



1985 OFFSHORE GEOTECHNICAL SITE INVESTIGATION

AMAULIGAK 1-65 SITE BEAUFORT SEA

Submitted to
**GULF CANADA RESOURCES
CALGARY, ALBERTA**

NOVEMBER, 1985



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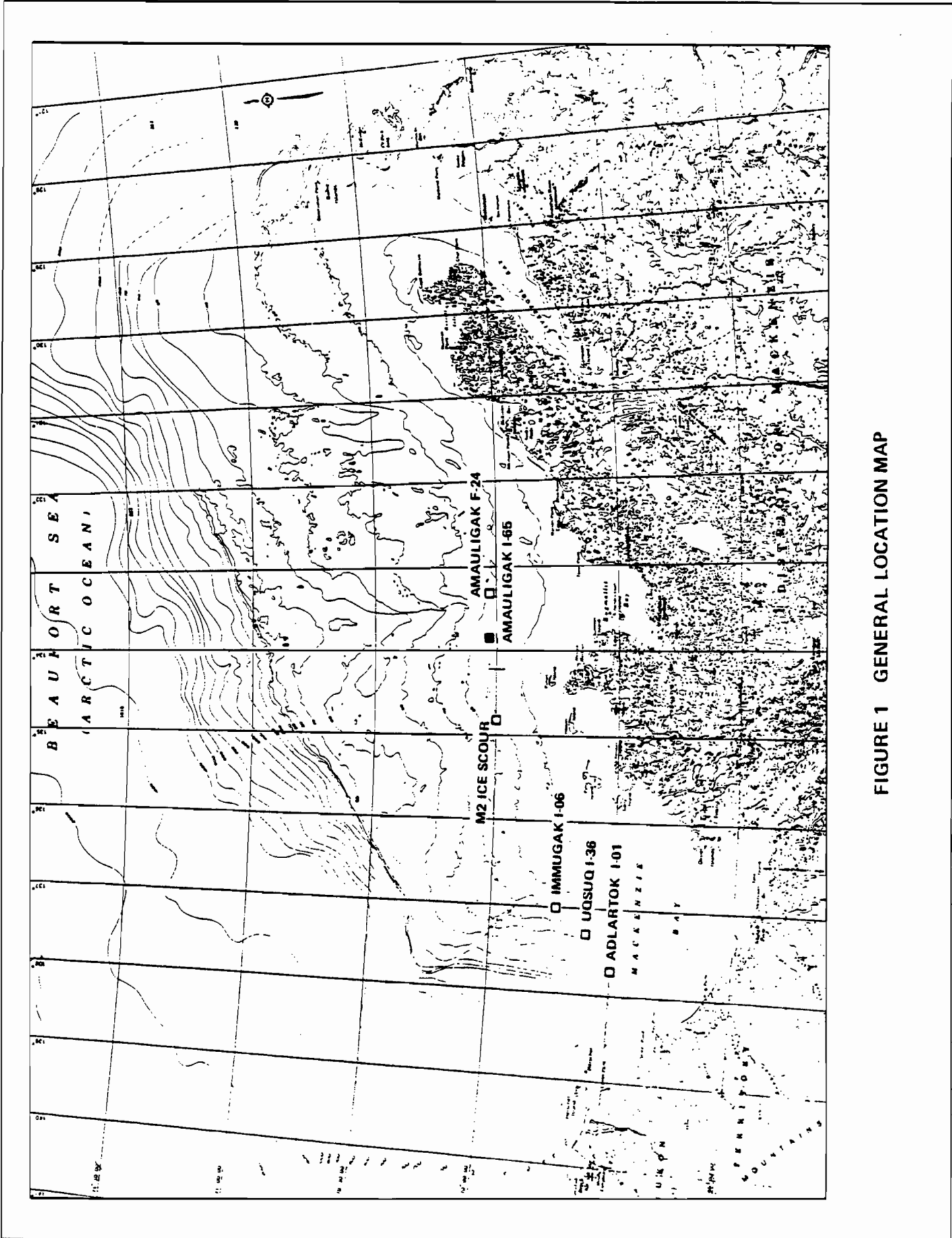


FIGURE 1 GENERAL LOCATION MAP

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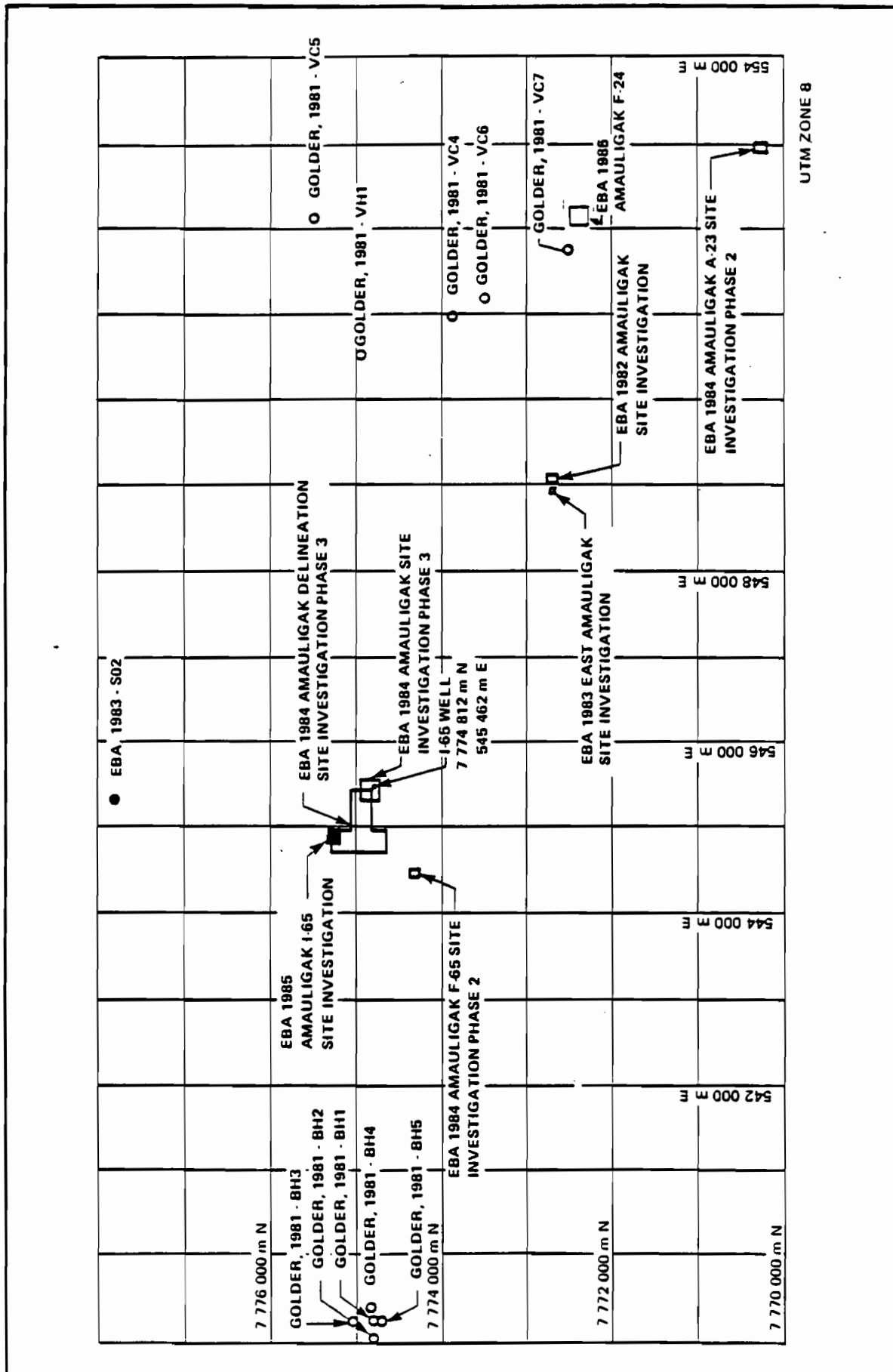
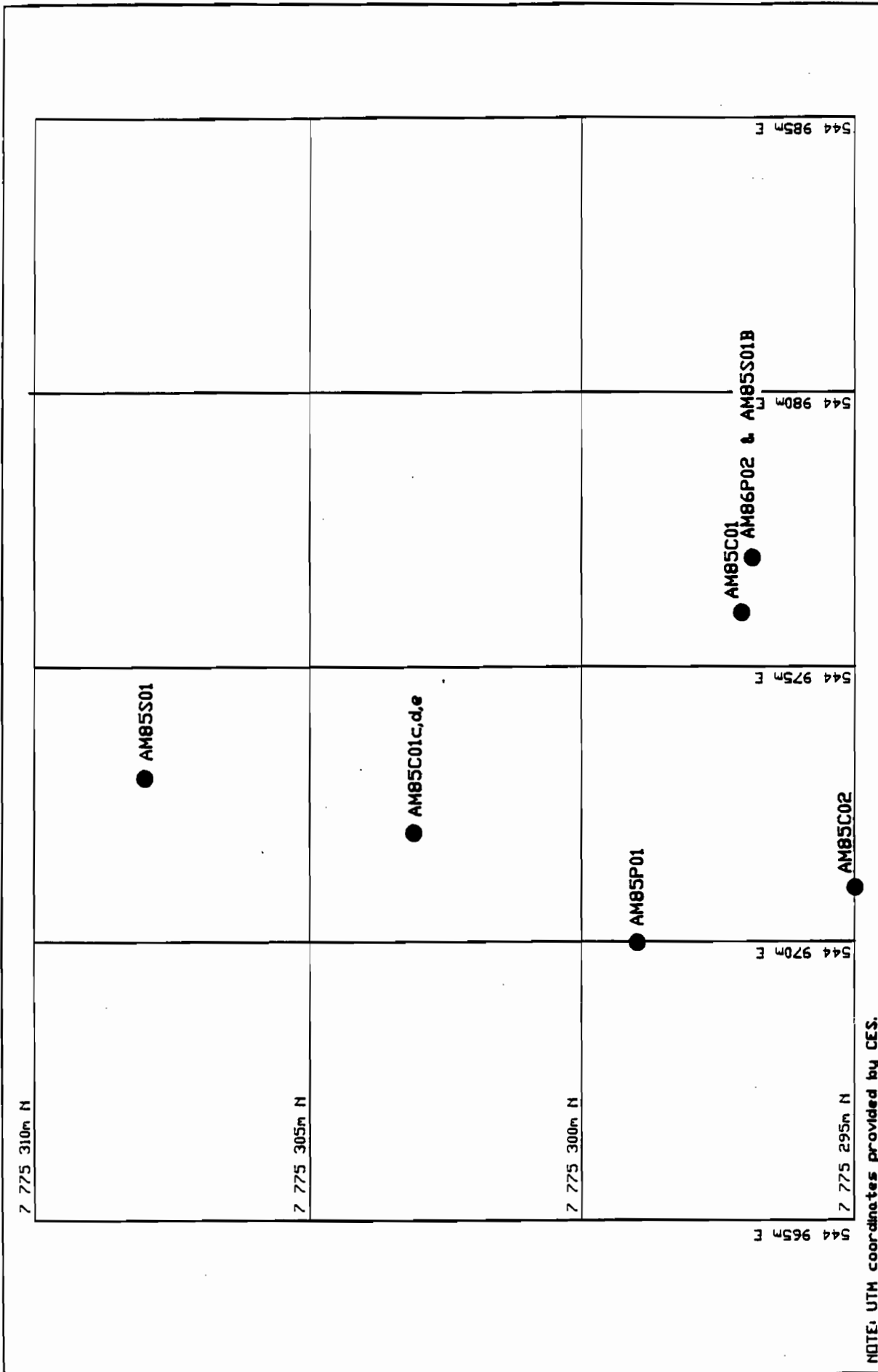


FIGURE 2 DETAILED BOREHOLE AND PROBEHOLE LOCATION MAP FOR ALL SITE INVESTIGATIONS ON THE AMAULIGAK BLOCK

November, 1985



NOTE: UTM coordinates provided by CES.

FIGURE 3 BOREHOLE AND PROBEHOLE LOCATION MAP
AMAULIGAK I-65 (1985) INVESTIGATION



TABLE 1

Stratigraphy of Site

The stratigraphy of the Aauligak I-65 site, as encountered in this investigation, is characterized by the following sequence:

	LITHOSTRATIGRAPHIC UNIT	DEPTH (metres)
UNIT I	CLAY (OH&MH); and silt, high plastic structureless very soft [Remoulded deltaic sediments], organic	0.0 to between 2.0 and 5.0
- Subunit Ia		
- Subunit Ib	CLAY (CH); silty, high plastic, thinly laminated soft to firm [Deltaic sediments deposited between late Wisconsin and present]	between 2.0 and 5.0 to 7.0
UNIT II	SAND (SP-SM); silty, fine-grained, compact, thinly laminated containing interbeds of silt and clay [on-lap sequence between late Wisconsin and present]	7.0 to 10.4
UNIT III	SAND (SP); fine-grained, massive, compact to dense (est.), occasional layers of gravel [Deltaic sediments deposited during late Wisconsin]	10.4 to 50.0
UNIT IV	CLAY (CI-CH); silty, medium to high plasticity thinly laminated, horizontal, parallel, discontinuous, black organic streaks, vivianite crystals evident, trace of shell fragments. [Deltaic sediments deposited during Mid-Wisconsin]	50.0 to 57.0
- Subunit IVa		
- Subunit IVb	Interbedded layers of SILT (OH-MH), CLAY (CL-CI) and SAND (SP-SM); wavy, discontinuous, laminations some organics rich seams, low to medium plasticity, very stiff. [Mid-Wisconsin, deposited in lagoonal type environment]	57.0 to 61.6
UNIT V	SAND (SP); trace of silt, massive, fine-grained, frozen; trace of fibrous organics [Mid-Wisconsin glacio-fluvial sediments]	61.6 to 80.0+



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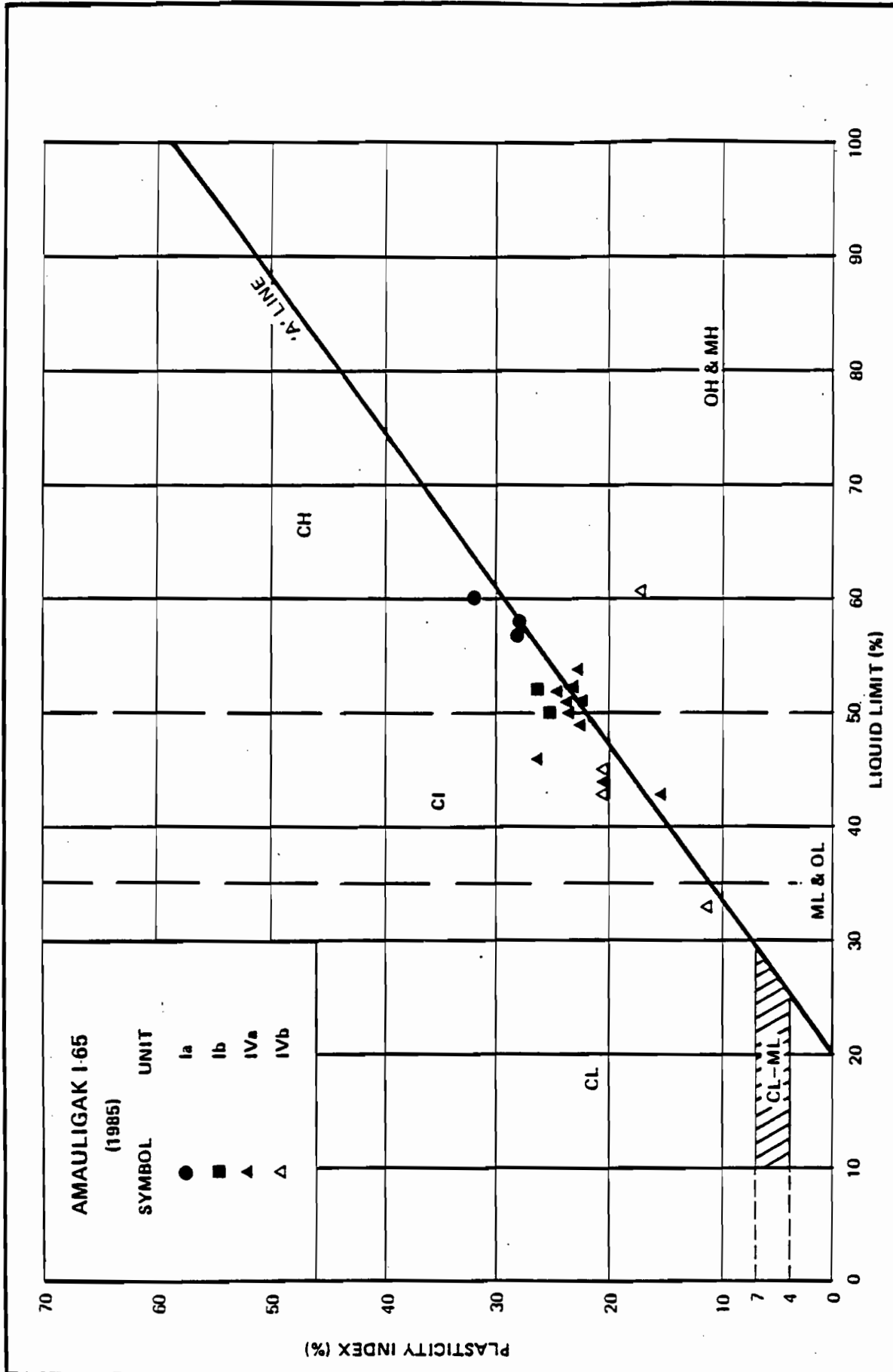


FIGURE 4
PLASTICITY CHART
AMALIGAK I-65 SITE



APPENDIX A

BOREHOLE LOGS

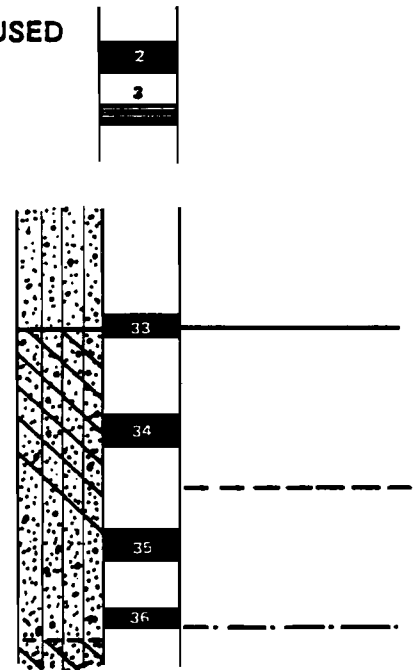
SYMBOLS AND ABBREVIATIONS USED ON BOREHOLE LOGS

SOIL SAMPLE

- represented by sample identification number which increases sequentially from the top of the hole, thickness of block is equivalent to sample recovery

SOIL BOUNDARIES

- have been indicated using the following system
- stratum boundary observed within sample
- stratum boundary assumed to occur within ± 0.5 m of the marked level and is probably gradational between the two samples
- stratum boundary assumed to occur within ± 1.0 m of the marked level
- stratum boundary notation for both depth below seabed (41.5 m) and elevation below sealevel (uncorrected for tides) (-64.6m. Elevation)



41.5 (-64.6 El.)

SOIL DESCRIPTION

UNIFIED SOIL CLASSIFICATION

- determined in accordance with chart on following page

USC

TEXTURAL DESCRIPTION

- determined in accordance with attached sheet and used to augment Unified Soil Classification

Special terms used include:

- e.g. - "becoming trace of/with some CLAY" indicating an overall change in a feature of the stratum not sufficient to change the total description
- "trace of/with some CLAY" indicating small feature displayed in that sample only

GROUND ICE DESCRIPTION

- determined in accordance with chart on following page; extra effort has been made to better describe the degree and extent of soil bonding and also a value of core temperature ($^{\circ}$ C) at that level
- see also definition of terms in text

GROUND ICE DESCRIPTION

- determined in accordance with chart on following page; extra effort has been made to better describe the degree and extent of soil bonding and also a value of core temperature ($^{\circ}\text{F}$) at that level
- see also definition of terms in text

e.g. FROZEN - 1.2 $^{\circ}\text{C}$
- Nf - Nbn
- poorly to slightly bonded
SAND: Nbn - 0.5 $^{\circ}\text{C}$
CLAY: not frozen

TEST RESULTS

- see legend at bottom of borehole log

CONSISTENCY

Fine-Grained Soils

Major portion passing No. 200 Sieve. Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silt. Consistency is rated according to undrained shear strength, as indicated by cone penetrometer reading or miniature vane and triaxial test results.

