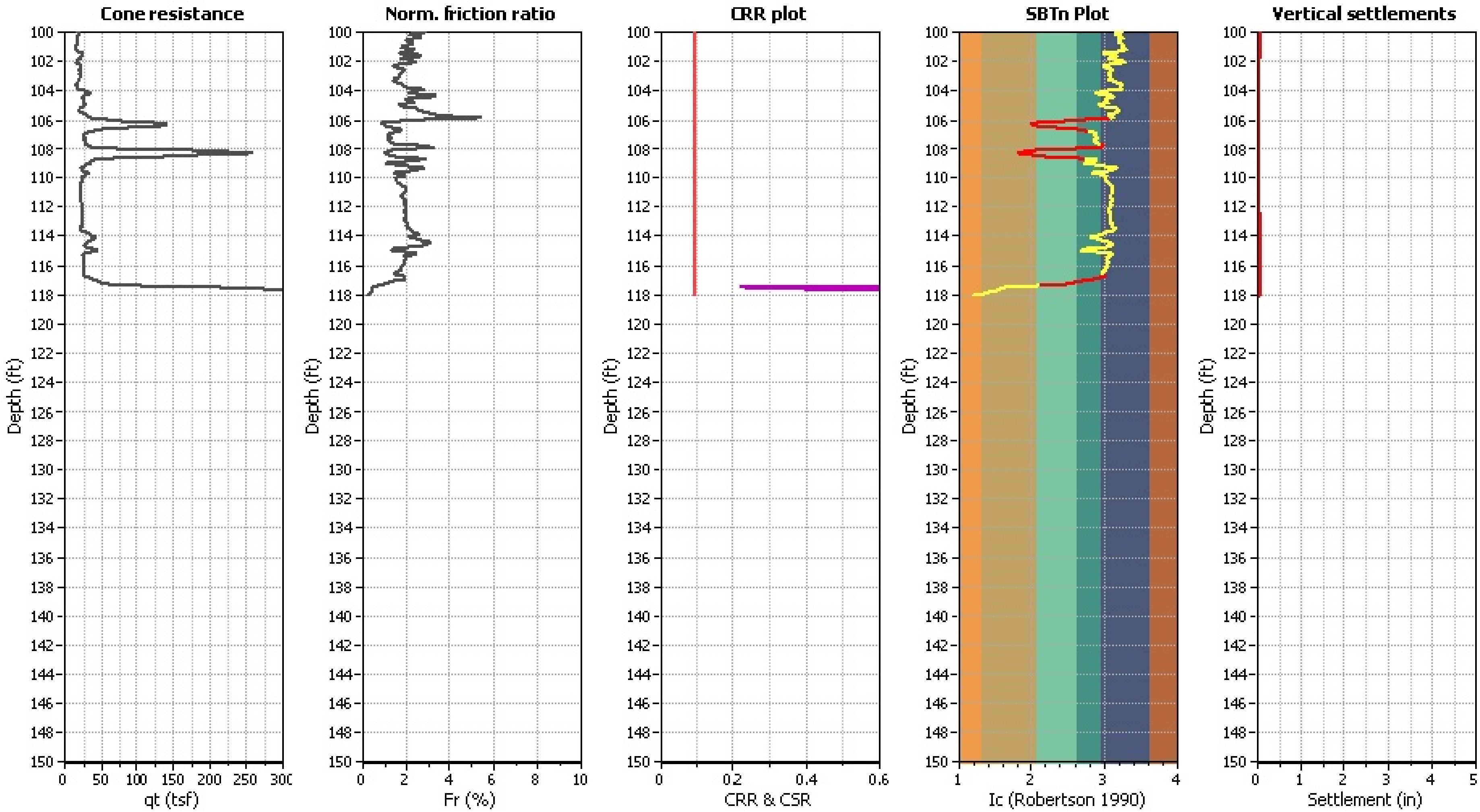
Project: **1160276 - Clean Harbors**
Location: **see Figure 1**

CPT: L-34
Total depth: 118.05 ft



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.20	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
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