

03275-1296

EBA Engineering Consultants Ltd.

Civil, Geotechnical and Materials Engineers

1987 OFFSHORE GEOTECHNICAL SITE INVESTIGATION

PROPOSED PRODUCTION STRUCTURE SITE
AND PIPELINE ROUTE
BEAUFORT SEA



LIST OF FIGURES

		<u>Page No.</u>
Figure 1	General Location Map	1
Figure 2	Detailed Borehole/Probehole Locations at Proposed Production Structure Site	3
Figure 3	Detailed Borehole/Probedhole Locations for Proposed Pipeline Site 1	4
Figure 4	Detailed Borehole/Probehole Locations for Proposed Pipeline Site 2	5
Figure 5	Detailed Borehole/Probehole Locations for Proposed Pipeline Site 3	6
Figure 6	Detailed Borehole/Probehole Locations for Proposed Pipeline Site 4	7
Figure 7	Generalized Subsoil Profile along Proposed Pipeline Route	8

LIST OF TABLES

Table 1	Borehole, CPT, Pressuremeter Test Locations for the Proposed Production Structure and Pipeline Route	2
Table 2	Stratigraphy - Proposed Pipeline Route	9
Table 3	Stratigraphy - Proposed Production Site	10

LIST OF APPENDICES

- Appendix A Borehole Logs (Proposed Production Site and Pipeline Route)
- Appendix B Diagnostic Profiles (Proposed Production Site and Pipeline Route)
- Appendix C Summary of Laboratory Testing (Proposed Production Site and Pipeline Route)
- Appendix D Particle Size Analysis (Proposed Production Site and Pipeline Route)
- Appendix E Cone Penetration Test Results (Proposed Production Site and Pipeline Route)