Descriptive Term	Undrained Shear strength (kPa)
Very Soft	less than 12.5
Soft	12.5 to 25
Firm	25 to 50
Stiff	50 to 100
Very Stiff	100 to 200
Hard	200 and higher

Coarse-Grained Soils

Major portion retained in No. 200 Sieve. Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

Descriptive Term	Relative Density
Very Loose	0 - 20%
Loose	20 - 40%
Compact or Medium	40 - 75%
Dense	75 - 90%
Very Dense	90 - 100%

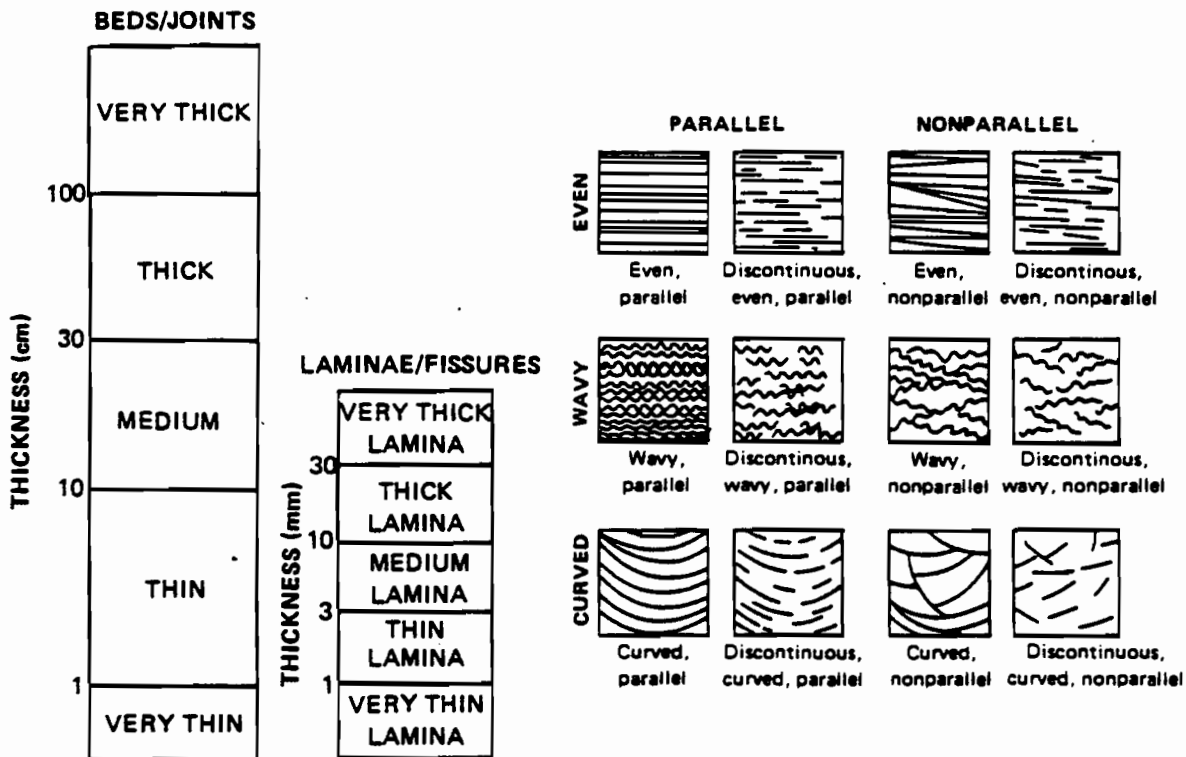
PLASTICITY

Low - Liquid limit less than 35
Medium - Liquid limit between 35 and 50
High - Liquid limit greater than 50

DESCRIPTION OF SEDIMENTARY STRUCTURES

BEDS SEDIMENTATION UNITS DEPOSITED UNDER ESSENTIALLY CONSTANT PHYSICAL CONDITIONS, SEPARATED BY BEDDING PLANES WHICH ARE RECOGNIZABLE BY TEXTURAL OR COMPOSITIONAL CHANGES RESULTING FROM PERIODS OF NON-DEPOSITION OR EROSION, OR ABRUPT CHANGES IN DEPOSITIONAL CONDITIONS. BEDS MAY BE INTERNALLY HOMOGENEOUS, OR COMPOSED OF SMALLER UNITS-LAMINAE

LAMINAE THE SMALLEST MEGASCOPIC LAYERS IN A SEDIMENTARY SEQUENCE, REPRESENTING MINOR FLUCTUATIONS IN PHYSICAL CONDITIONS DURING THE DEPOSITION OF BEDS. LAMINAE ARE RELATIVELY UNIFORM IN TEXTURE AND COMPOSITION AND GENERALLY LACK MEGASCOPIC INTERNAL LAYERING.



e.g. Thick bed
Thickly spaced joint

e.g. Thin lamina
Thinly spaced fissures

(After Campbell, 1967)

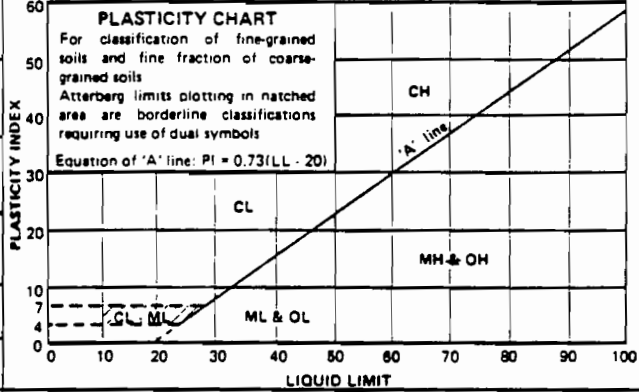
(Modified after Ingram, 1954
and Campbell, 1967)

UNIFIED SOIL CLASSIFICATION†

MAJOR DIVISIONS		GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS <small>More than 50% retained on No. 200 sieve*</small>	GRAVELS <small>50% or more of coarse fraction retained on No. 4 sieve</small>	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting both criteria for GW Atterberg limits plot below 'A' line or plasticity index less than 4 Atterberg limits plot above 'A' line and plasticity index greater than 7
		GRAVELS WITH FINES	GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines	
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures	
		GRAVELS WITH FINES	GC	Clayey gravels, gravel-sand clay mixtures	
	SANDS <small>More than 50% of coarse fraction passes No. 4 sieve</small>	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting both criteria for SW Atterberg limits plot below 'A' line or plasticity index less than 4 Atterberg limits plot above 'A' line and plasticity index greater than 7
			SW	Poorly-graded sands and gravelly sands, little or no fines	
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures	
			SC	Clayey sands, sand-clay mixtures	
			SM	Silty sands, sand-silt mixtures	
			SC	Clayey sands, sand-clay mixtures	

Classification on basis of percentage of fines
 GW, GP, SW, SP, GM, GC, SM, SC
 Borderline classification requiring use of dual symbols

FINE GRAINED SOILS		GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA	
SILTS AND CLAYS <small>Liquid limit 50% or less</small>	SILTS AND CLAYS	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	PLASTICITY CHART For classification of fine-grained soils and fine fraction of coarse-grained soils Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols Equation of 'A' line: $PI = 0.73(LL - 20)$	
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
		OL	Organic silts and organic silty clays of low plasticity		
	SILTS AND CLAYS <small>Liquid limit greater than 50%</small>	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts		
		CH	Inorganic clay of high plasticity, fat clays		
		OH	Organic clays of medium to high plasticity		
HIGHLY ORGANIC SOILS			PT	Peat, muck and other highly organic soils	<small>*Based on the material passing the 3 in. (75 mm) sieve †ASTM Designation D 2487, for identification procedure see D 2488</small>



GROUND ICE DESCRIPTION

ICE NOT VISIBLE

GROUP SYMBOLS	SYMBOLS	SUBGROUP DESCRIPTION	VISUAL REPRESENTATION
N	Nf	Poorly-bonded or friable	
	Nbn	No excess ice, well-bonded	
	Nbe	Excess ice, well-bonded	

VISIBLE ICE LESS THAN 50% BY VOLUME

GROUP SYMBOLS	SYMBOLS	SUBGROUP DESCRIPTION	VISUAL REPRESENTATION
V	Vx	Individual ice crystals or inclusions	
	Vc	Ice coatings on particles	
	Vr	Random or irregularly oriented ice formations	
	Vs	Stratified or distinctly oriented ice formations	

VISIBLE ICE GREATER THAN 50% BY VOLUME

GROUP SYMBOLS	SYMBOLS	SUBGROUP DESCRIPTION	VISUAL REPRESENTATION
ICE	ICE + Soil Type	Ice with soil inclusions	
	ICE	Ice without soil inclusions (greater than 25 mm (1 in.) thick)	

- NOTE:**
- Dual symbols are used to indicate borderline or mixed ice classifications
 - Visual estimates of ice contents indicated on borehole logs $\pm 5\%$
 - This system of ground ice description has been modified from NRC Technical Memo 79, Guide to the Field Description of Permafrost for Engineering Purposes

LEGEND
 Soil Ice



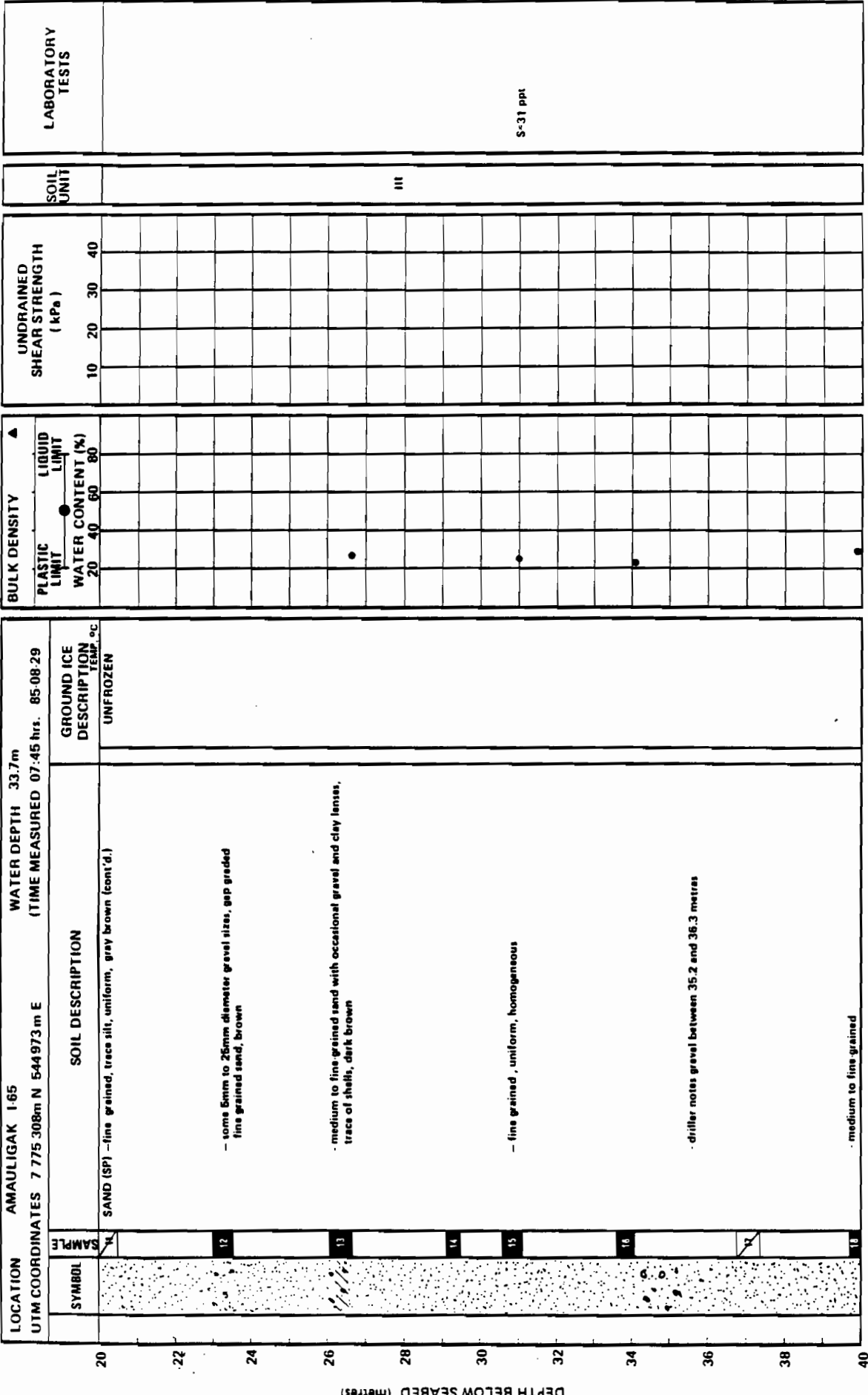
LOCATION		AMAULIGAK 1-65		WATER DEPTH		33.7 m	
UTM COORDINATES		7 775 308 m N 544 973 m E		(TIME MEASURED		07:45hrs. 85-08-29)	
SYMBOL	SAMPLE	SOIL DESCRIPTION		GROUND ICE DESCRIPTION		TEMP. °C	
	1	CLAY (CH) silty, trace of black organics, trace of shells, homogeneous, very soft to soft, high plasticity, dark grey.		UNFROZEN		-1.2	
	2	parallel even laminations, 3mm thick, soft to firm, gray to dark grey.				-0.5	
	3	sand lens at 4.9m.				-0.8	
	4	thick parallel even laminations, occasional 2mm thick silt laminations with shell fragments and organics, spaced 150mm apart (approx.).				-1.0	
	5	-6.97m (-40.3m El.)				0.8	
	6	SAND (SP-SM) trace to some silt, homogeneous, very fine-grained sand, uniform. Medium-grained sand with clay lenses between 6.7 and 6.9m becoming clean at 6.97m. Below 6.97m fine-grained sand, silt to some silt, some laminations organic rich.				-0.1	
	7					1.1	
	8	SAND (SP) trace of silt, fine- to medium-grained, uniform, dense (estimated), grayish brown.					
	9						
	10	- massive, brown.					

LABORATORY TESTS	SOIL UNIT	UNDRAINED SHEAR STRENGTH (kPa)	BULK DENSITY	SAMPLE TYPE	SOIL SYMBOLS	PROJECT NUMBER	DRILLING COMPLETED	TERMINATION DEPTH	DRILLING RIG	LOG COMPILED BY
S = 24 ppt	la	10	PLASTIC LIMIT WATER CONTENT (%)	Thin Wall Tube	Gavel Sand Silt Clay	101C-4417	1985-08-31	80.3m (114.0m El.)	SIMCO 5000	TRIM/MDW
S = 17 ppt	lb	20	LIQUID LIMIT	Split Spoon						
S = 20 ppt	II	30		Liner						
S = 25 ppt	III	40		Disturbed						
				No Recovery						

TEST IDENTIFICATION	SHEAR STRENGTH	BOREHOLE NUMBER
C Consolidation	+ Torvane	AM85S01
TS Thaw Strain	x Mini Vane	
DS Direct Shear	Δ Pilean Vane	
DSS Direct Simple Shear	⊕ In Situ Vane	
T Triaxial Shear	▲ UU Triaxial	
S P.W. Salinity	▽ Fall Cone	
G Gas Analysis		

EDA Engineering Consultants Ltd.

BOREHOLE LOG AND LABORATORY TEST RESULTS

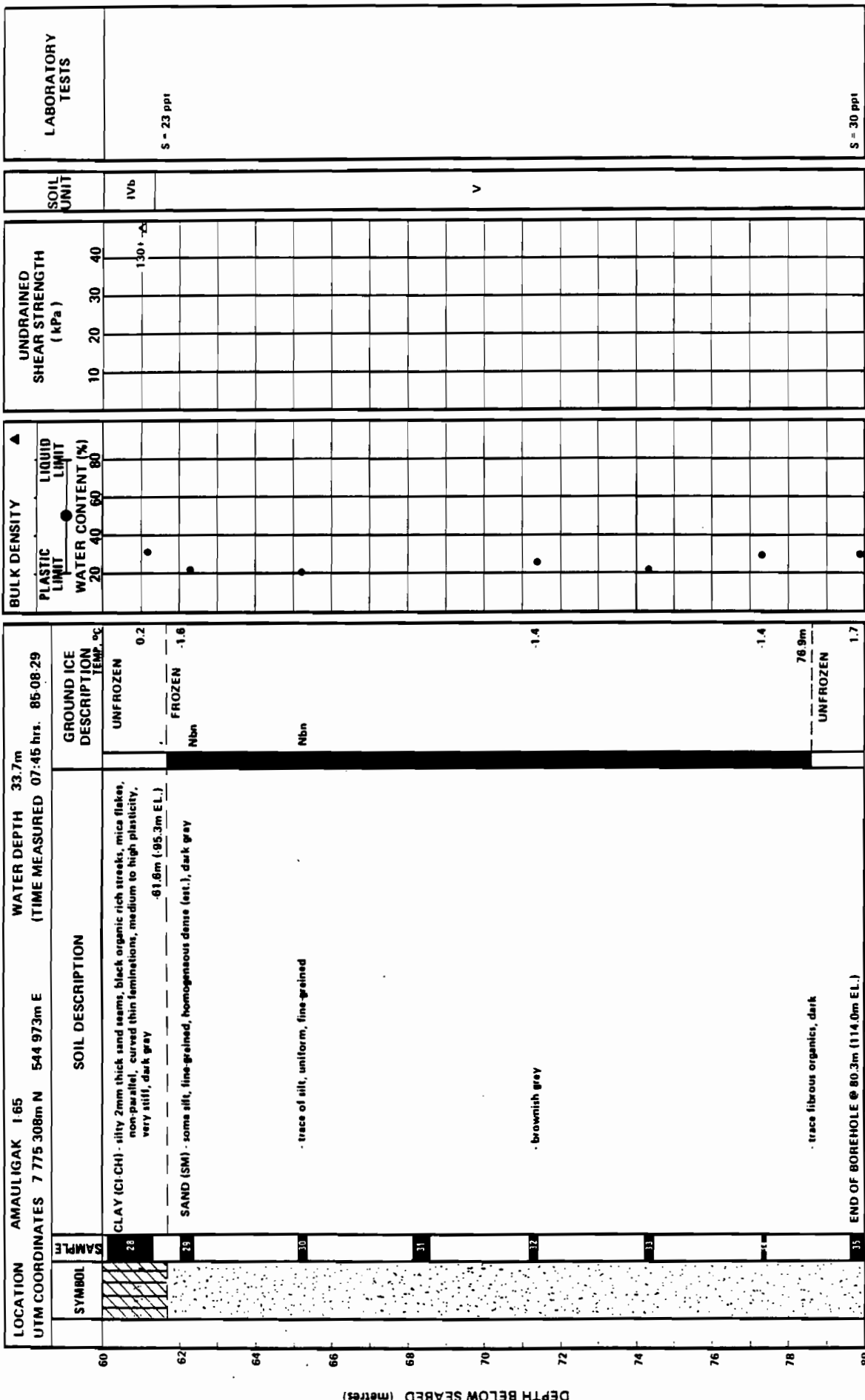


PROJECT NUMBER 101C-4417	SOIL SYMBOLS Gravel Sand Silt Clay	SAMPLE TYPE Thin Wall Tube Core Disturbed No Recovery	SHEAR STRENGTH + Torvane x Mini Vane △ Pileon Vane ◇ In Situ Vane	TEST IDENTIFICATION C Consolidation TS Thaw Strain DS Direct Shear DSS Direct Simple Shear	BOREHOLE NUMBER AMB5S01
DRILLING COMPLETED 1985-08-31					PAGE 2 OF 4
TERMINATION DEPTH 80.3m (-114.0m E.L.)					
DRILLING RIG SIMCO 5000					
LOG COMPILED BY TRM/RMDW					



LOCATION AMAULIGAK I-65 UTM COORDINATES 7 775 308m N 544 973m E		WATER DEPTH 33.7m (TIME MEASURED 07:45 hrs. 85-08-29)		GROUND ICE DESCRIPTION TEMP. °C	SOIL DESCRIPTION	BULK DENSITY ▲ LIQUID LIMIT ● WATER CONTENT (%) PLASTIC LIMIT	UNDRAINED SHEAR STRENGTH (kPa)	SOIL UNIT	LABORATORY TESTS
SYMBOL	SAMPLE	DEPTH BELOW SEABED (metres)	TEMP. °C						
	18	40		UNFROZEN	SAND (SP) - trace silt, fine to medium grained, uniform, dense (est.) brownish gray (cont'd.)				
	19	42							
	20	44							
	21	46	4.4						
	22	48	4.1						
	23	50			NOTE: DRILLER DEFINED CONTACT 50m (-83.7m E.L.) CLAY (Cl-CH) - silty, black organic streaks, trace of shell fragments, thinly laminated, medium to high plasticity, stiff to very stiff, dark gray				
	24	52	0.3				85 Δ		S = 12 ppt
	25	54	0.3				130+ Δ		S = 16 ppt
	26	56	2.3				130+ Δ		
	27	58	0.3				130+ Δ		S = 20 ppt
	28	60	3.0				130+ Δ		
	29		3.0				130+ Δ		

PROJECT NUMBER 101C-4417	SOIL SYMBOLS Gravel Sand Silt Clay	SAMPLE TYPE Thin Wall Tube Split Spoon Liner Core Disturbed No Recovery	SHEAR STRENGTH ▲ UU Triaxial ▽ Fall Cone + Torvane x Mini Vane Δ Picon Vane ⊕ In Situ Vane	TEST IDENTIFICATION C Consolidation TS Thaw Shear DS Direct Shear DSS Direct Simple Shear T Triaxial Shear S P.W. Salinity G Gas Analytic	BOREHOLE NUMBER AM85S01
DRILLING COMPLETED 1985-08-31					PAGE 3 OF 4
TERMINATION DEPTH 80.3m (-114.0m E.L.)					
DRILLING RIG SIMCO 5000					
LOG COMPILED BY TRM /MDW					