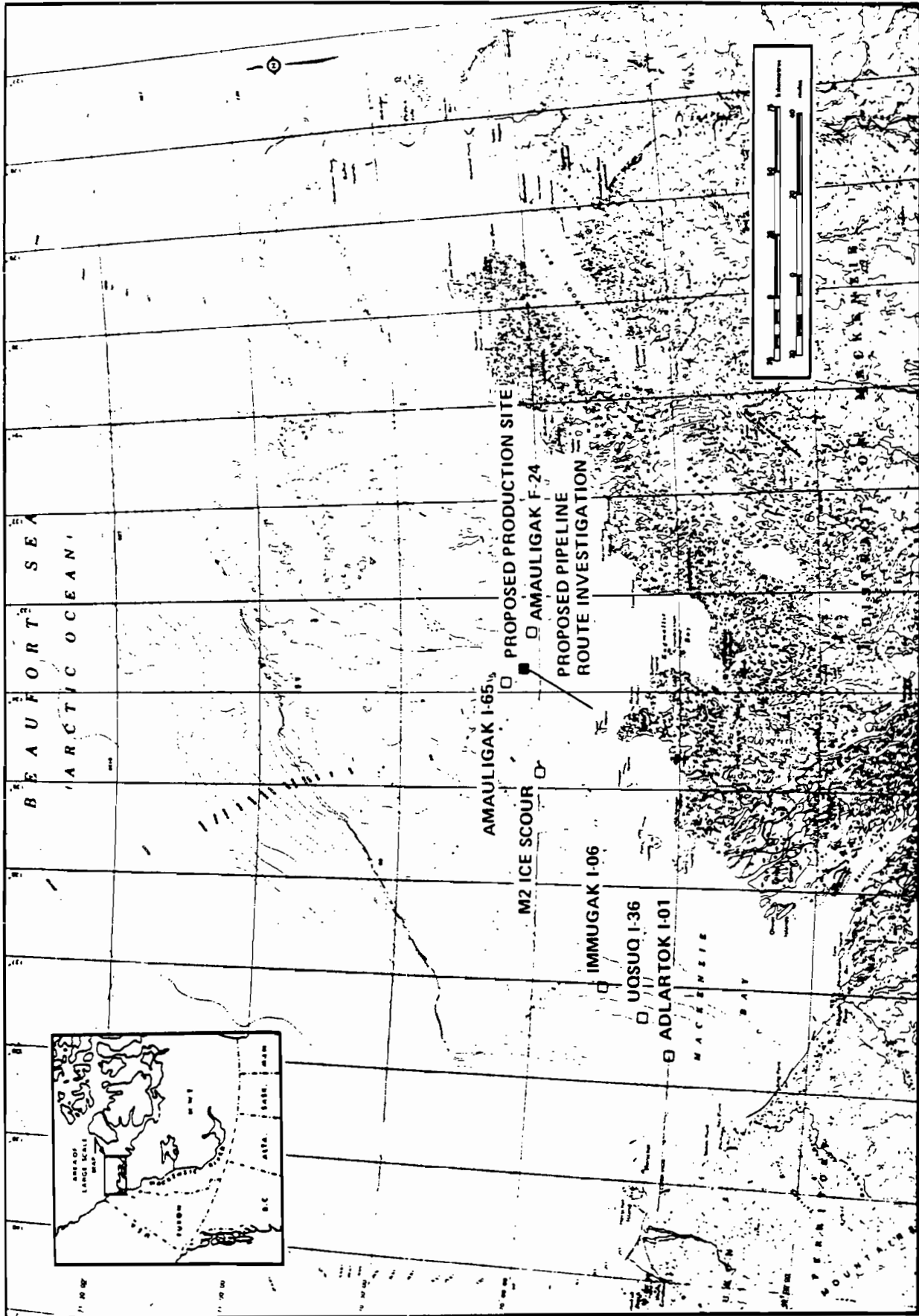


FIGURE 1 GENERAL LOCATION MAP

3076/E/86