LOCATION AMAULIGAK 1.65 **WATER DEPTH** 33.7m
UTM COORDINATES 7 775 308m N 544 973m E **(TIME MEASURED)** 07:45 hrs. 85:08:29

SOIL DESCRIPTION
 CLAY (CI CH) - silty 2mm thick sand seams, black organic rich streaks, mica flakes, non-parallel, curved thin laminations, medium to high plasticity, very stiff, dark gray
 SAND (SM) - some silt, fine-grained, homogeneous dense (est.), dark gray
 - trace of silt, uniform, fine-grained
 - brownish grey
 - trace fibrous organics, dark

GROUND ICE DESCRIPTION
 UNFROZEN 0.2
 FROZEN -1.6
 Nbn
 Nbn
 UNFROZEN -1.4
 UNFROZEN -1.4
 UNFROZEN 78.9m
 UNFROZEN 1.7

BULK DENSITY
 PLASTIC LIMIT
 LIQUID LIMIT
 WATER CONTENT (%)

UNDRAINED SHEAR STRENGTH (kPa)
 10 20 30 40
 130

SOIL UNIT
 IVb
 V

LABORATORY TESTS
 S = 23 ppt
 S = 30 ppt

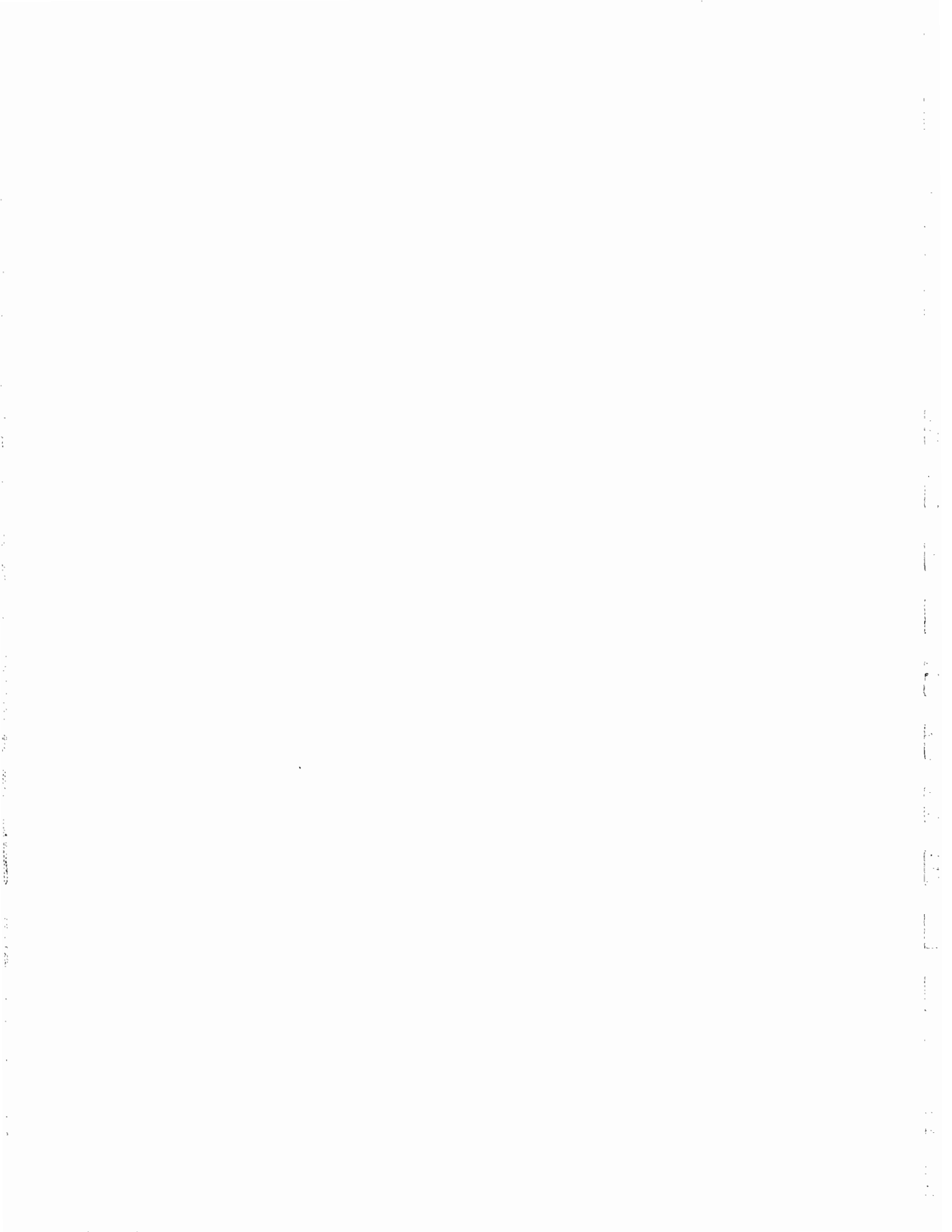
PROJECT NUMBER	SOIL SYMBOLS	SAMPLE TYPE	SHEAR STRENGTH	TEST IDENTIFICATION	BOREHOLE NUMBER
101C - 4417	Gravel Silt Clay Sand	Thin Wall Tube Split Spoon Liner	+ Torvane x Mini Vane △ Picon Vane ◇ In Situ Vane	C Consolidation TS Thaw Strain DS Direct Shear DSS Direct Simple Shear	AMB5501
1985.08.31		Core Disturbed No Recovery	▲ UU Triaxial ▽ Fall Cone	T Triaxial Shear S P.W. Salinity G Gas Analysis	PAGE 4 OF 4
DRILLING COMPLETED					
TERMINATION DEPTH					
DRILLING RIG					
LOG COMPILED BY					
80.3m (114.0m EL.)					
SIMCO 5000					
TRM/MDW					



LOCATION	AMAULIGAK 1-65	WATER DEPTH	33.5m					
UTM COORDINATES	7 775 297m N 544 977m E	(TIME MEASURED)	13:45 hrs. 1985-09-02					
SYMBOL	SOIL DESCRIPTION	GROUND ICE DESCRIPTION	TEMP. °C	BULK DENSITY		UNDRAINED SHEAR STRENGTH (kPa)	SOIL UNIT	LABORATORY TESTS
				PLASTIC LIMIT	LIQUID LIMIT			
	NOTE: Sampling did not begin until 51.8m seabed penetration. CPT and pressurimeter testing was performed between mudlines and 51.8m							
	CLAY (CH) - silty, thinly laminated, even, continuous, parallel, black organic streaks, trace of shell fragments, vitelline, medium to high plasticity, very stiff, dark gray		1.1		130+ Δ			S = 22 ppt
	occasional silt lenses (ML & CL)		0.3		130+ Δ			
	trace of micaceous fine sand (MH & OH)		0.3		130+ Δ	IVa		S = 28 ppt
	becoming medium plastic		0.8		130+ Δ			S = 28 ppt
			0.6		130+ Δ			S = 27 ppt
			0.8		130+ Δ			S = 28 ppt
	CLAY (CI) AND SAND (SP-SM) - clay and sand layers are interbedded, clay is stiff with curved, uneven, nonparallel laminations, with occasional sand partings and pockets, low to medium plasticity sand is fine-grained, homogeneous, beds approx. 100mm thick, brownish gray		0.2		130+ Δ			S = 32 ppt
			1.8					S = 27 ppt
			-0.2					S = 22 ppt
	END OF BOREHOLE 61.0m (94.5m EL.)							

PROJECT NUMBER 101C-4417	SOIL SYMBOLS Gravel Sand Silt Clay	SAMPLE TYPE Thin Wall Tube Split Spoon Liner Core Disturbed No Recovery	SHEAR STRENGTH + Torvane x Mini Vane Δ Pileon Vane ◇ In Situ Vane	TEST IDENTIFICATION C Consolidation TS Thaw Strain DS Direct Shear DSS Direct Simple Shear	BOREHOLE NUMBER AMBSS01B
DRILLING COMPLETED 1985-09-02					PAGE 1 OF 1
TERMINATION DEPTH 61.0m					
DRILLING RIG SIMCO 5000 - KIGGIAK					
LOG COMPILED BY TRM/MDW/RVW					





APPENDIX B
DIAGNOSTIC PROFILES

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APPENDIX C

TABLE OF CONTENTS

- Figure C.1 Natural Moisture Content Profile
 Amauligak I-65 (1985) Site
- Figure C.2 Plasticity Index Profile
 Amauligak I-65 (1985) Site
- Figure C.3 Liquidity Index Profile
 Amauligak I-65 (1985) Site
- Figure C.4 Undrained Shear Strength Profile
 Amauligak I-65 (1985) Site
- Figure C.5 Porewater Salinity Profile
 Amauligak I-65 (1985) Site