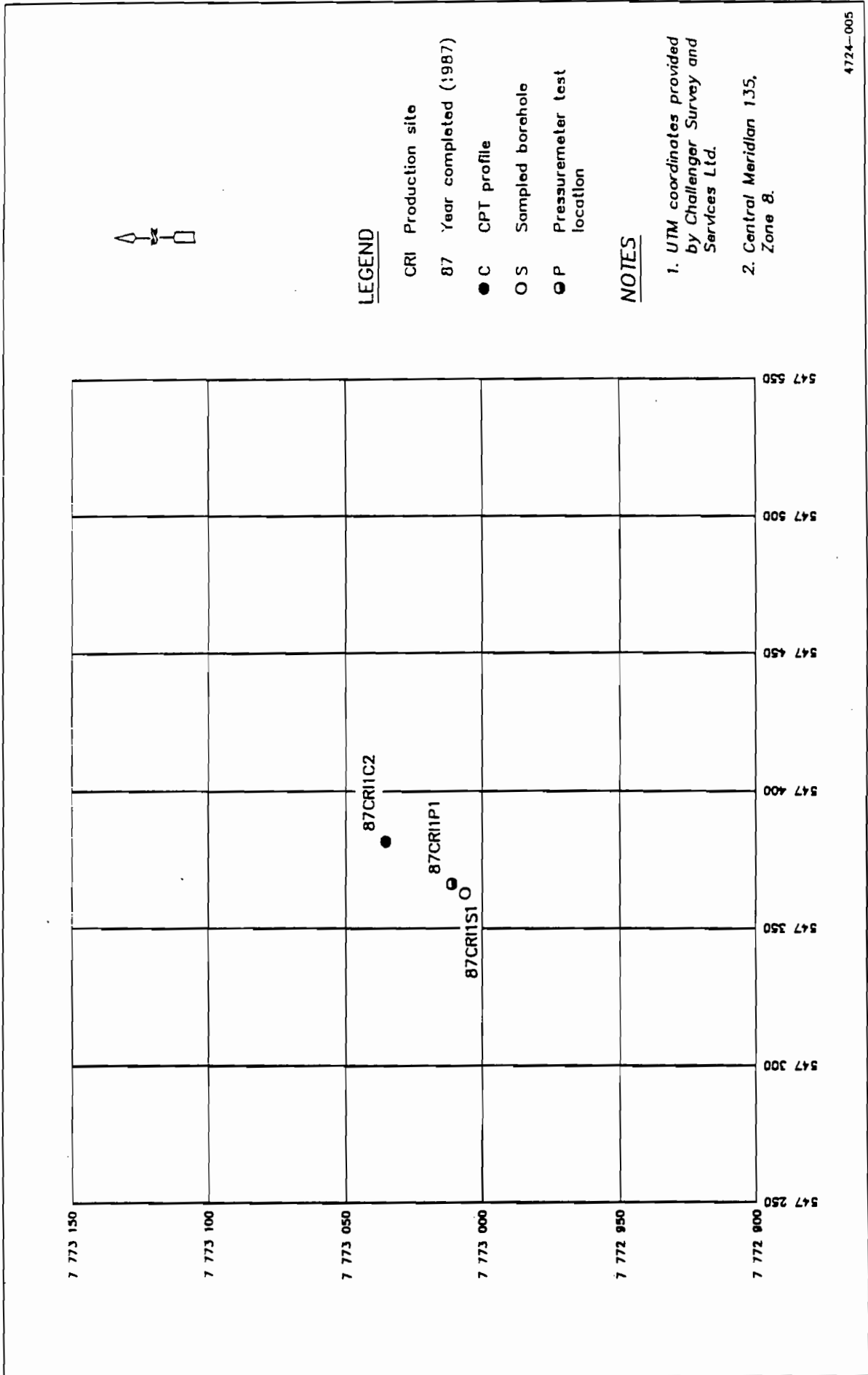
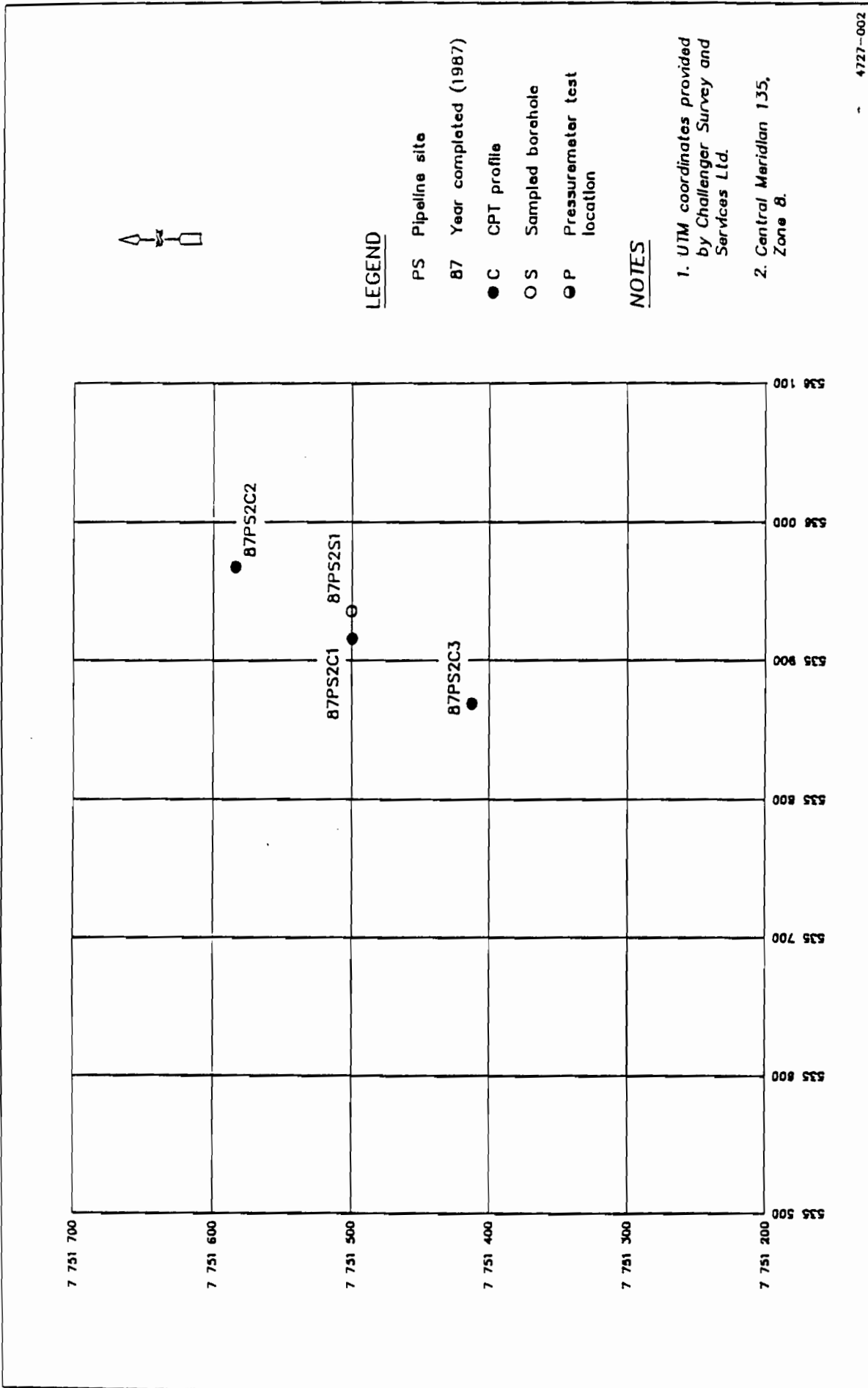