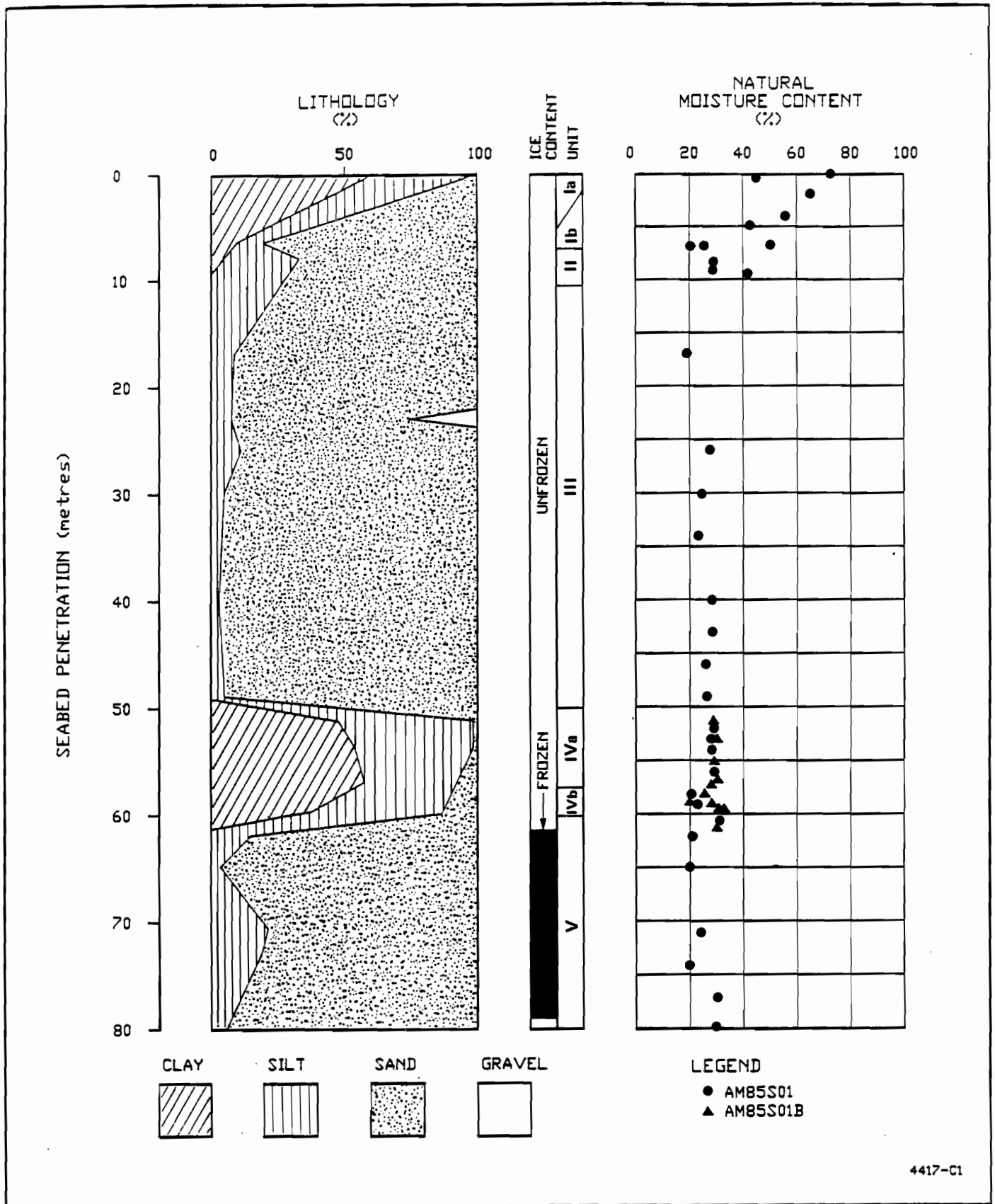


FIGURE C.1 NATURAL MOISTURE CONTENT PROFILE
AMAULIGAK I-65 (1985) SITE

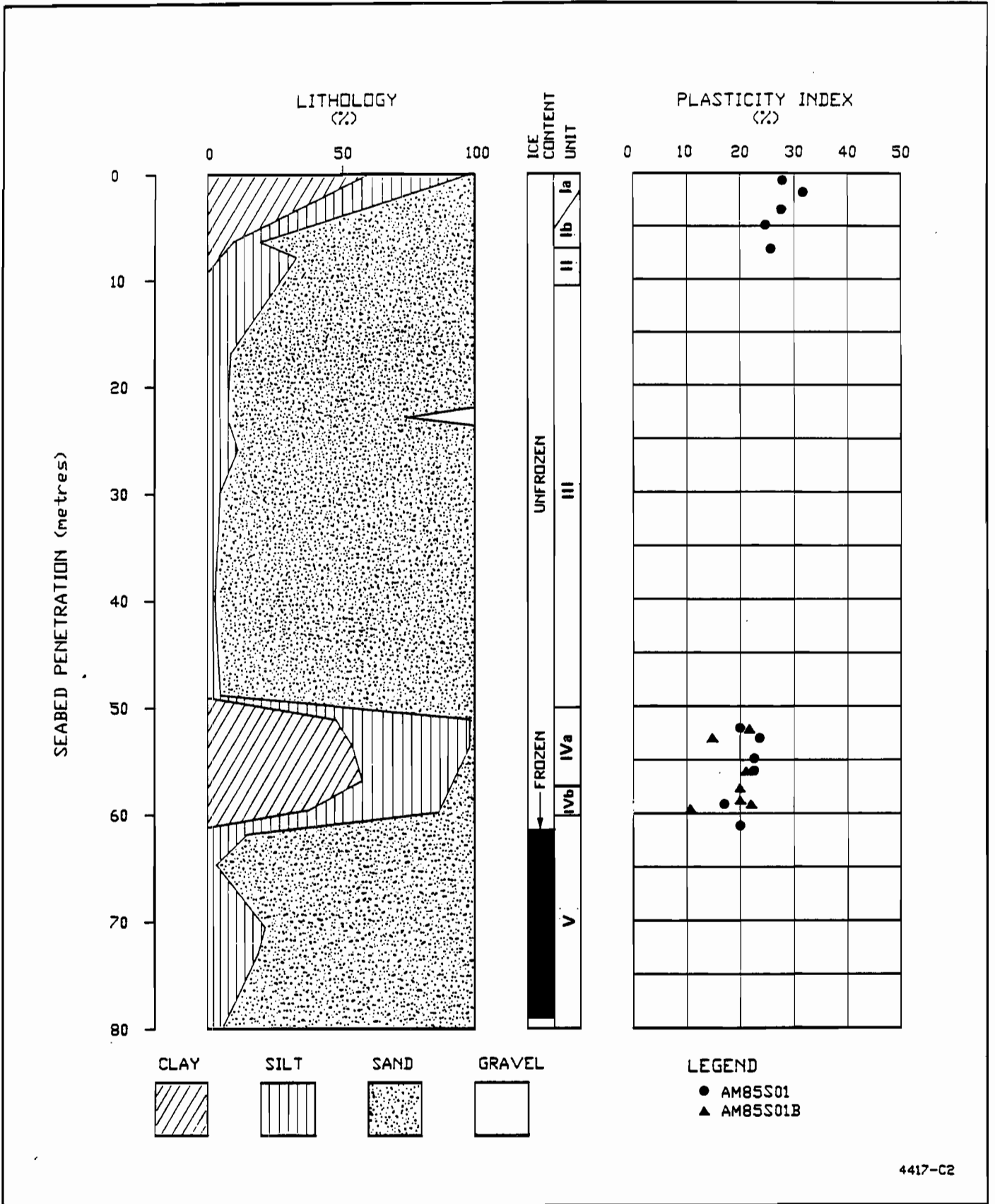


FIGURE C.2 PLASTICITY INDEX PROFILE
 AMAULIGAK I-65 (1985) SITE

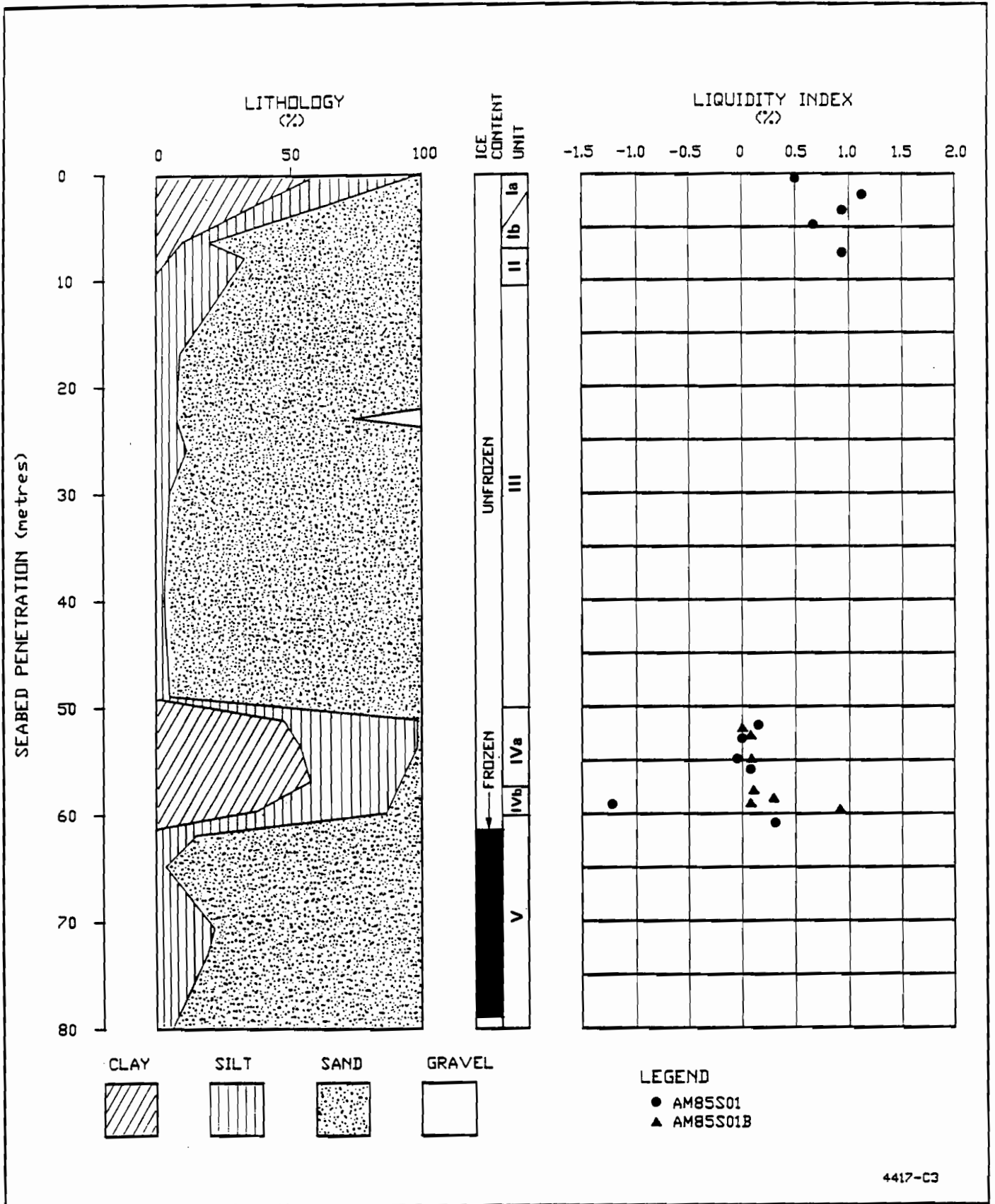


FIGURE C.3 LIQUIDITY INDEX PROFILE
AMAULIGAK I-65 (1985) SITE

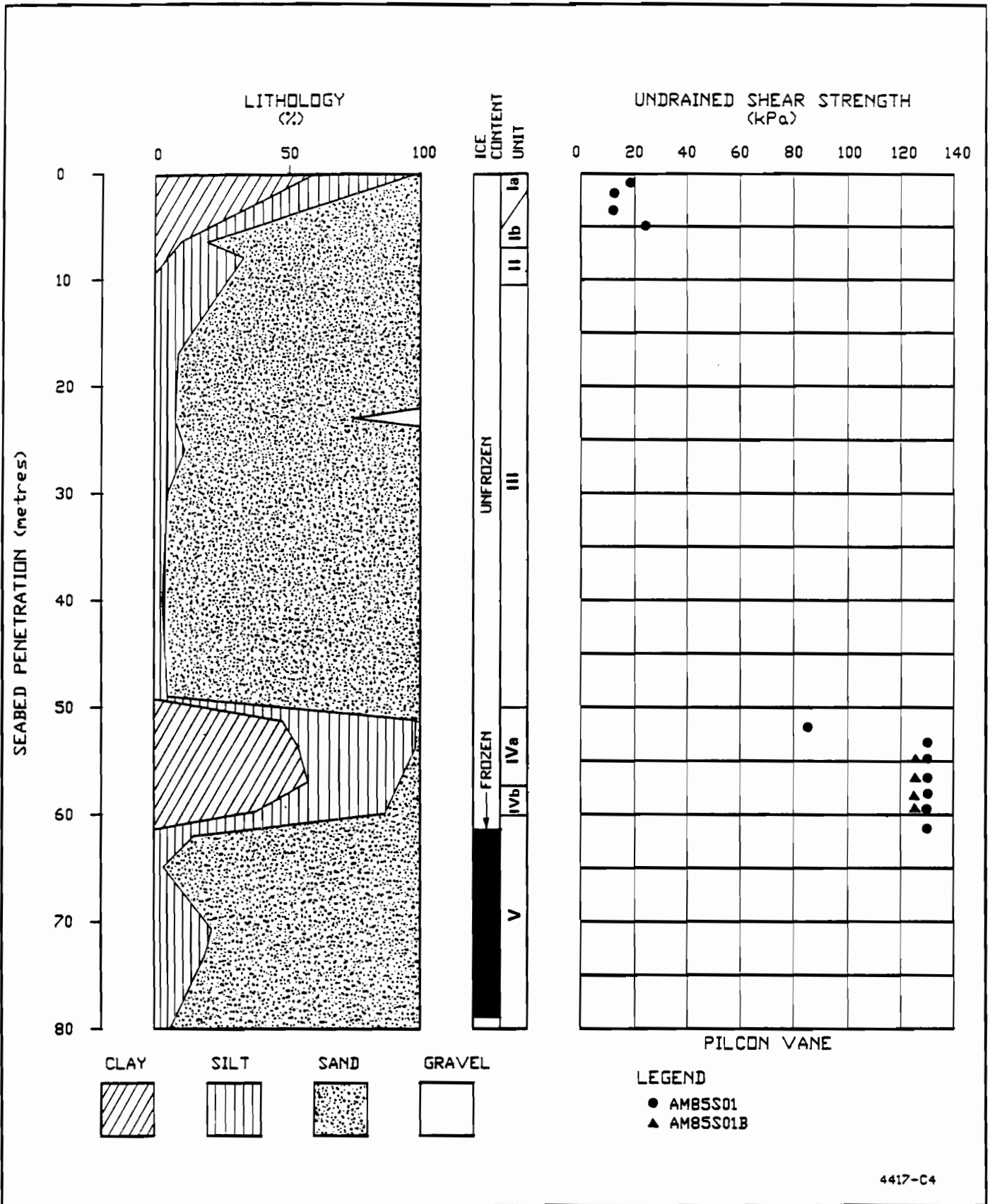


FIGURE C.4 UNDRAINED SHEAR STRENGTH PROFILE
AMAULIGAK I-65 (1985) SITE

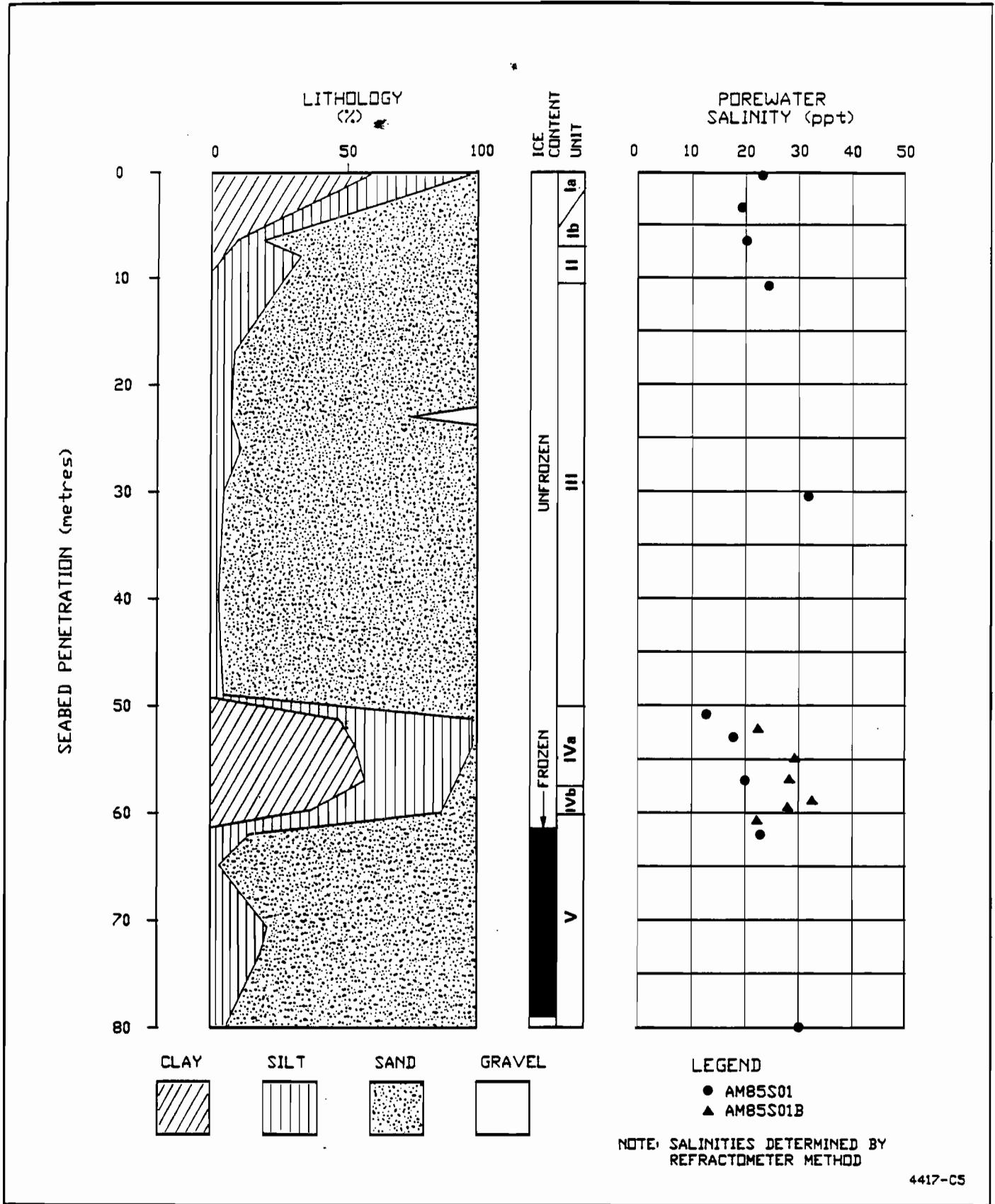


FIGURE C.5 POREWATER SALINITY PROFILE
AMAULIGAK I-65 (1985) SITE

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APPENDIX C

LABORATORY TEST SUMMARY



AMAULIGAK I-65

BOREHOLE AM85S01

SUMMARY OF TEST RESULTS

Sample Number	Depth (metres)	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density	GRAIN SIZE DISTRIBUTION				SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST RESULTS		
								Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)		Consistency	P ₀
1A	0.0 - 0.6			-1.2	73														S=2.7	
1B	0.0 - 0.6	CH			44								PV	18		Soft			S=24pp	
2A	1.7 - 2.1																			
2B	1.7 - 2.1	CH		-0.5	64								PV	12		V. Soft				
3A	3.2 - 3.9																			
3B	3.2 - 3.9	CH		-0.8	55								PV	12		V. Soft			S=17pp	
4A	4.7 - 5.2																			
4B	4.7 - 5.2	CI-CH		-1.0	42								PV	24		Soft				
5A	6.3 - 6.8	CH		0.8	50															
5B	6.8 - 7.0	SC			25															S=20pp
6A	7.8 - 8.6																			
6B	7.8 - 8.6	SM		-0.1	28															
7A	9.1 - 9.4				28															
7B	9.4 - 9.9			1.1	42															

LEGEND/NOTES
 H Bag Sample
 G Gas Sample
 L Liquid Sample
 P Piston Sample
 NH No Recovery
 NS No Sample Remaining
 C Frost Cure
 PV Porewater Sample
 T Sample Stored in Tube
 W Wash Sample
 HC Refabrication sample
 MV Miniature
 FC Fall Cone
 TV Torvan
 PV Pileon Vane
 RV Remite Vane
 UU Unconsolidated Undrained Triaxial
 UU_p UU Triaxial with Pore Pressure Measurements
 CU Consolidated Undrained Triaxial
 CU_p CU Triaxial with Pore Pressure Measurements
 CD Consolidated Drained Triaxial
 D Organic Content
 S Salinity
 TS Thaw Strain
 SG Specific Gravity



SUMMARY OF TEST RESULTS

Sample Number	Depth (metres) <small>Sample Position/Depth</small>	Unified Soil Classification	Ground Ice Description (%)	Temp (°C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density	GRAIN SIZE DISTRIBUTION					SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST RESULTS SEPARATELY TABULATED	
								Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (%)	Failure Strain (%)	Consistency		P _o
0A B	10.8																			S=2ppt SG=2.65
9A NR	13.9																			
10A B	16.9 - 17.3	SP-SM			19						9	91								
11A NR	20.0																			
12A B	23.0 - 23.5	SP-SM									8	68	24							
13A B	26.1 - 26.7	SM			27						12	88								
14A B	29.0																			
15A B	30.6 - 31.1	SP			24						5	95								S=3ppt SG=2.68
16A B	33.7 - 34.1				23															
17A NR	36.7																			
18A B	39.8	SP			29						3	97								

GULF CANADA RESOURCES
1985 OFFSHORE SITE INVESTIGATION
ANNUAL IGAK I-65
BOREHOLE AM85S01

LEGEND AND NOTES
 B Bag Sample
 G Gas Sample
 L Liner Sample
 P Piston Sample
 NR No Recovery
 NS No Sample Remaining
 C Frozen Core
 PW Porewater Sample
 T Sample Stored in Tube
 W Waxed Sample
 RC Radiocarbon sample
 MV Minivan
 FC Fall Cone
 TV Torvair
 PV Piston Vane
 RV Remote Vane
 UU Unconsolidated Undrained Triaxial
 UU Triaxial with Pore Pressure Measurements
 CU Consolidated Undrained Triaxial
 CU Triaxial with Pore Pressure Measurements
 CD Consolidated Drained Triaxial
 O Organic Content
 S Salinity
 TS Thaw Strain
 SG Specific Gravity

Project Number **101C-4417**

Reviewed By: **T. R. MURPHY** P. Eng

Page **2** of **4**

SUMMARY OF TEST RESULTS

Sample Number	Sample Type	Depth (metres) *Sample Photographed	Unified Soil Classification	Ground Ice Description (%)	Temp (°C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density	ATTENBERG LIMITS				GRAIN SIZE DISTRIBUTION					SHEAR STRENGTH				CONSOLIDATION CHARACTERISTICS			TEST RESULTS REFERENCED	
									Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P ₀	P _c	C _c				
19A	B	42.8 - 43.4				28																				
20A	B	45.8 - 46.1			4.4	26																				
21A	B	48.2 - 49.2	SP		4.1	26					5	95														
22A	B	51.9 - 52.9	CI		0.3	29					46	26														S=12ppt SG=2.72
23A	T	52.9 - 53.9																								
23B	B	52.9 - 53.9	CH		0.3	28					52	28	48	51												
23C	G	52.9 - 53.9																								
24A	T	54.4 - 55.0			2.3																					
24B	B	54.4 - 55.0	CH			28					52	28														S=16ppt
25A	T	55.9 - 56.5			0.3																					
25B	B	55.9 - 56.5	CI-CH			29					50	27														
26A	T	57.4 - 58.0			3.0																					
26B	B	57.4 - 58.0				21					22	35	4													S=20ppt
26L	G	57.4 - 58.0																								

GULF CANADA RESOURCES
1985 OFFSHORE SITE INVESTIGATION
AMMULIGAK I-65
BOREHOLE AM85501

Legend and Notes:
 B Bar Sample
 G Gas Sample
 L Liner Sample
 P Piston Sample
 NH No Recovery
 NS No Sample Remaining
 C Frozen Core
 PV Postwater Sample
 T Sample Stored in Tube
 W Waxed Sample
 RC Radio carbon sample
 MV Minimum
 FC Full Core
 TV Triaxial
 PV Picon Vane
 RV Remote Vane
 UU Unconsolidated Undrained Triaxial
 UUp UU Triaxial with Pore Pressure Measurements
 CU Consolidated Undrained Triaxial
 CUp CU Triaxial with Pore Pressure Measurements
 CD Consolidated Drained Triaxial
 O Organic Content
 S Salinity
 TS Thaw Strain
 SG Specific Gravity

Project Number: 101C-4417

Reviewed By: T.R. MURPHY P. Eng.

Page 3 of 4

SUMMARY OF TEST RESULTS

Sample Number	Soil Type	Depth (metres) <small>(Sample Horizontal)</small>	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Moisture (%)	Frozen Moisture (%)	Bulk Density	ATTENBERG LIMITS				GRAIN SIZE DISTRIBUTION				SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			SPREADER TEST RESULTS									
									Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P _o	P _c	C _c										
27A	B	58.9 - 59.5	OH-MI		3.0	23			61	44							PV	130														
28A	T	60.5 - 61.3																														
28B	B	60.5 - 61.3	CI		-0.2	31			45	25																						
28C	G	60.5 - 61.3																														
29A	B	62.0 - 62.3	SM	Nbn	-1.6	21																									5=23ppt 5G=2.66	
30A	B	65.1 - 65.3	SP	Nbn		20																										
31A	NR	68.1																														
32A	B	71.2 - 71.4	SM	Nbn	-1.4	24																										
33A	B	74.2 - 74.4	SM	Nbn		21																										
34	B	77.3 - 77.4		Nbn	-1.4	30																										
35A	B	80.3 - 80.7	SP-SM			30																										5=30ppt 5G=2.65

END OF BOREHOLE

LEGEND AND NOTES

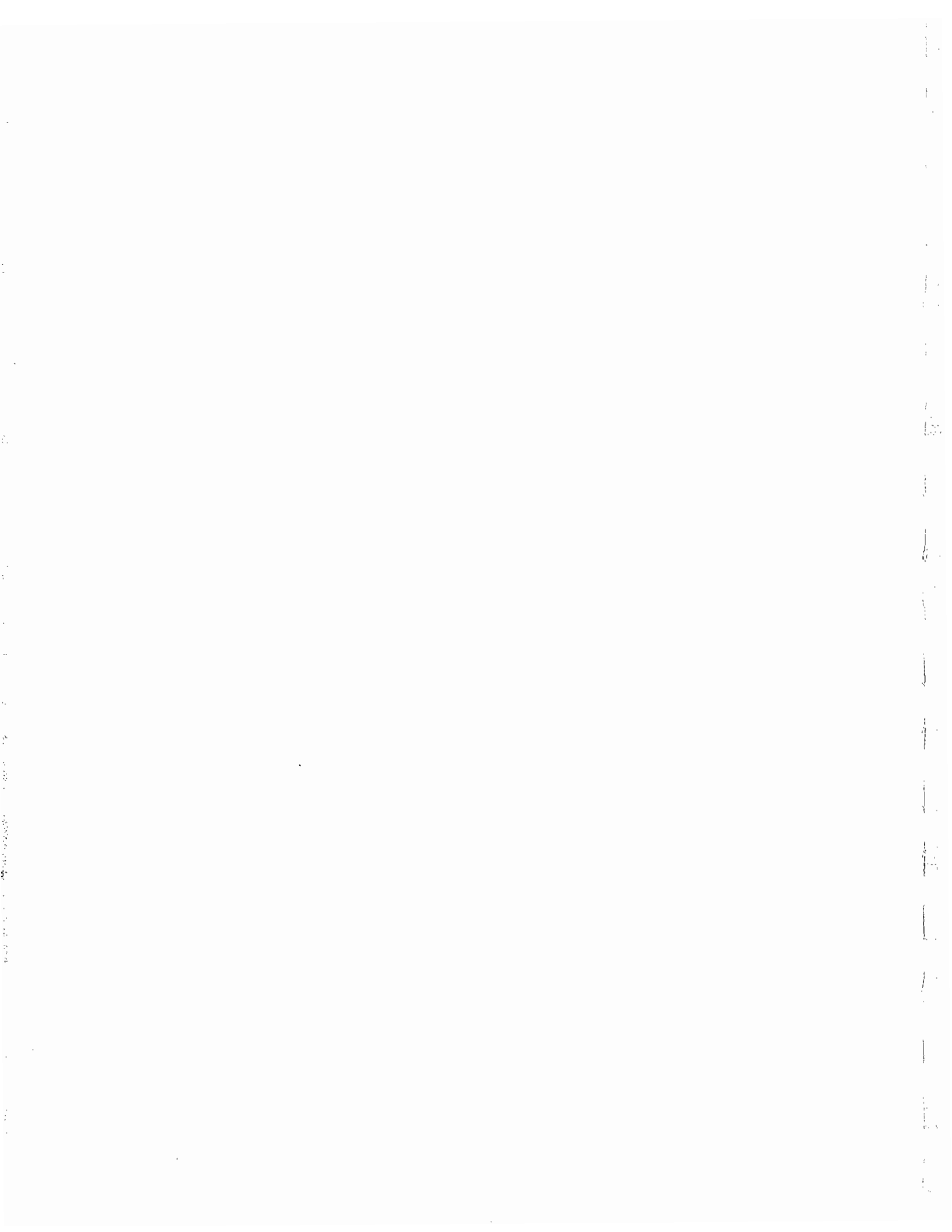
B	Reg Sample	C	Frozen Core	MV	Minivan	UU	Unconsolidated Undrained Triaxial	O	Organic Content
G	Gas Sample	PW	Potewater Sample	FC	Fall Cone	UUP	UU Triaxial with Pore Pressure Measurements	S	Salinity
L	Liner Sample	T	Sample Stored in Tube	TV	Torvan	CU	Consolidated Undrained Triaxial	TS	Thaw Strain
P	Piston Sample	W	Waxed Sample	PV	Pilcon Vane	CUP	CU Triaxial with Pore Pressure Measurements	SG	Specific Gravity
NR	No Recovery	RC	Radiocarbon sample	RV	Remote Vane	CD	Consolidated Drained Triaxial		
NS	No Sample Remaining								

GULF CANADA RESOURCES
1985 OFFSHORE SITE INVESTIGATION
ANNAU IGAK I-65
BOREHOLE AM85S01

Project Number **101C-4417** Reviewed By: **T.R. MURPHY** P. Eng
 Page **4** of **4**

AMAULIGAK I-65

BOREHOLE AM85S01B



SUMMARY OF TEST RESULTS

Sample Number	Depth (metres) *Sample Photo-logged	Unified Soil Classification	Ground Ice Description (%)	Temp. (°C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density	ATTENBERG LIMITS					GRAIN SIZE DISTRIBUTION				SHEAR STRENGTH				CONSOLIDATION CHARACTERISTICS			TEST RESULTS SEPARATELY
								Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P ₀	P _c	C _c			
1A	51.8 - 52.3			1.1	29			51	29	53	46	1			PV	130+		V. Stiff						S=22ppt
1B	51.8 - 52.3	CH																						
2A	52.7 - 53.3			0.3	29			43	28						PV	130+		V. Stiff						SG=2.72
2B	52.7 - 53.3	ML&OL																						
3A	53.8																							
4A	54.7 - 55.4			0.3	29			54	31	54	45	1			PV	130+		V. Stiff						S=28ppt
4B	54.7 - 55.4	OH&MH																						
5A	55.8 - 56.3			0.8	30			51	28						PV	130+		V. Stiff						
5B	55.8 - 56.3	CH																						
6A	56.7 - 57.3			0.6	28			49	27	44	49	7			PV	130+		V. Stiff						S=26ppt
6B	56.7 - 57.3	CI																						
7A	57.6 - 58.1			0.8	26			44	24						PV	130+		V. Stiff						
7B	57.6 - 58.1	CI																						
7C	57.6 - 58.1																							

LEGEND AND NOTES

R Bag Sample C Frozen Core MV Minivan UU Unconsolidated Undrained Triaxial O Organic Content

G Gr Sample PW Porewater Sample FC Full Cone UUP UU Triaxial with Pore S Salinity

L Liner Sample T Sample Stored in Tube TV Torvane Pressure Measurements TS Thaw Strain

P Piston Sample W Washed Sample PV Pilon Vane CU Consolidated Undrained Triaxial SG Specific Gravity

NR No Recovery RC Radiocarbon sample RV Remote Vane CUP CU Triaxial with Pore Pressure Measurements

NS No Sample Remaining CD Consolidated Drained Triaxial

**GULF CANADA RESOURCES
1985 OFFSHORE SITE INVESTIGATION
AMAILIGAK 1-65
BOREHOLE AM85S01B**

SUMMARY OF TEST RESULTS

Sample Number	Depth (metres) *Sample Photographed	Unified Soil Classification	Ground Ice Description (%)	Temp (°C)	Moisture Content (%)	Frozen Content (%)	Bulk Density	ATTENBERG LIMITS					GRAIN SIZE DISTRIBUTION					SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS			TEST METHOD				
								Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P ₀	P _c	C _c							
8A	58.5 - 58.6	CI			29			43	23	4	5	91																SG=2.72
8B	58.6 - 58.7	SP-SM			20			49	27																			S=32ppt
8C	58.7 - 58.8	CI		0.2	25																							S=27ppt
9A	59.6				31																							S=28ppt
9B	59.4	CL		1.8	33			33	22																			SG=2.71
10A	60.9			-0.2	30					37	49	14																S=22ppt
END OF BOREHOLE																												

LEGEND AND NOTES

B Bag Sample
 G Gas Sample
 L Limer Sample
 P Pilon Sample
 NR No Recovery
 NS No Sample Remaining

C Frozen Core
 PV Porewater Sample
 T Sample Stored in Tinja
 W Wash Sample
 RC Radiocarbon sample

MV Minivan
 FC Fall Cone
 TV TriVane
 PV Pilon Vane
 RV Remme Vane

UU Unconsolidated Undrained Triaxial
 UU_p UU Triaxial with Pore Pressure Measurements
 CU Consolidated Undrained Triaxial
 CU_p CU Triaxial with Pore Pressure Measurements
 CD Consolidated Drained Triaxial

O Organic Content
 S Salinity
 TS Thaw Strain
 SG Specific Gravity

GULF CANADA RESOURCES
 1985 OFFSHORE SITE INVESTIGATION
 ANAULIGAK I-65
 BOREHOLE AN85S018

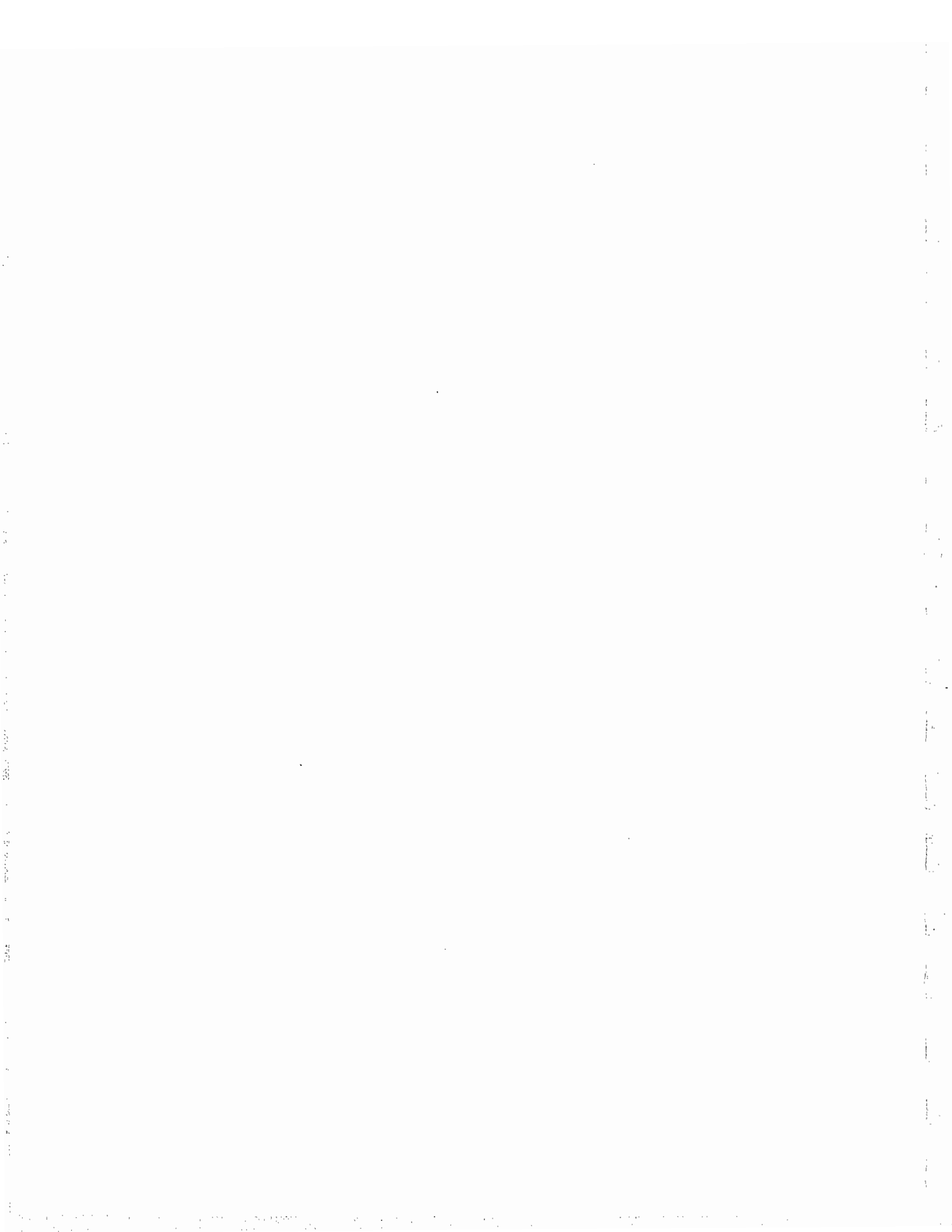
Project Number: 101C-4417

Reviewed By: T.R. MURPHY P. Eng.

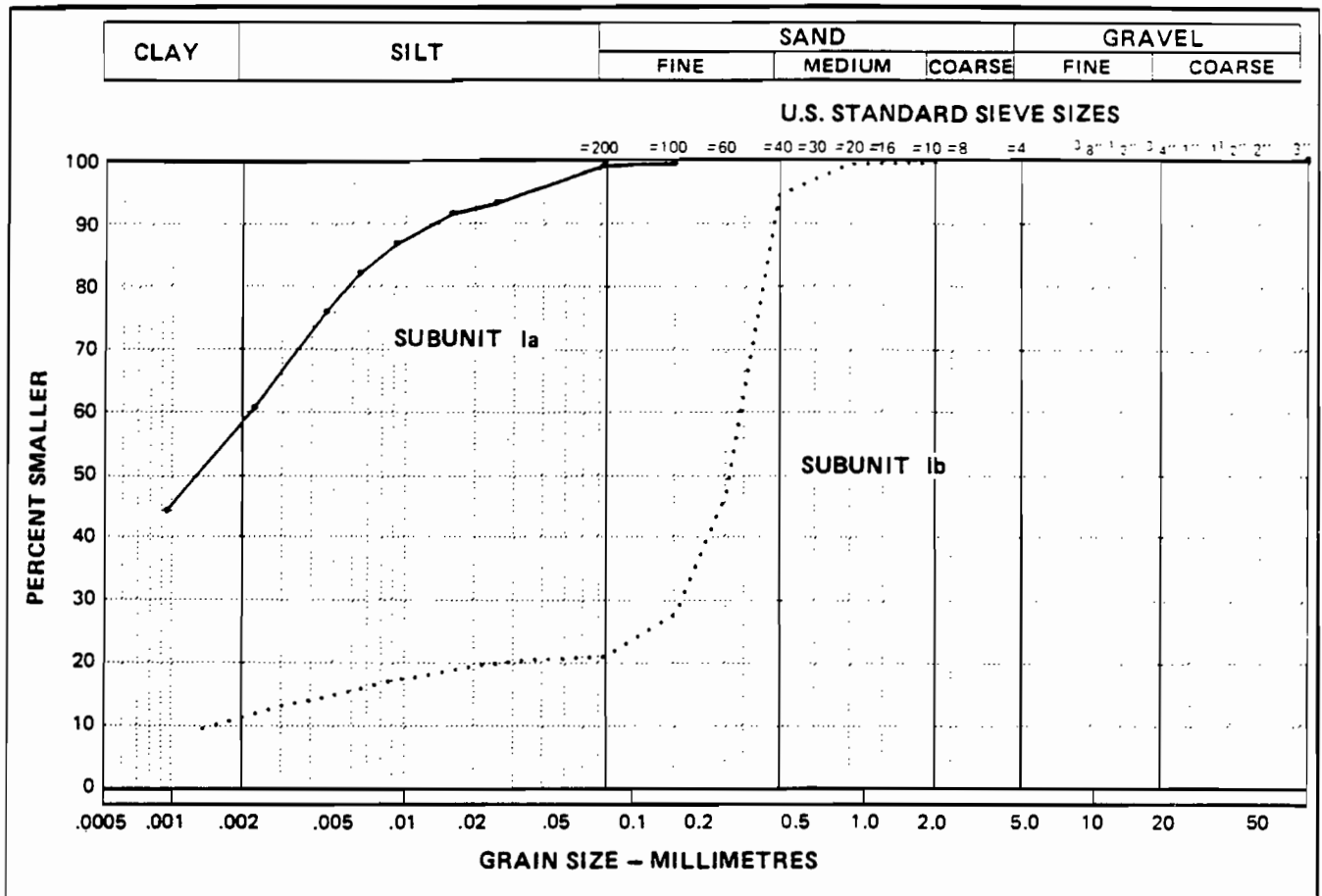
Page 2 of 2

APPENDIX D

PARTICLE SIZE ANALYSIS



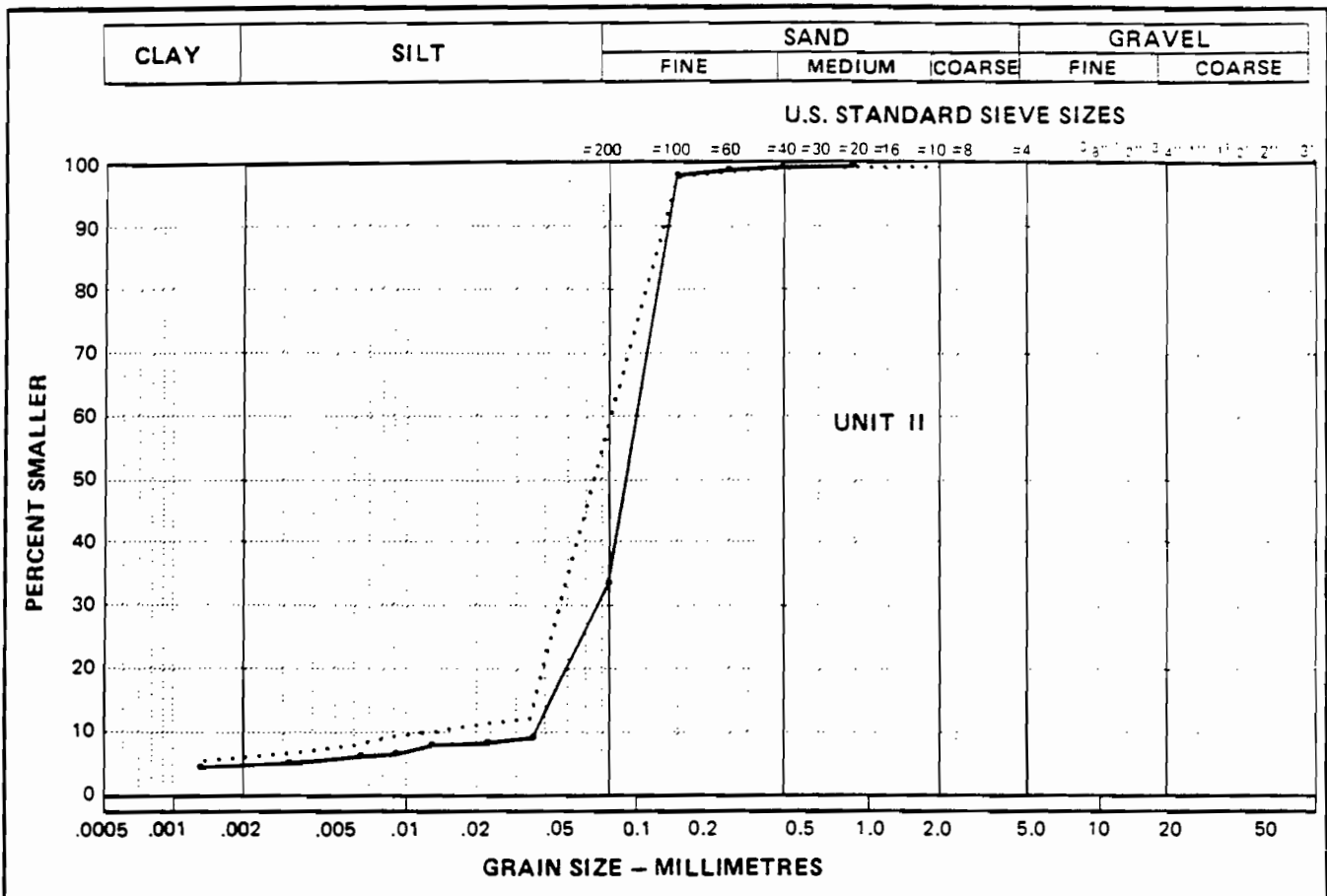
PARTICLE - SIZE ANALYSIS OF SOILS



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	AM85S01	.35 - .56	58.8	40.9	.3	0.0	-	-	-
.....	AM85S01	6.77 - 6.97	11.0	9.3	79.7	0.0	183.5	56.8	SC

JOB NO. 101 -4417 DATE 85-10-25

PARTICLE - SIZE ANALYSIS OF SOILS

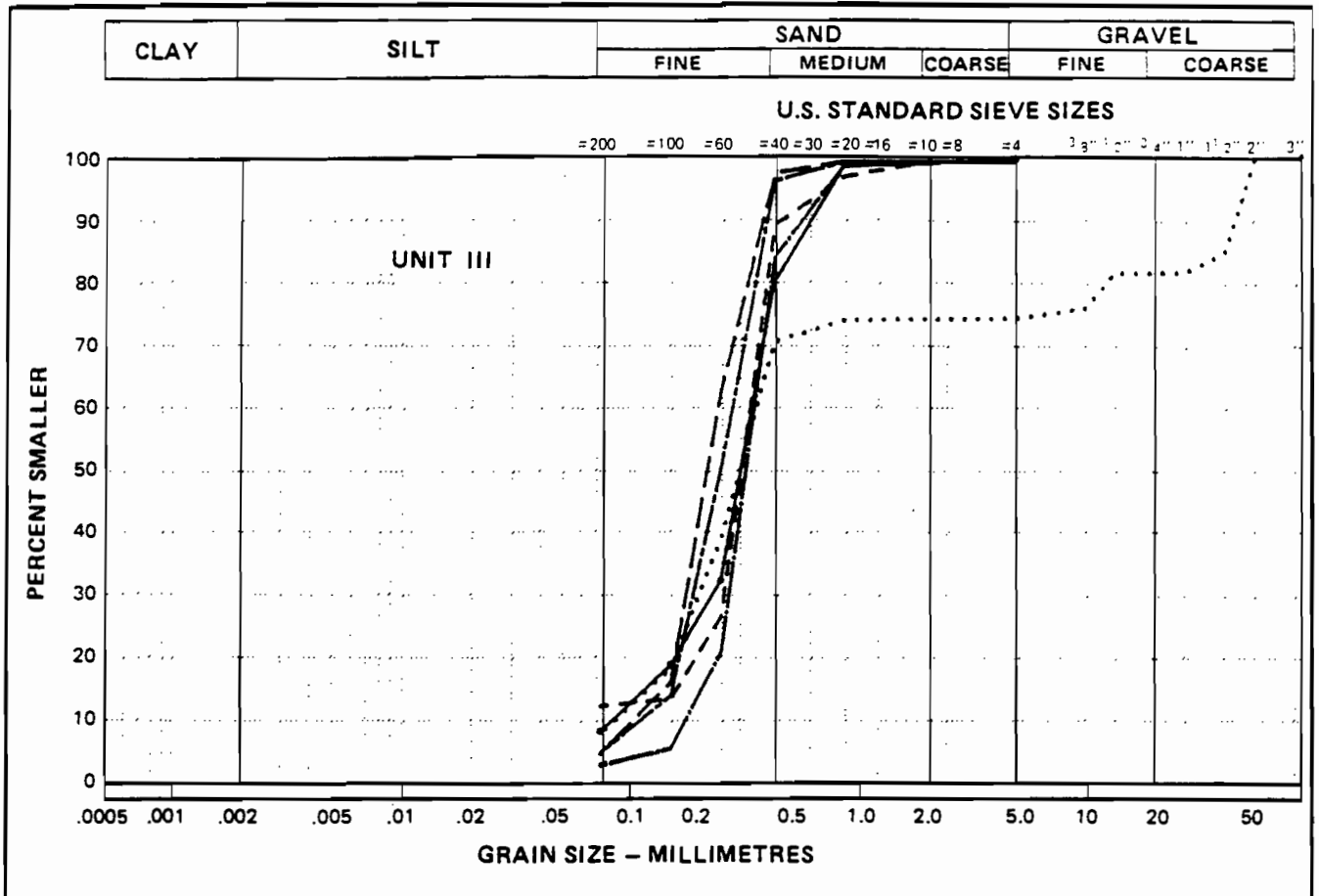


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	AM85S01	7.77 - 8.57	4.7	28.4	66.9	0.0	2.7	1.3	SM
.....	AM85S01	9.14 - 9.40	6.1	52.3	41.6	0.0	5.8	2.1	-

JOB NO. 101 -4417

DATE 85-10-25

PARTICLE - SIZE ANALYSIS OF SOILS

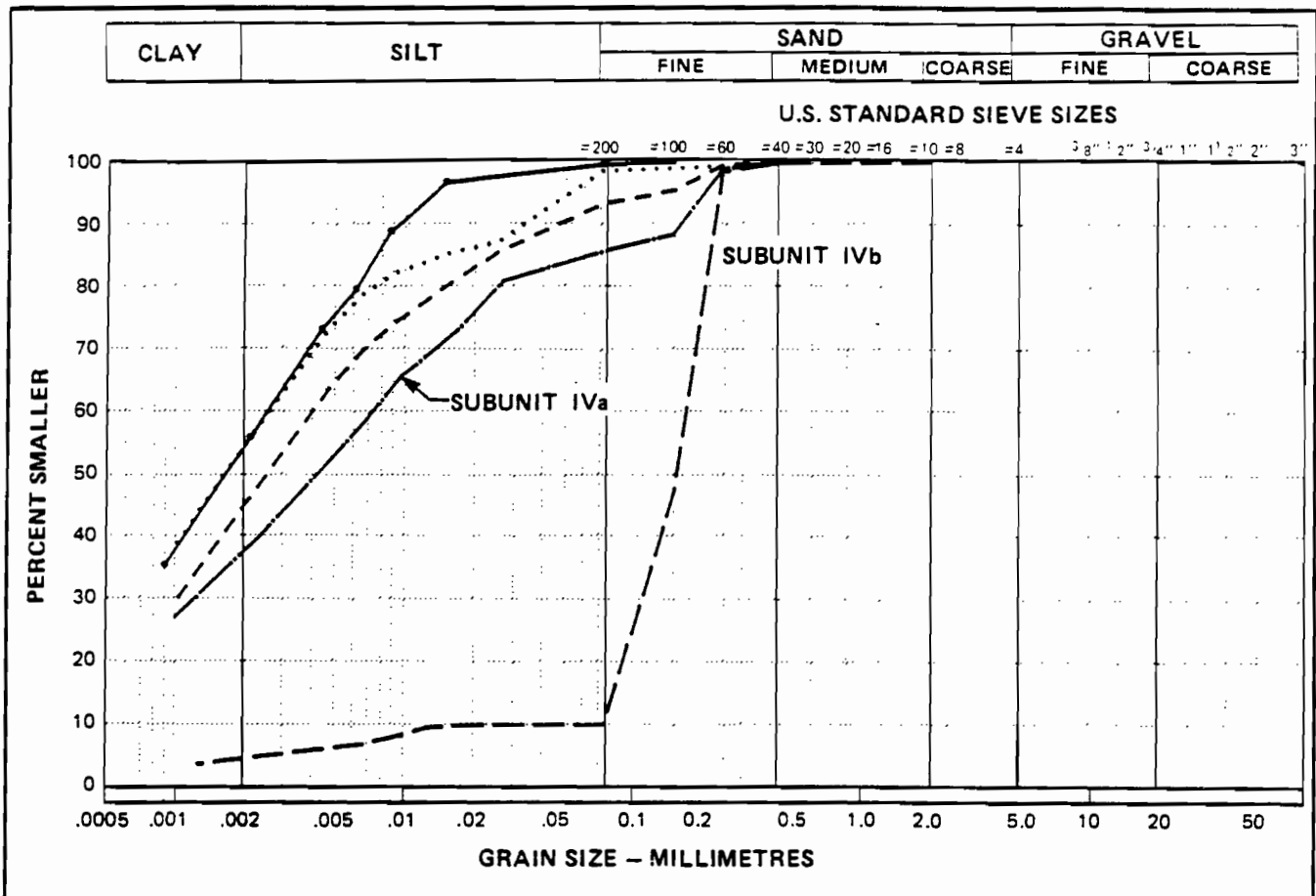


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	AM85S01	16.90 - 17.30	-	7.4	92.6	0.0	3.9	1.8	SP-SM
.....	AM85S01	23.00 - 23.00	-	7.2	67.2	25.6	4.0	1.3	SP-SM
----	AM85S01	26.10 - 26.70	-	11.7	88.3	0.0	-	-	-
_____	AM85S01	30.60 - 31.10	-	4.1	95.9	0.0	2.3	1.2	SP
.....	AM85S01	39.80 - 40.00	-	2.2	97.8	0.0	2.0	1.2	SP
----	AM85S01	48.90 - 49.20	-	4.2	95.8	0.0	2.4	1.1	SP