FIGURE 2 DETAILED BOREHOLE, CPT AND PRESSUREMETER LOCATIONS



4727-002

FIGURE 4 DETAILED BOREHOLE AND CPT LOCATIONS PROPOSED PIPELINE SITE 2

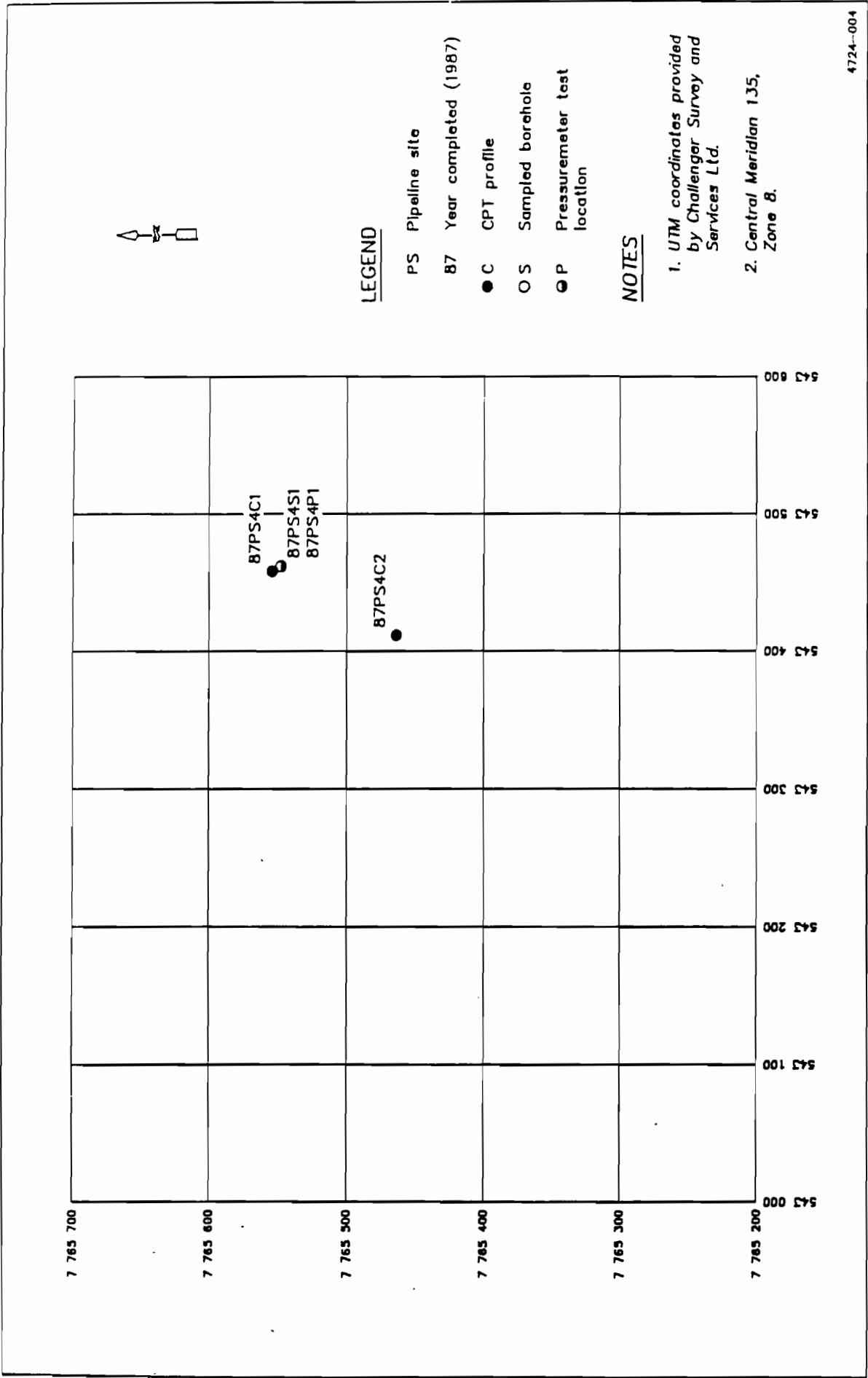


FIGURE 6 DETAILED BOREHOLE, CPT AND PRESSUREMETER LOCATIONS PROPOSED PIPELINE SITE 4

TABLE 2

UNIT	MATERIAL	DESCRIPTION	SEABED PENETRATION (metres)
87PS1	CLAY (CL)	and silt, trace sand becoming some sand with depth, homogeneous soft at surface, stiff with depth	0.0 - 5.2
	SILT (ML)	sandy, some clay to clayey, sand, homogeneous, interbedded with SAND (SM) and SILT (ML)	5.2 - 7.0
	CLAY (CL)	and silt, trace to some sand, trace shells, homogeneous, soft to stiff, low plastic	7.0 - 13.6
	SAND (SM)	some silt, trace clay, trace pebble, becoming clayey with depth, (SC), inclined soft silt interbeds, fine-grained, medium to coarse sand interbeds 2 to 5 mm thick, dense	13.6 - 18.7
	SAND (SP)	fine to medium-grained, becoming finer with depth, dense	18.7 to end of borehole
87PS2	CLAY (CL)	and silt, trace sand, homogeneous, low plastic, soft to firm	0.0 - 8.0
	SILT (MH-OL)	organics throughout, shell fragments, very thin laminae of silt and organics, fibrous, soft to firm, black	8.0 - 10.0
	SAND (SM)	silty, some clay, fine-grained dilatant, soft	10.0 to end of borehole
87PS3	CLAY (CL)	and silt, trace shells and sand, homogeneous, low plastic, becoming high plastic (CH) at 5.0 m depth, soft becoming stiff with depth	0.0 - 8.5
	SAND (SP)	fine to medium-grained, dense	8.5 - 11.0
	CLAY (CL)	and silt, trace sand and shells, black fibrous organic zones, soft	11.0 - 12.7
	SAND (SP-SM)	trace silt, trace shells, fine-grained, dense, becoming SAND (SP) by 18.0 m, with isolated gravel pieces, dense	12.7 to end of borehole
87PS4	CLAY (CH)	and silt, homogeneous, very soft	0.0 - 3.0
	CLAY (CL)	and silt, very thin parallel and curved laminae, occasional thin sand lense interbedded, firm	3.0 - 13.5
	SAND (SP)	trace clay, abundant shells, fine-grained, dense	13.5 to end of borehole

APPENDIX A

BOREHOLE LOGS

- **Proposed Production Site**
- **Proposed Pipeline Route**



PROPOSED PRODUCTION SITE



ANALOGAK PRODUCTION SITE
GULF CANADA RESOURCES LTD.

WATER DEPTH: 31.4 metres
UTM COORD: 7,773,016N, 547,475E ZONE 8

DEPTH (m)	SAMPLE TYP NO. Q	SOIL DESCRIPTION	GROUND ICE DESCRIPTION	TEMP C	PLASTICITY		SPECIAL TESTS	UNIT
					WATER CONTENT (%)	LIQUID LIMIT		
0	1A	CLAY (CH) - homogeneous, wet, very soft, high plasticity, olive-grey to dark grey (5Y 4/2)		-2.7	45	80		1
3	2A, 2B	- moist to wet, soft		-2.7	45	80		1
6	3A, 3B	- trace shells, very dark grey		-1.8	45	80		1
9	4A, 4B	SAND (SM) - silty, trace of clay, fine-grained, damp to moist, grey-brown		-3.2	45	80		1
12	5A	- 90 mm thick sandy clay seam at 12.3 m		-0.78	45	80		1
15	6A, 6B	- 125 mm thick silt layer at 15.6 m		0.04	45	80		2a
17	7A	- Driller's Note: hard drill at 16.7 m						2a
18	7A, 7B	- 225 mm thick sand-silt layer at 17.8 m, soft, wet, dilatant		-0.53	45	80		2a

DRILL RIG: SIMCO 5000/ARCTIC KIGGIAK
COMPLETION DEPTH 64.1 m
Completed 23:30 87-09-06
Compiled by BAB JWC

EBA ENGINEERING CONSULTANTS LTD.
EDMONTON ALBERTA
DRAWING NUMBER
47248-1

THIN WALL NO RECOVERY BAG

SAMPLE TYPE
HAMMER

BOREHOLE NUMBER
87CRIS 1

PAGE 1 OF 4

BOREHOLE LOG AND LABORATORY TEST RESULTS

AMALUJAK PRODUCTION SITE		WATER DEPTH: 31.4 metres	
GULF CANADA RESOURCES LTD.		UTM COORD: 7,773,016N, 547,475E ZONE 8	
SAMPLE	SOIL DESCRIPTION	GROUND ICE DESCRIPTION	TEMP C
140	damp, firm, low to medium plasticity, fissured structure, very dark grey		-1.2
15A 15B	- fissured and blockey structure, trace shells, medium plasticity, stiff, damp, dark grey CLAY (CL) - and silt, trace of shells, fissured and blockey structure, damp, stiff, low to medium plasticity, dark grey		-1.1
16A 16B	- stiff to very stiff		-0.43
17A		Vr/Vc	2.35
18A	CLAY (CH) - and silt, trace of shells, thin black organic layers, visible veinlets of ice, very stiff, thin curved laminae, high plasticity, dark grey, white specks (soils)		.78
19A	- very thin parallel curved laminae - visible veinlets of ice, thin organic layers, shell fragments		0.04
20A	- 1-2 mm thin fine sand seams, very thin curved laminae, stiff to very stiff		

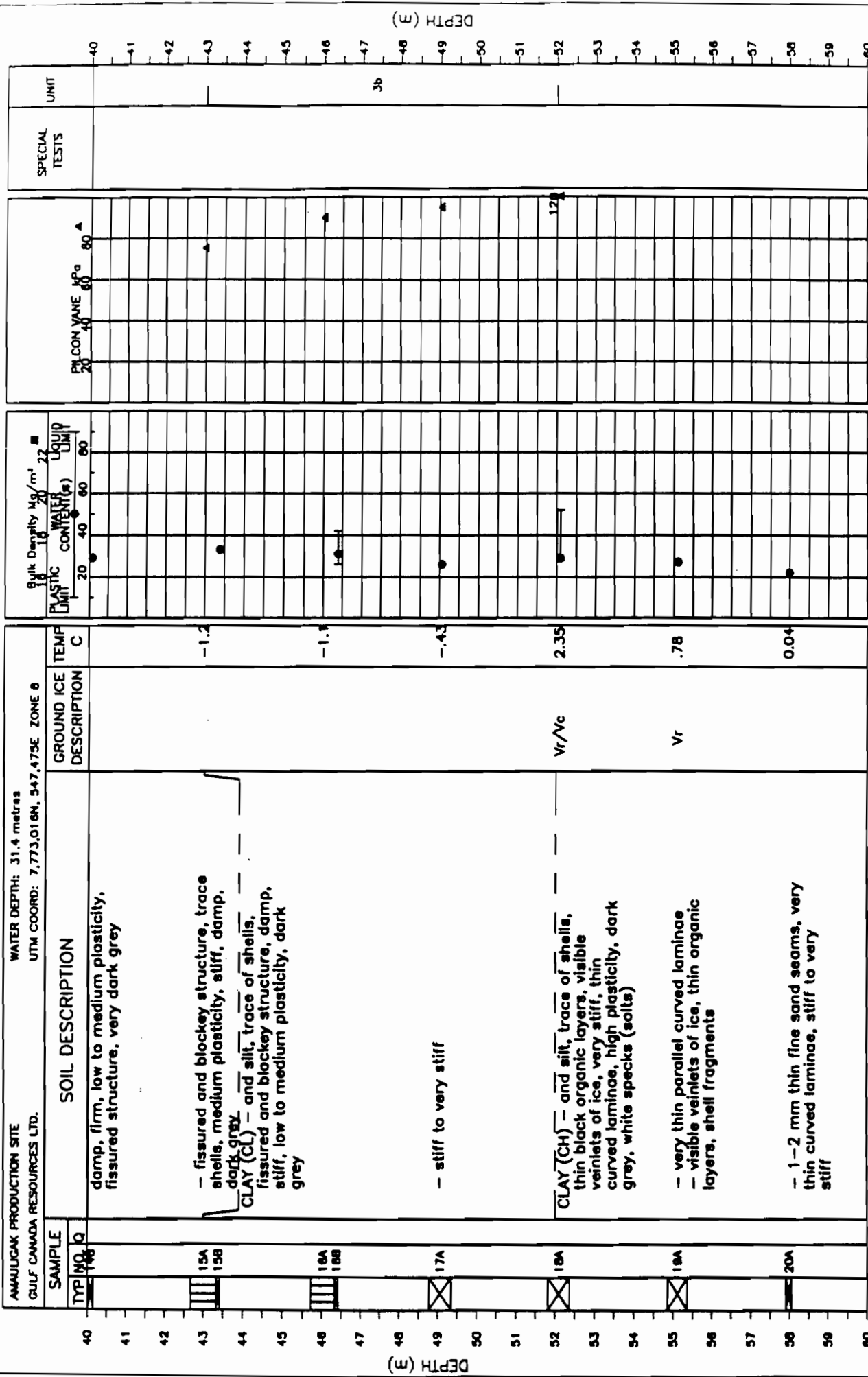
DRILL RIG: SIMCO 5000/ARCTIC KIGGIK
 COMPLETION DEPTH 64.1 m
 Completed 23:30 87-09-08
 Compiled by BAB JWC