JOB NO. 101 -4417

DATE

PARTICLE - SIZE ANALYSIS OF SOILS

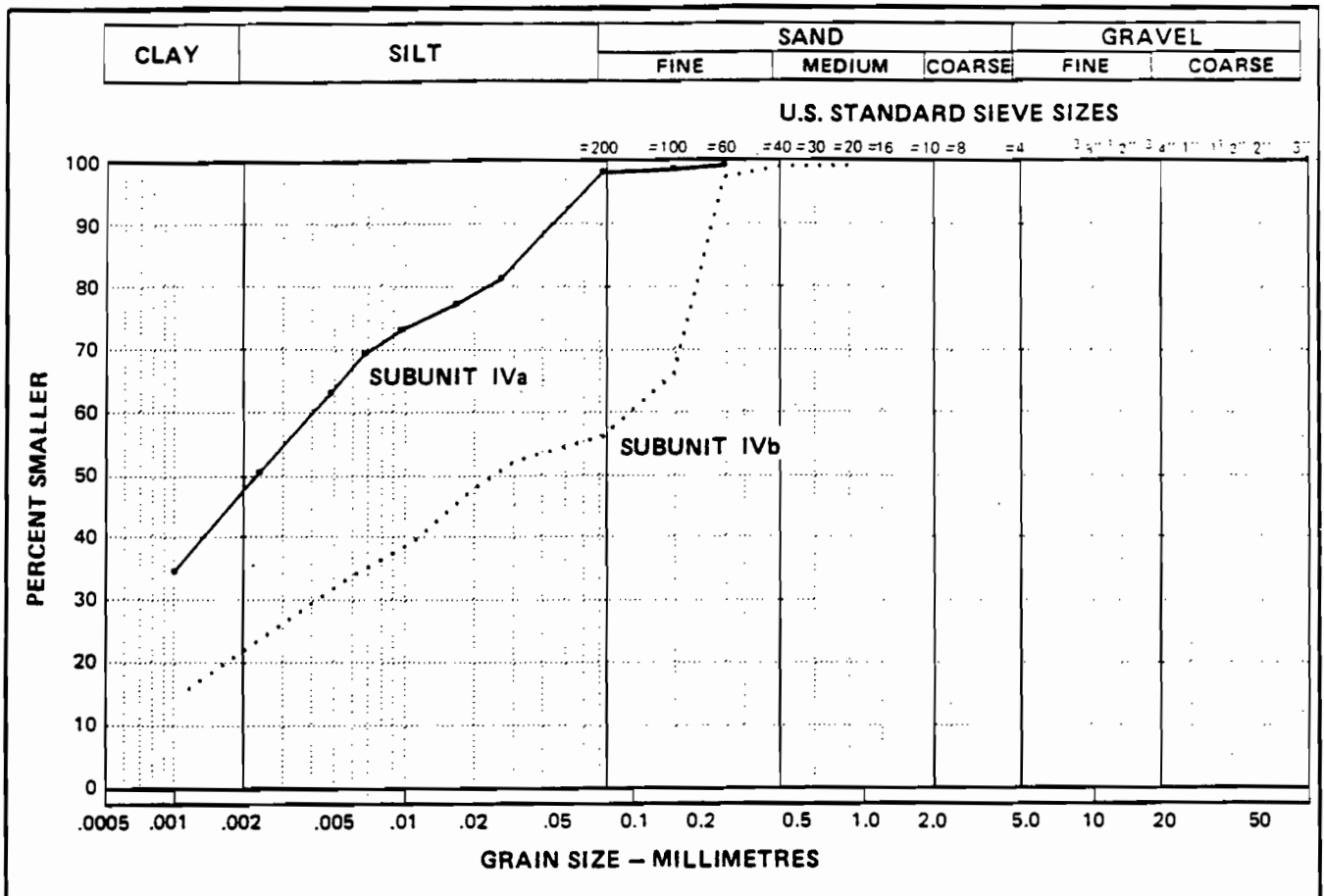


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
—	AM85S01B	51.80 - 52.30	53.3	46.3	.4	0.0	-	-	-
.....	AM85S01B	54.70 - 55.40	53.7	45.1	1.2	0.0	-	-	-
---	AM85S01B	56.70 - 57.30	44.1	49.3	6.6	0.0	-	-	-
---	AM85S01B	58.60 - 58.70	3.9	5.0	91.1	0.0	2.3	.9	SP-SM
---	AM85S01B	60.90 - 60.90	37.0	48.8	14.2	0.0	-	-	-

JOB NO. 101 -4417

DATE 85-10-25

PARTICLE - SIZE ANALYSIS OF SOILS

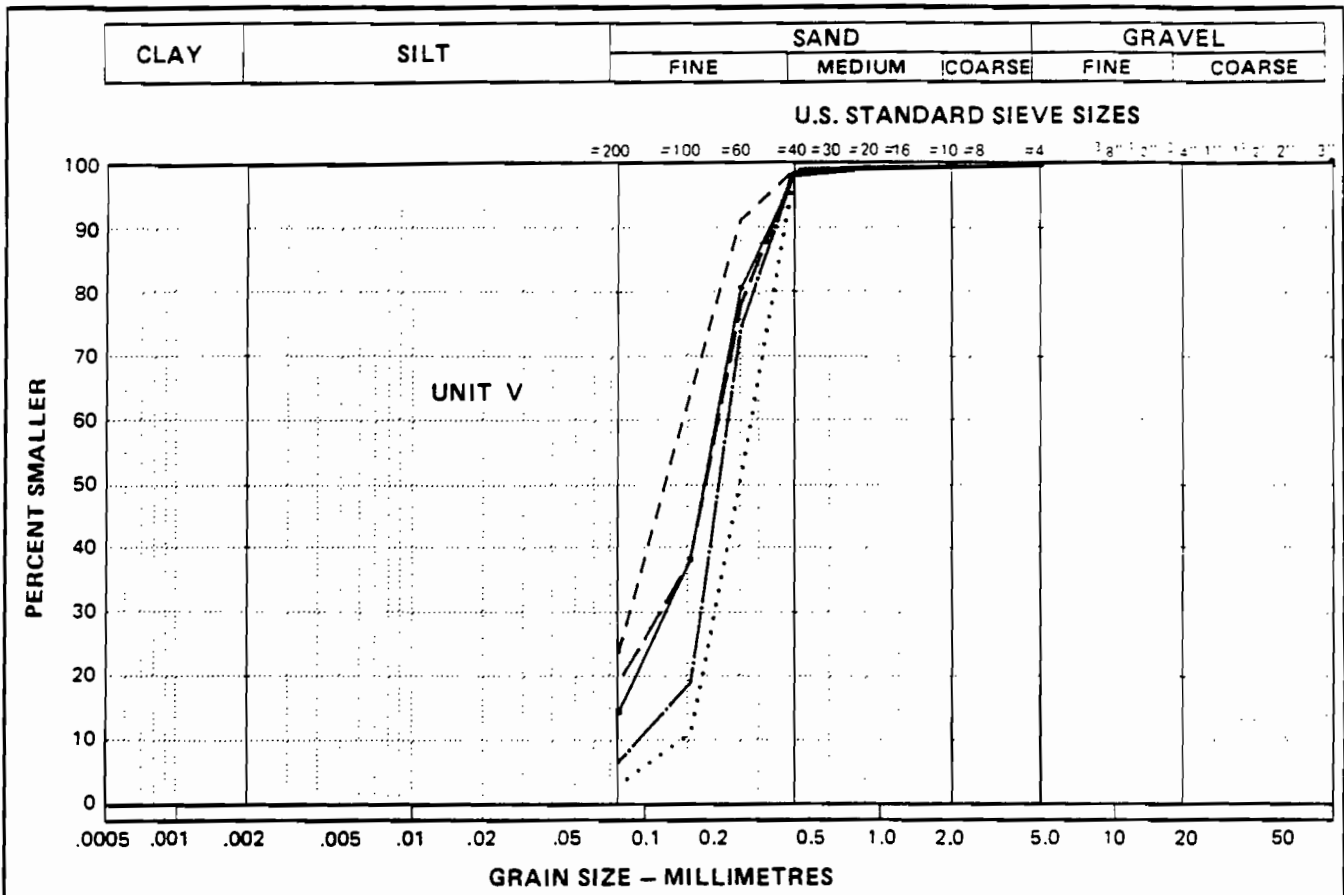


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
—	AM85S01	52.90 - 53.90	47.5	51.5	1.0	0.0	-	-	-
.....	AM85S01	57.40 - 58.00	21.8	34.5	43.7	0.0	-	-	-

JOB NO. 101 -4417

DATE 85-10-25

PARTICLE - SIZE ANALYSIS OF SOILS



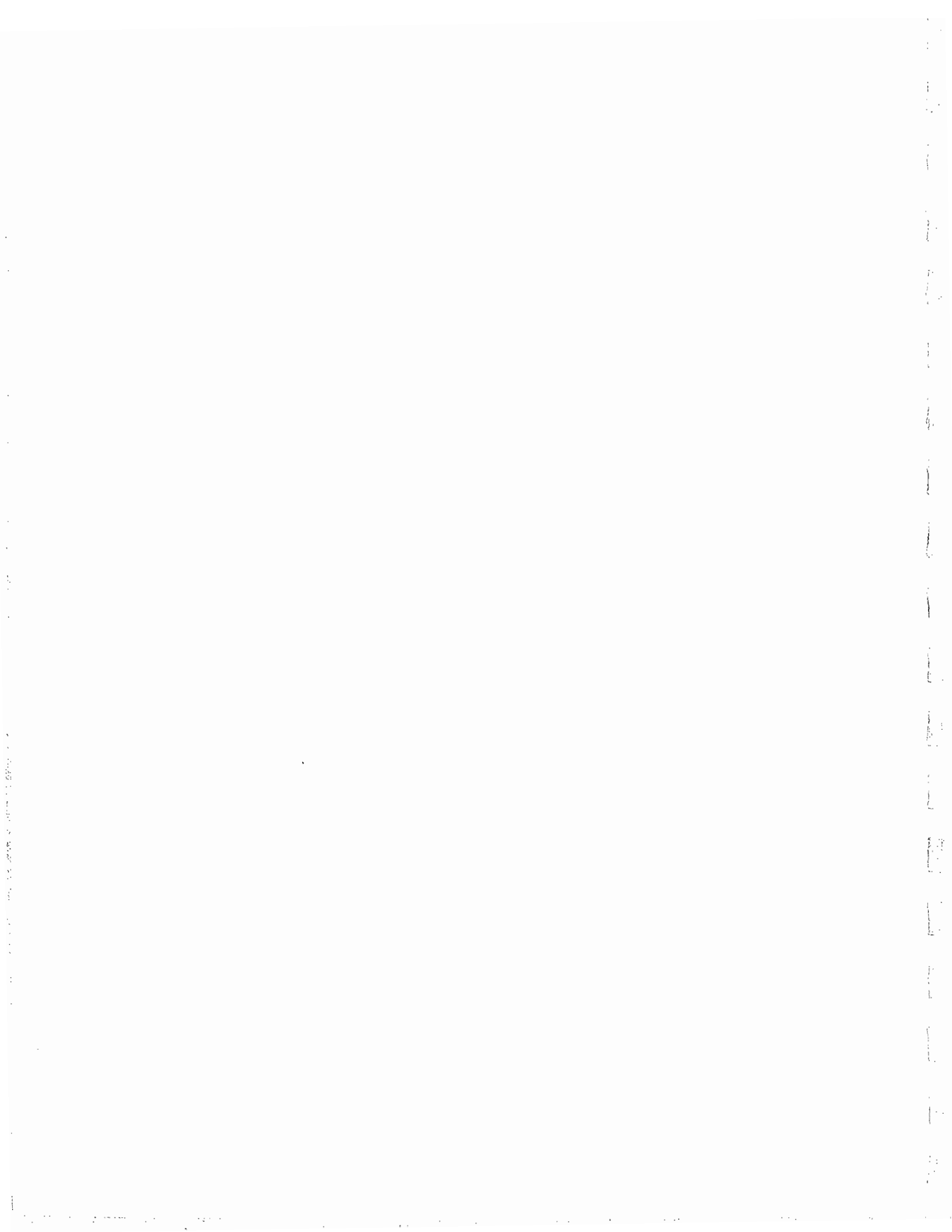
SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
_____	AM85S01	62.00 - 62.30	-	13.7	86.3	0.0	-	-	-
.....	AM85S01	65.10 - 65.30	-	2.4	97.6	0.0	1.9	.9	SP
---	AM85S01	71.20 - 71.40	-	23.0	77.0	0.0	-	-	-
_____	AM85S01	74.20 - 74.40	-	18.4	81.6	0.0	-	-	-
_____	AM85S01	80.30 - 80.70	-	6.0	94.0	0.0	2.4	1.4	SP-SM

JOB NO. 101 -4417

DATE

APPENDIX E

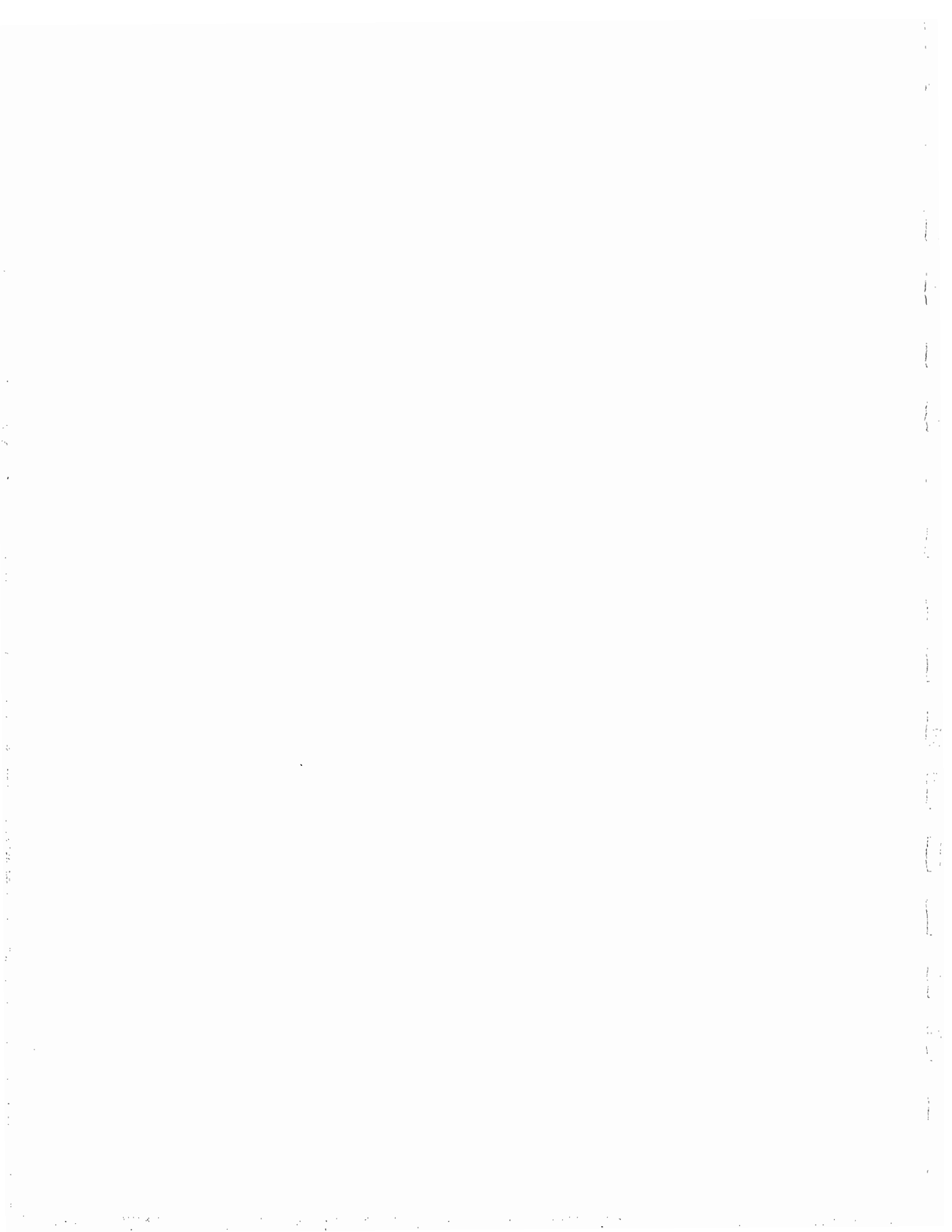
SUBCONSULTANT'S REPORT



ANALYTICAL METHOD

HYDROCARBON GAS ANALYSES

Sediment samples for hydrocarbon gas analysis were sealed in cans in a brine solution at the drill site. To prepare the samples for analysis, 100cc of sea water was displaced from the can using helium. The cans were then mechanically agitated for one hour to displace the hydrocarbon gases into the head space. The head space gas was analyzed for methane, ethane, propane, ethylene and propylene. Results are reported as gas volume hydrocarbon component per 10^6 volumes of wet sediment (ppm vol/vol). This method of reporting is the same as that used in past reports.



EBA ENGINEERING CONSULTANTS LTD.
 14535 - 118 AVENUE
 EDMONTON, ALTA
 T5L 2M7

PROJECT: 85-5630
 DATE: 85-10-28

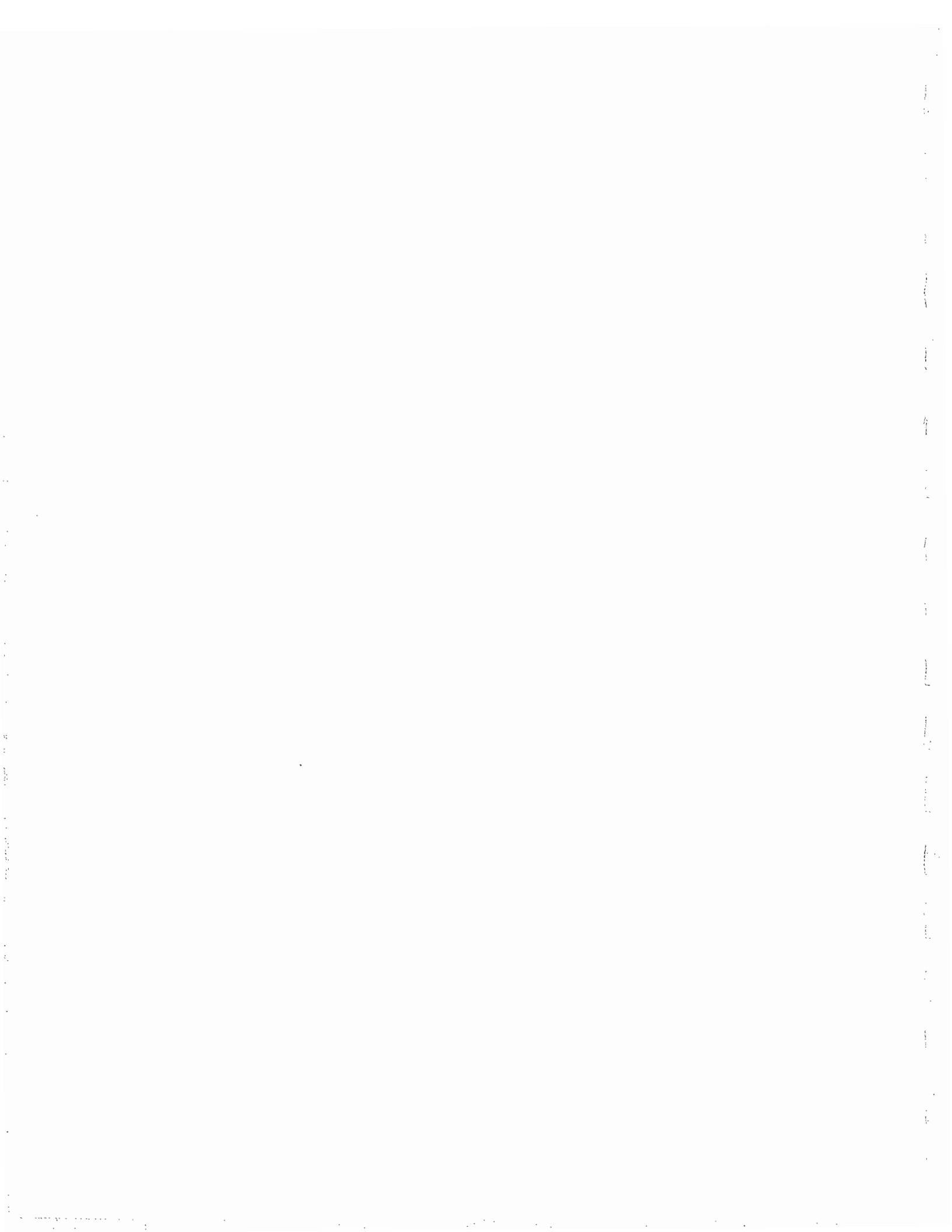
HYDROCARBON ANALYSIS

101C-4417 AMAULIGAK I-65

CONCENTRATION (ppm)