SAMPLE TYPE: HAMMER
 THIN WALL
 NO RECOVERY
 BAG

EBA ENGINEERING CONSULTANTS LTD.
 EDMONTON ALBERTA
 DRAWING NUMBER 4724B-1

BOREHOLE NUMBER 87CRIS1
 PAGE 3 OF 4

BOREHOLE LOG AND LABORATORY TEST RESULTS



SPECIAL TESTS

UNIT

36

HAUJG

PELINE

E SITE

W

DEPTH

.metre

PROPOSED PIPELINE ROUTE



AMALUJAK PIPELINE ROUTE SITE 1
GULF CANADA RESOURCES LTD.

WATER DEPTH: 5.8 metres
UTM COORD: 7,743,749N, 531,743E ZONE 6

SAMPLE
TYP NO. Q

SOIL DESCRIPTION

GROUND ICE
DESCRIPTION

TEMP
C

PLASTIC
LIMIT

LIQUID
LIMIT

WATER
CONTENT (%)

Bulk Density Mg/m³

SPECIAL
TESTS

UNIT

PILCON VANE MPa

DEPTH (3)

DEPTH (3)

10

11

12

13

14

15

16

17

18

19

20

CLAY (CL) - (continued)

- some sand becoming less with depth, trace of shell fragments, interbedded fine to medium sand lenses, 5 to 15 mm thickness, pocket penetrometer resistance of 50 kPa at top

SAND (SM) - some silt; trace of clay, shells, mica flakes, and pebbles (to 15 mm dia.); inclined soft silt interbeds, 15 mm thick; medium to coarse-grained sand interbeds, 2 to 5 mm thick; dense, damp

SAND (SC) - clayey, trace of shells, fine grained, damp, olive grey

SAND (SP) - fine to medium-grained, becoming finer with depth, dense, moist, olive grey

END OF BOREHOLE 19.13 metres (-24.7 m EL)

0.72

3.10

55

0A
0B
0C

0A
0B

10A
10B

DRILL RIG: SIMCO 5000/ARCTIC KIGGIAK
COMPLETION DEPTH 19.1 m
Completed 09:00 87-09-03
Compiled by BAB JWC

THIN WALL
NO RECOVERY
BAG

SAMPLE TYPE
HAMMER

EBA ENGINEERING CONSULTANTS LTD.
EDMONTON ALBERTA
DRAWING NUMBER
47248-2

BOREHOLE
NUMBER
87PS1S1
PAGE 2 OF 2

BOREHOLE LOG AND LABORATORY TEST RESULTS

ANALUGAK PIPELINE ROUTE SITE 2
GULF CANADA RESOURCES LTD.

WATER DEPTH: 10.0 metres
UTM COORD: 7,751,498N, 535,938E ZONE 8

SAMPLE
TYP NO. 0

SOIL DESCRIPTION

SAND (SM) - silty, some clay, fine-grained, dilatant, moist, soft, grey

- dark olive grey (5Y 3/2)

- assumed fine to medium-grained sand, cleaner than above

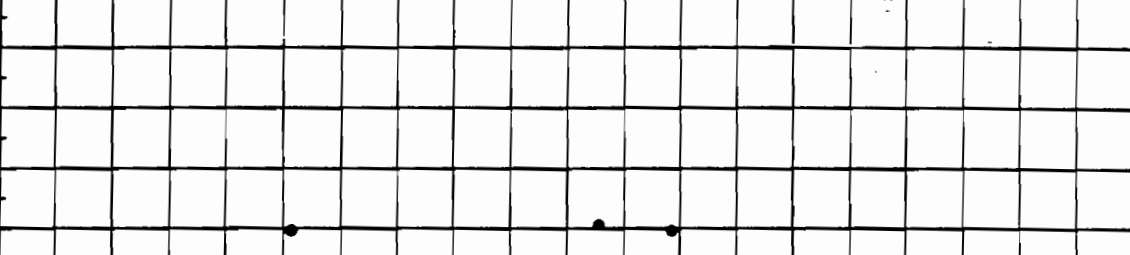
END OF BOREHOLE 19.2 metres (-29.2m EL.)

GROUND ICE TEMP DESCRIPTION C

3.92

Plastic Content

20 40 60 80



SPECIAL TESTS

UNIT

DEPTH (m) 10 11 12 13 14 15 16 17 18 19 20

DRILL RIG: SIMCO 5000/ARCTIC KIGGIAK
COMPLETION DEPTH 19.2 m
Completed 19:00 87-09-01
Compiled by BAB JWC

THIN WALL
NO RECOVERY
BAG

SAMPLE TYPE
HAMMER

EBA ENGINEERING CONSULTANTS LTD.
EDMONTON ALBERTA
DRAWING NUMBER
47248-3

BOREHOLE NUMBER
87PS2S1
PAGE 2 OF 2

BOREHOLE LOG AND LABORATORY TEST RESULTS

AMALUJAK PIPELINE ROUTE SITE 3
GULF CANADA RESOURCES LTD.

WATER DEPTH: 14.3 metres
UTM COORD: 7,758,468N, 539,674E ZONE 8

DEPTH (3)	SAMPLE TYP. NO. Q	SOIL DESCRIPTION	GROUND ICE DESCRIPTION	TEMP C	Bulk Density Mg/m ³ 22		SPECIAL TESTS	UNIT
					PLASTIC LIMIT	LIQUID LIMIT		
10		SAND (SP) - (continued)						
11		CLAY (CL) - and silt, trace of sand and shells, homogeneous, brown oxide stains, black fibrous organic zones, moist, soft, top 130 mm dark grey, remainder of sample is black		3.33				
12	8A 8B 8C	SAND (SP-SM) - trace of silt, trace shells and mica platelets, fine-grained, dense moist to wet, dark grey						
13		- moist, very dark grey brown (10yr 3/2)						
14								
15								
16	9A							
17								
18	10A 10B	SAND (SP) - isolated gravel to 20 mm diameter, fine-grained, poorly graded, moist, dense, grey brown		1.25				
19		END OF BOREHOLE 18.9 metres (-33.2 m EL.)						
20								

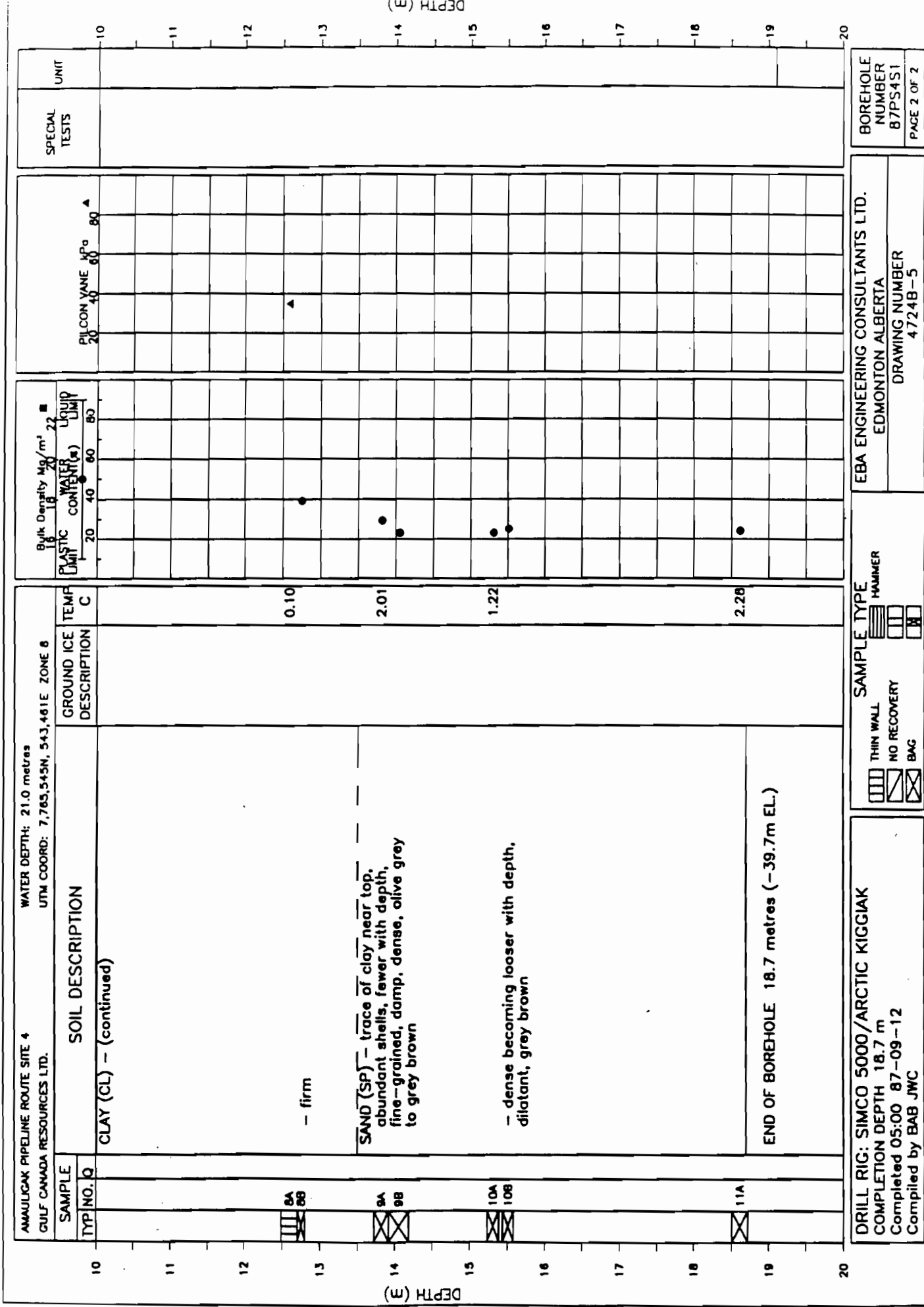
DRILL RIG: SIMCO 5000/ARCTIC KIGGIK
COMPLETION DEPTH 18.9 m
Completed 05:30 87-09-04
Compiled by BAB JWC

THIN WALL HAMMER
NO RECOVERY
BAG

EBA ENGINEERING CONSULTANTS LTD.
EDMONTON ALBERTA
DRAWING NUMBER
4724B-4

BOREHOLE
NUMBER
87PS3S1
PAGE 2 OF 2

BOREHOLE LOG AND LABORATORY TEST RESULTS



BOREHOLE LOG AND LABORATORY TEST RESULTS

DRILL RIG: SIMCO 5000/ARCTIC KIGGIAK
 COMPLETION DEPTH 18.7 m
 Completed 05:00 87-09-12
 Compiled by BAB JWC

THIN WALL
 NO RECOVERY
 BAG

SAMPLE TYPE
 HAMMER
 NO RECOVERY
 BAG

EBA ENGINEERING CONSULTANTS LTD.
 EDMONTON ALBERTA
 DRAWING NUMBER
 47248-5

BOREHOLE NUMBER
 87PS4S1
 PAGE 2 OF 2

AMALUJAK PIPELINE ROUTE SITE 4
 GULF CANADA RESOURCES LTD.