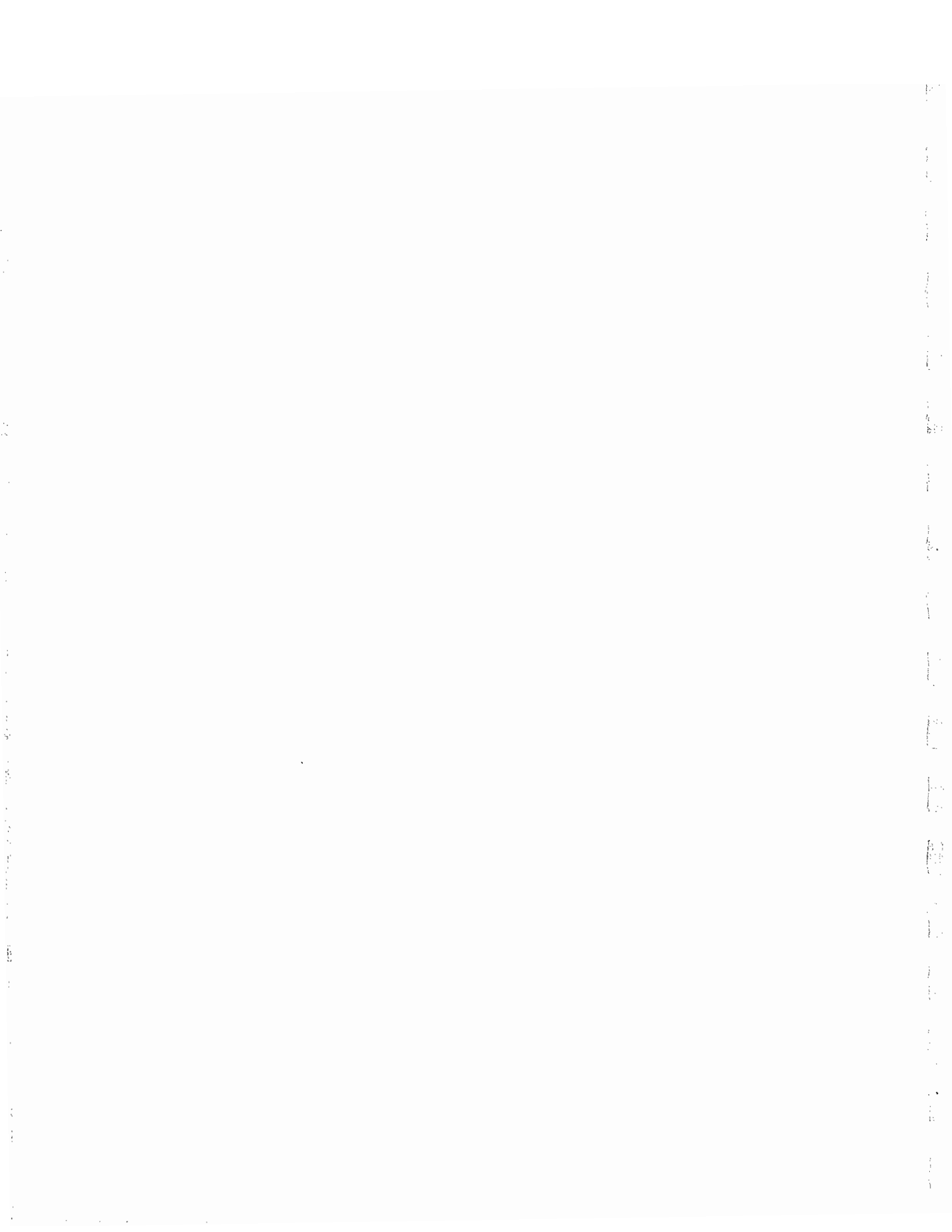
BOREHOLE #	SAMPLE #	DEPTH (meters)	METHANE	ETHANE	PROPANE	ETHYLENE	PROPY- LENE
AM85S01B	7C	58.0M	5960	<.1	<1	<1	<1
AM85S01	23C	53.0M	1710	<.1	<1	<1	<1
AM85S01	26C	58.0M	5310	<.1	<1	<1	<1
AM85S01	28C	60.5M	2370	<.1	<1	<1	<1





APPENDIX F

IN SITU TESTING



101C-4417

November, 1985

Page G.1

APPENDIX F

The following profiles and analysis were provided by Gulf Canada Resources.

THE
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GULF CANADA RESOURCES INC.

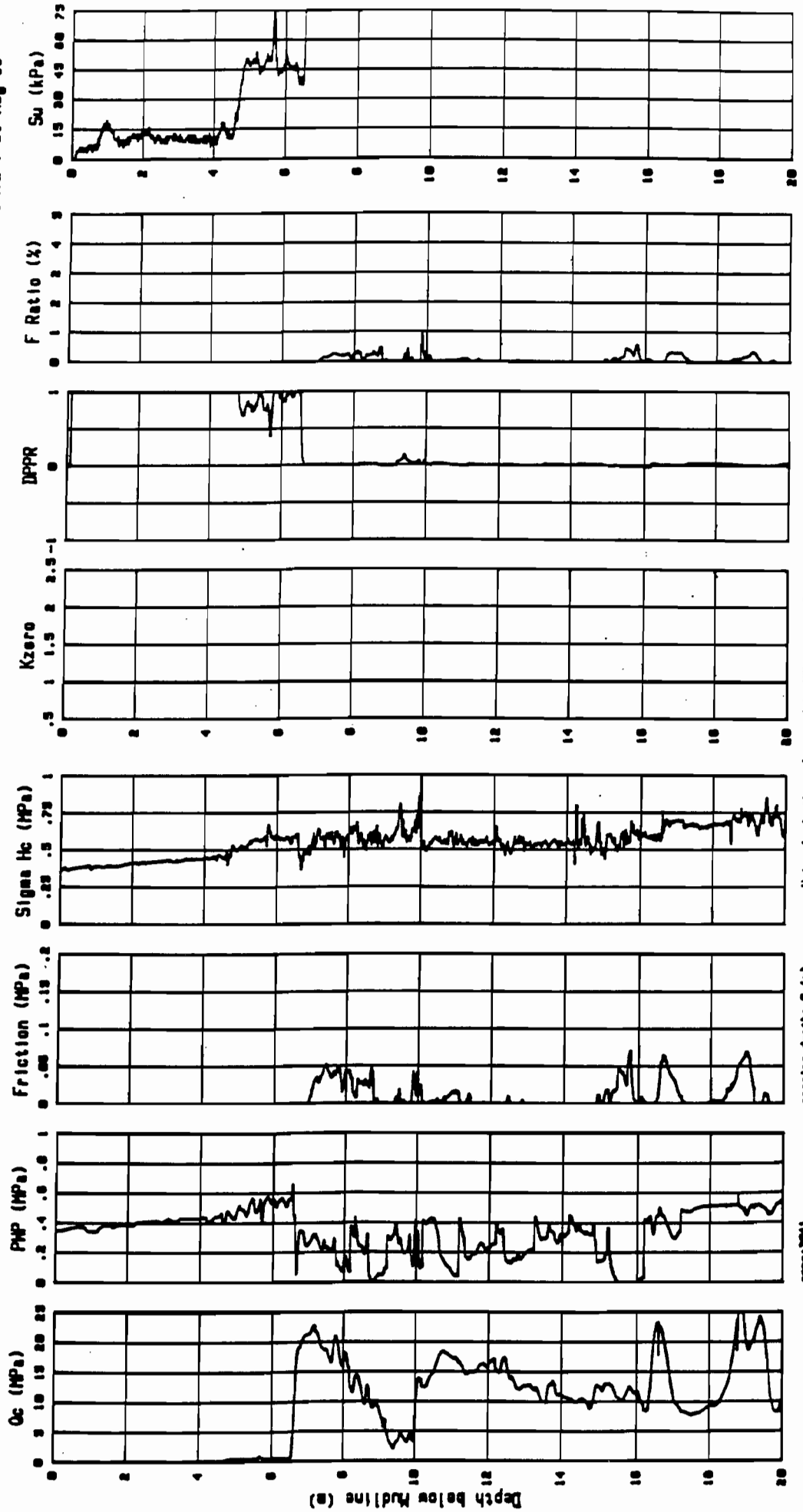
Location: AMALIGIK I-65

Water depth (m): 33.5

PAGE 1 of 2

DATE: 31/Aug'85

CPT: AM85C81



Notes: 1. depths referenced to ML
 2. stress's referenced to ML
 3. well density taken as 18.3 kN/m³
 4. Kzero determined from estimated average (horizontal) value
 5. Lambda as taken as: .07

AM85C81
 type: CH15/ver-mp
 file name: AM85C81

GULF CANADA RESOURCES INC.

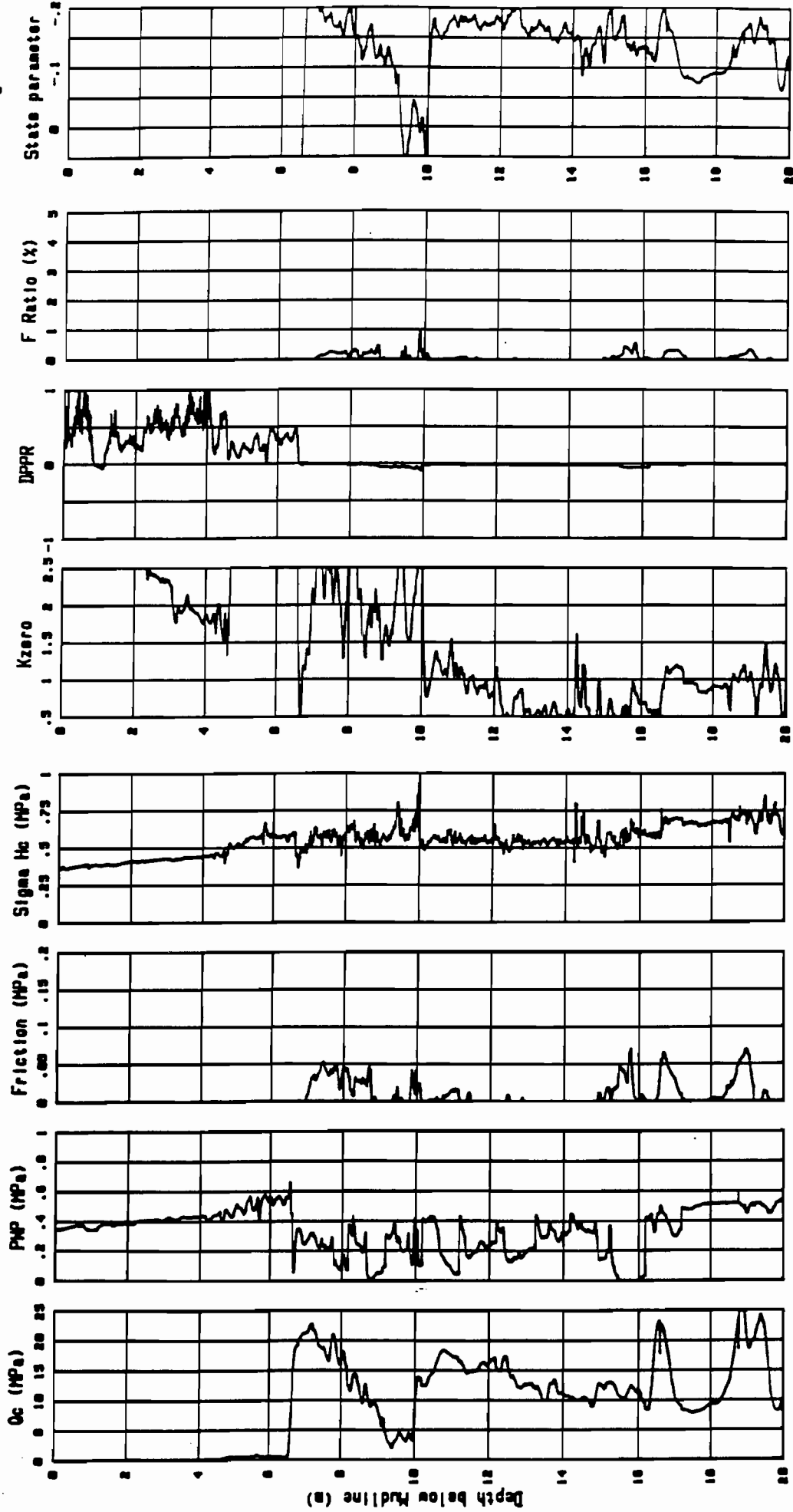
Location: AMALIGAK I-65

Meter depth (m) : 33.5

PAGE 1 of 2

DATE : 31/Aug'85

CPT : AM85C01



Notes: 1. depths referenced to ML. 2. stress's referenced to ML. 3. cell density taken at 10.5 m/sg 5. Lambda_0 taken at .00
 4. Kzero determined from direct use of sigma_v0

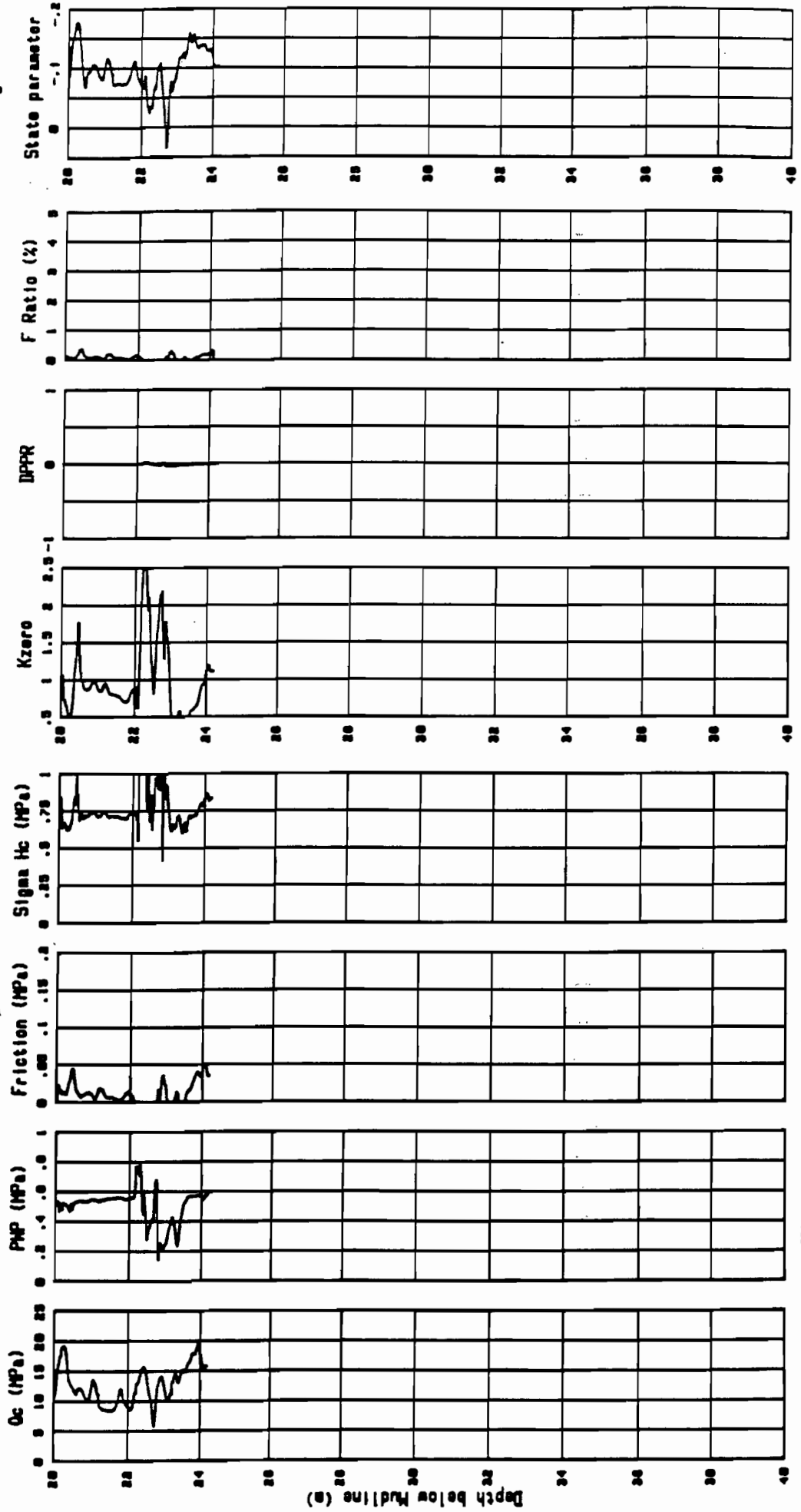
010 am85C01
 0001201
 type:Ch100v-mp

GULF CANADA RESOURCES INC.

Location: **AMULIGAK I-65**
 Water depth (m): **33.5**

PAGE 2 of 2
 DATE: 31/Aug'85

CPT: **PH85C81**



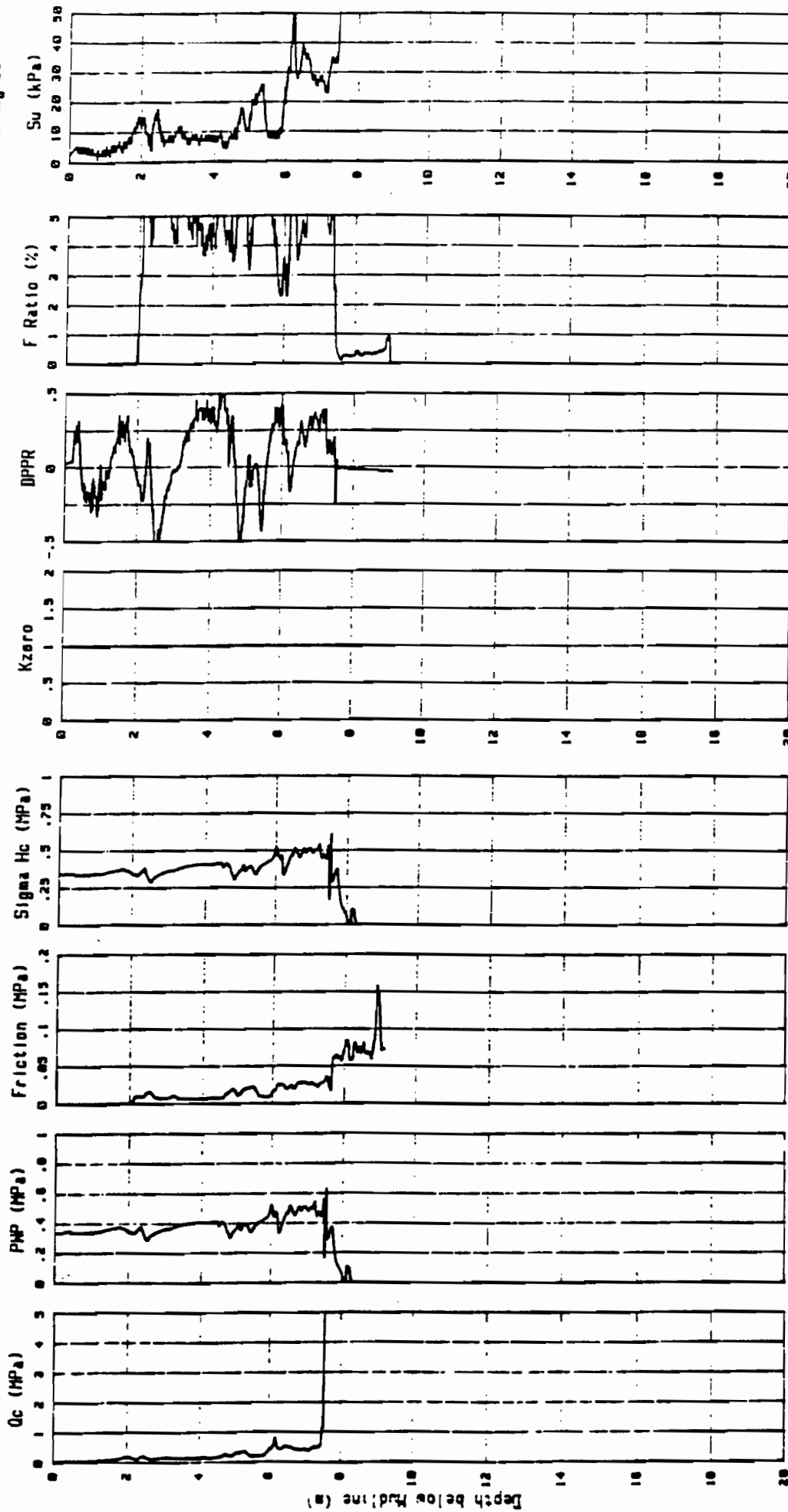
file name: **PH85C81** zeroing depth @ 32.5 (m) start push @ 32.5 (m) Notes: 1. depth referenced to RL 2. stress's referenced to RL 3. cell density taken @ 10.5 kN/m³ 4. Kzero determined from direct use of sigma_h 5. Lambda_{so} taken as: .08

GULF CANADA RESOURCES INC.

Location: **AMPAULIGAK**
 Water depth (m) : **33.5**

PAGE 1 of 1
 DATE : 31/Aug '85

CPT : **AMB5C01b**



File name: **AMB5C01b** cone: **3010** start depth: **32.5 (m)** Note: 1. depth referenced to RSL 3. Load₅₀ taken at .05
 type: **3010/ver** start push: **32.0 (m)** 2. stress's referenced to RSL 4. Kzero determined from estimated average (cone₅₀) value

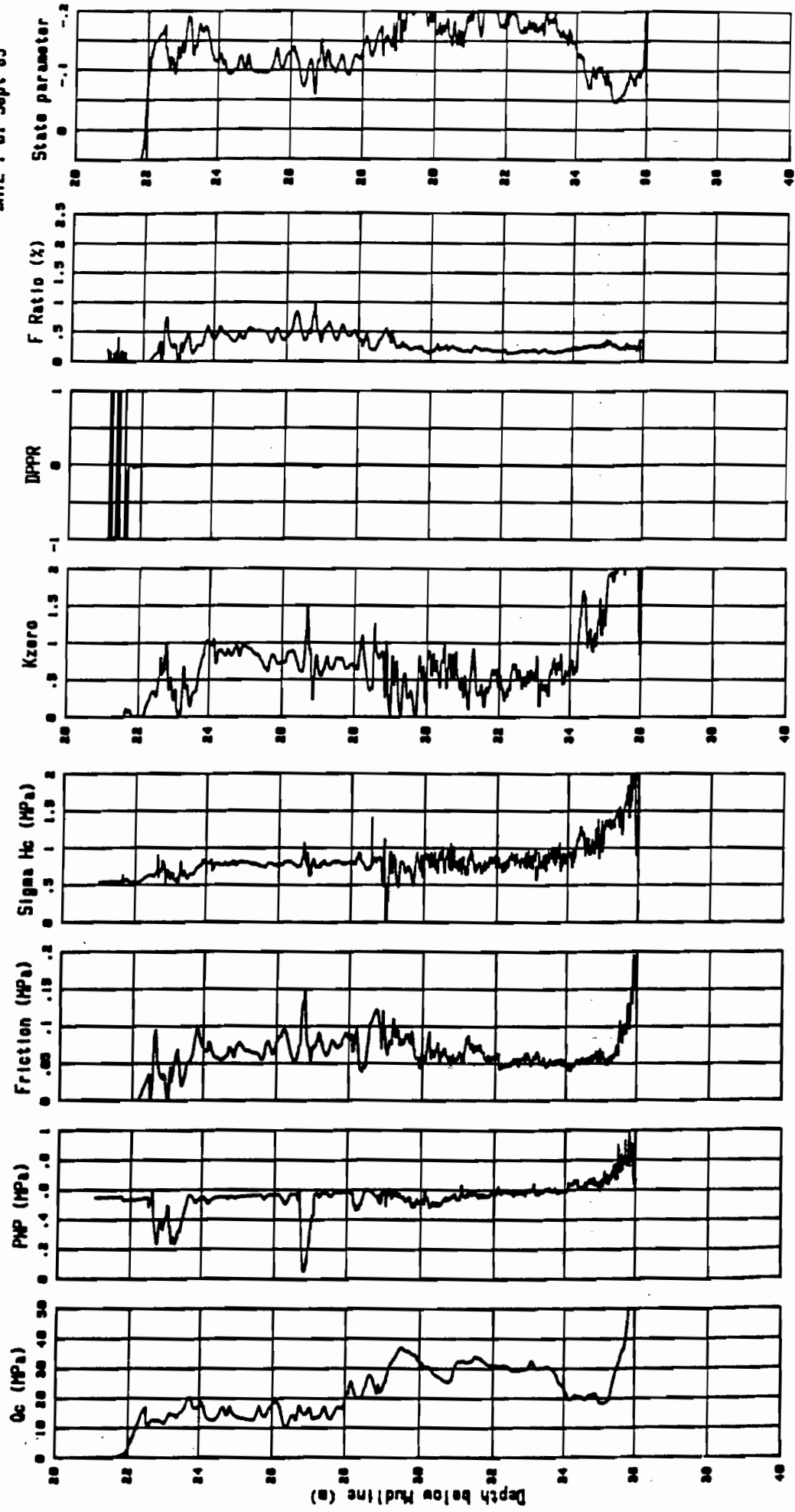
GULF CANADA RESOURCES INC.

Location: **PARLIGR I-65**

Water depth (m) : **33.5**

PAGE 1 of 1
DATE : 01 Sept '85

CPT : **AMB5C01c**



0110 amb5C01C01c
0001001
Type: CPT0105rev-04
start push at 34.5 (m)
sampling depth 3 (m)
Notes: 1. depth referenced to ML
2. well density taken as 19.5 lb/ft³
3. Limit on taken as .05
4. Kzero determined from direct use of sigma_{hc}

GULF CANADA RESOURCES INC.

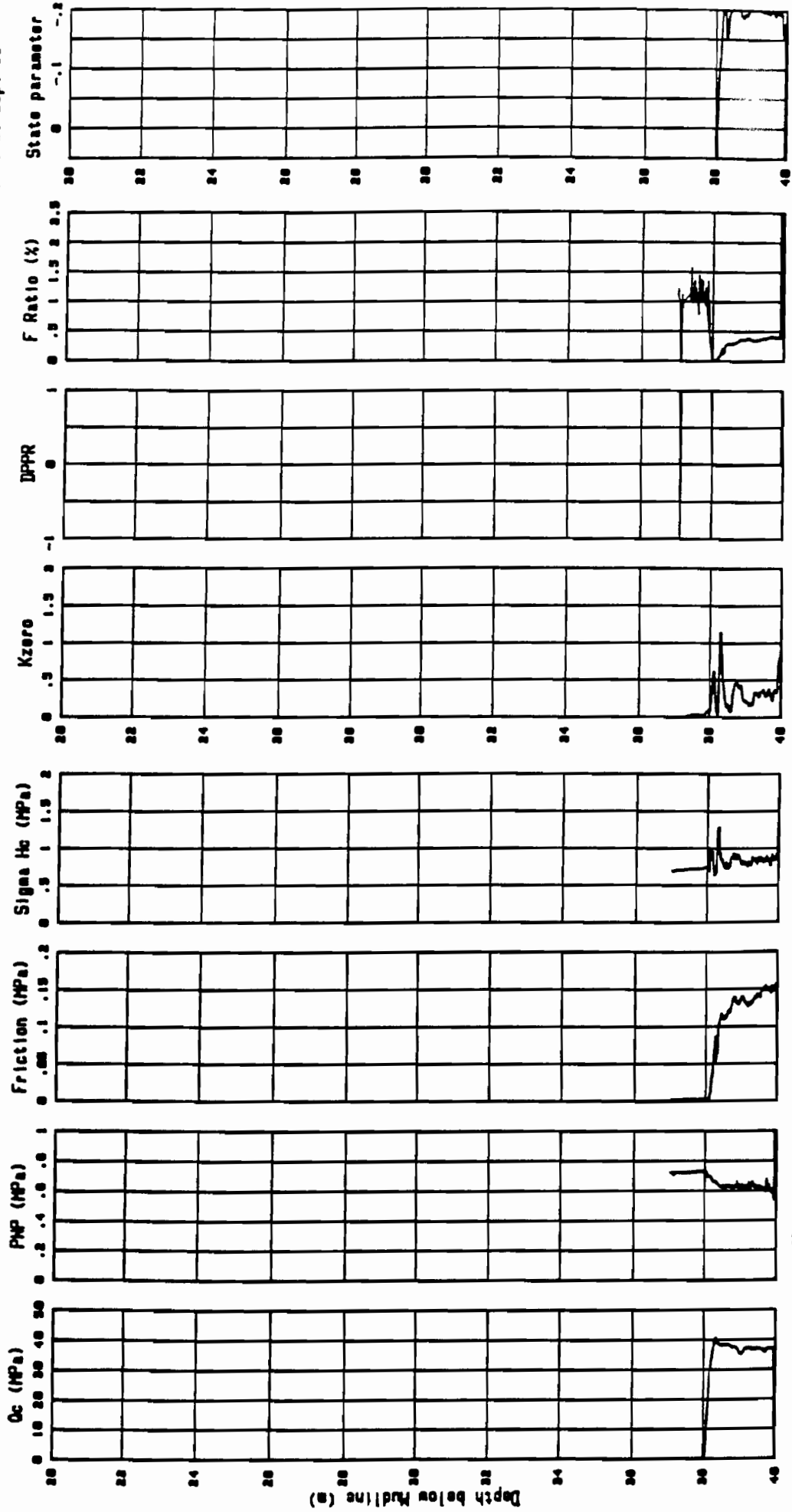
Location: **PARULIGK I-65**

Water depth (m) : **33.5**

CPT : **AMSC01d**

PAGE 1 of 2

DATE : 01 Sept '05



0110 amms1000031d
 00001001
 type:Ch100-mp
 start depth: 0 (m)
 start push: 01: 70.5 (a)
 Meter 1: depth referenced to ML
 2: stress's referenced to ML
 Meter 2: density taken at: 10.5 kN/m³
 3: Lambda_00 taken at: .00
 4: Kzero determined from direct use of sigma_hc
 5: Lambda_00 taken at: .00

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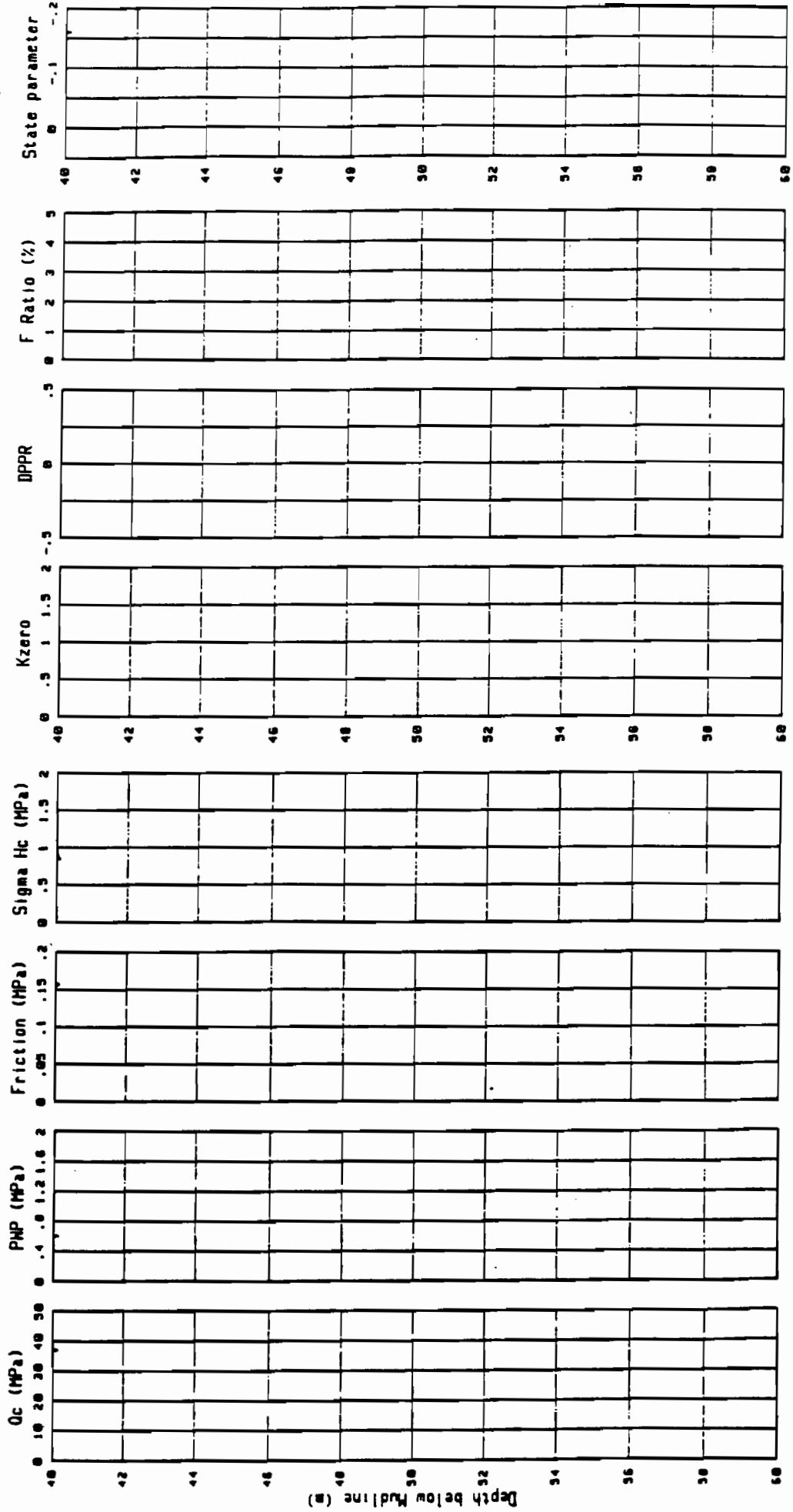
Location: AMVALIGAK I-65

Water depth (m) : 33.5

PAGE 2 of 2

DATE : 01 Sept '85

CPT : AMB5C01d



file name: AMB5C01d
 case: 3041
 type: CPT85ver-amp
 zeroing depth: 32.5 (m)
 start push off: 78.5 (m)
 Note: 1. depth referenced to MSL
 2. stress's referenced to MSL
 3. soil density taken as 18 kN/m³
 4. Kzero determined from estimated average (constant) value
 5. Lambda as taken as: .06

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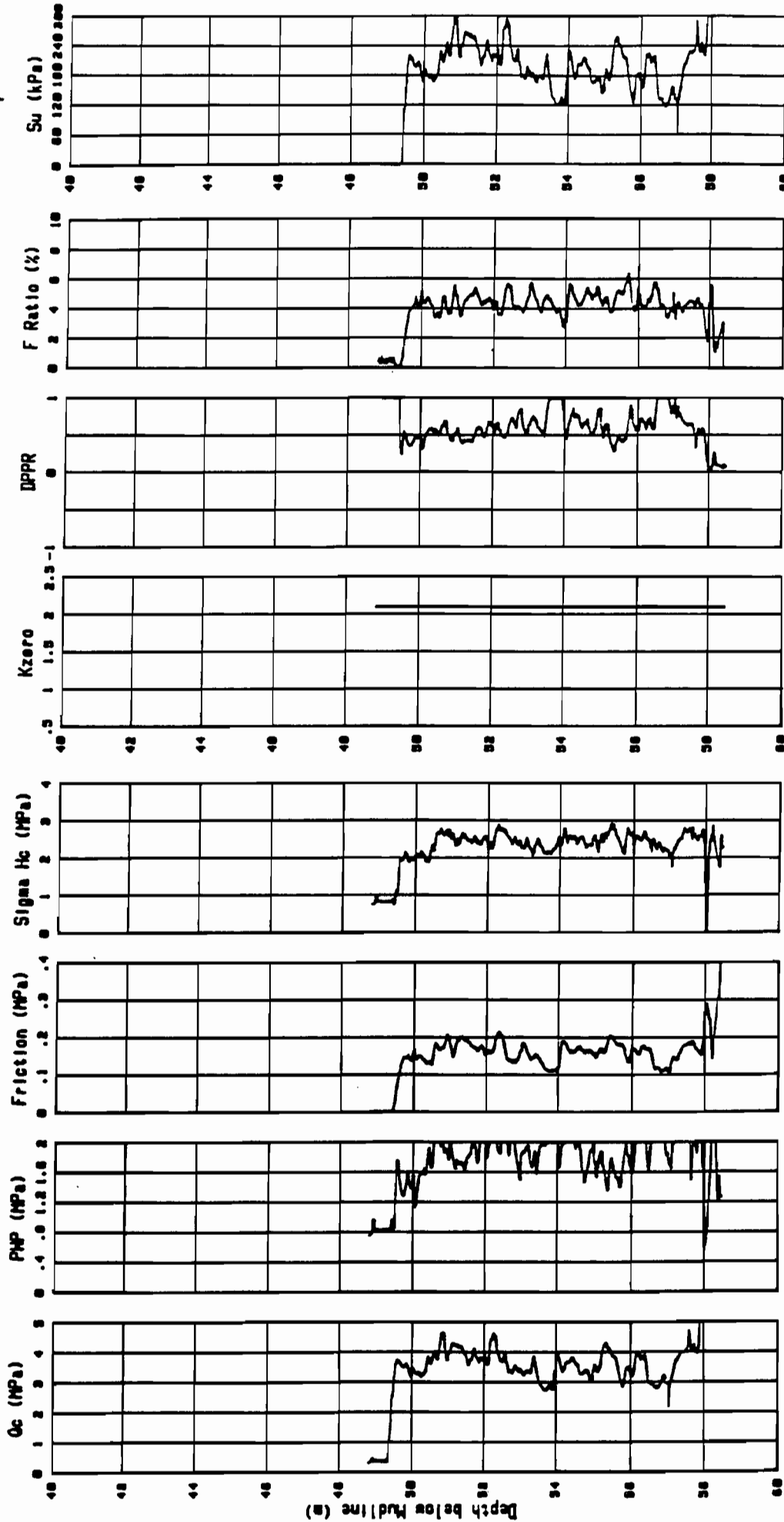
Location: **FAHULLIGOK I-65**

Water depth (m) : **33.5**

PAGE 1 of 1

DATE : 01 Sept '85

CPT : **FAH5C81E**

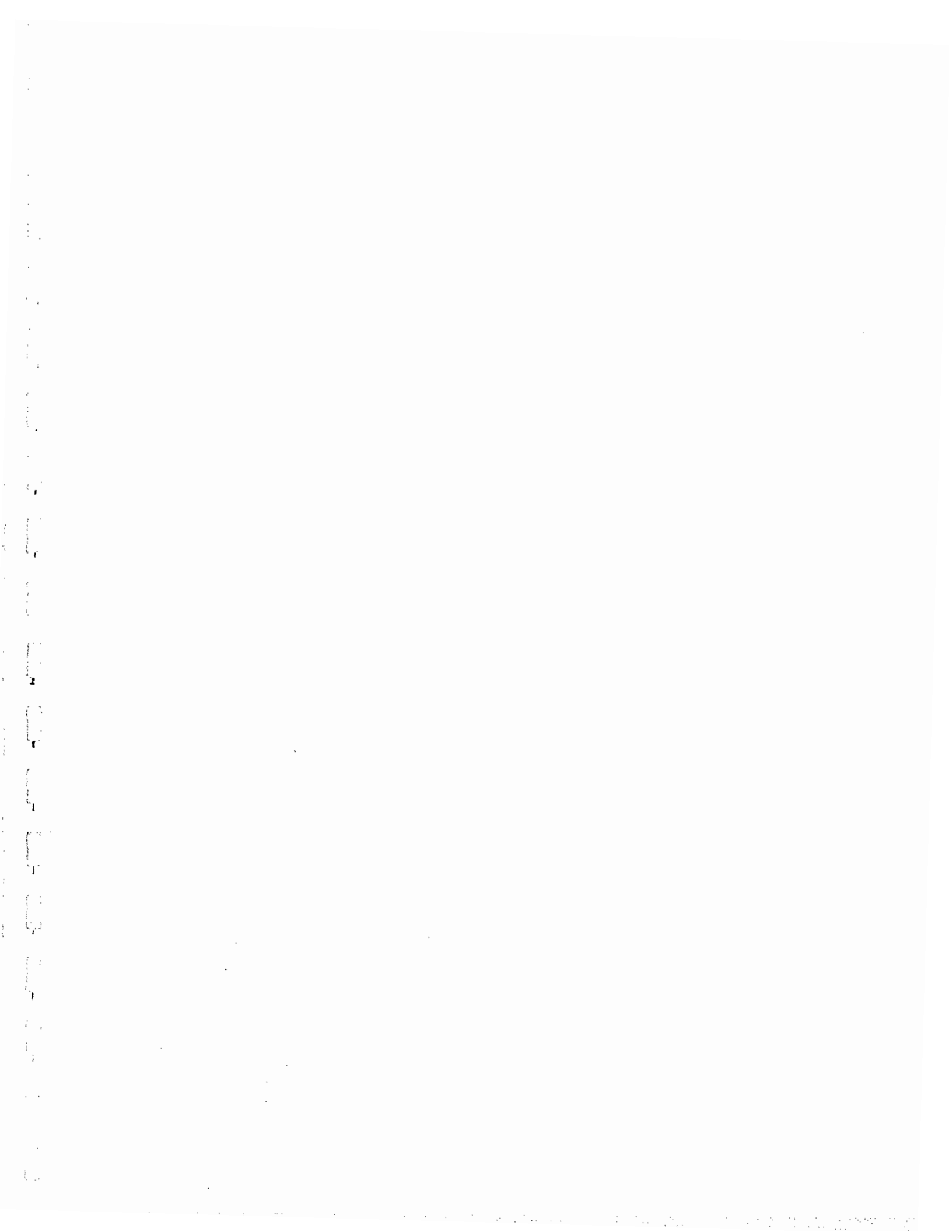


Notes: 1. depths referenced to ML 2. stress's referenced to ML 3. cell density taken at 19.5 kN/m³ 4. Kzero determined from estimated average (kzeroest)/value 5. Leads as taken at .04

zeroing depth: 0 (m) start point at: 02.0 (m)

file name: FAH5C81E

console: type: C:\d:\dive-up



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COMPUTER DATA DISCS WERE NOT FOUND IN THE
FIRST SEARCH. THE RESPECTIVE CONTRACTORS
HAVE BEEN CONTACTED TO CONTINUE THE SEARCH.