WATER DEPTH: 21.0 metres
 UTM COORD: 7,785,545N, 543,461E, ZONE 8

SOIL DESCRIPTION

GROUND ICE DESCRIPTION

TEMP C

Bulk Density Mg/m³
 PLASTIC LIMIT (%)
 LIQUID LIMIT (%)

PORE CONE VALUE (kPa)

SPECIAL TESTS

UNIT

DEPTH (m)

DEPTH (m)

APPENDIX B

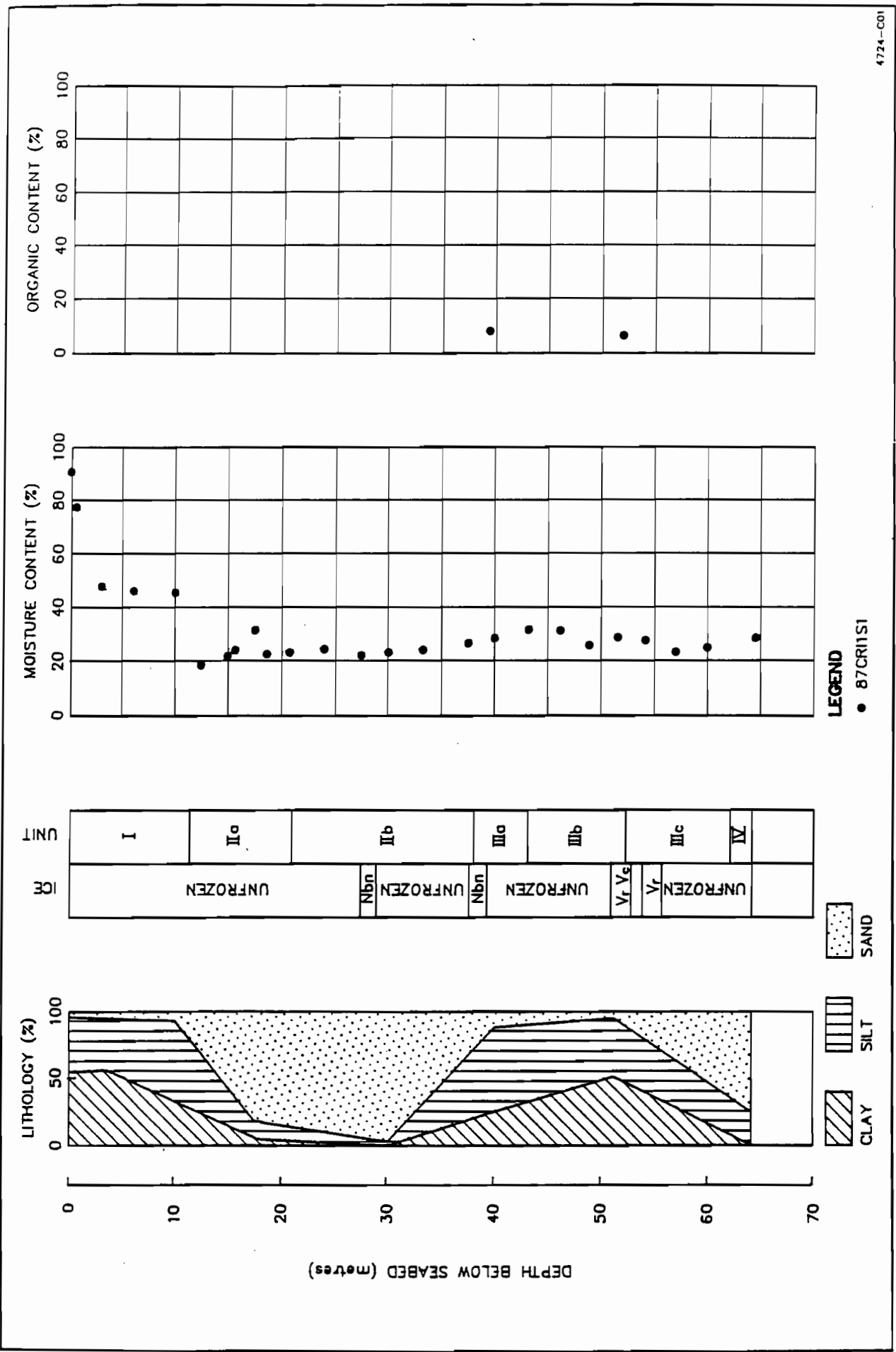
DIAGNOSTIC PROFILES

- Proposed Production Site
- Proposed Pipeline Route



PROPOSED PRODUCTION SITE





4774-C01

FIGURE C.1 MOISTURE CONTENT AND ORGANIC CONTENT PROFILES PROPOSED AMAULGAK PRODUCTION SITE

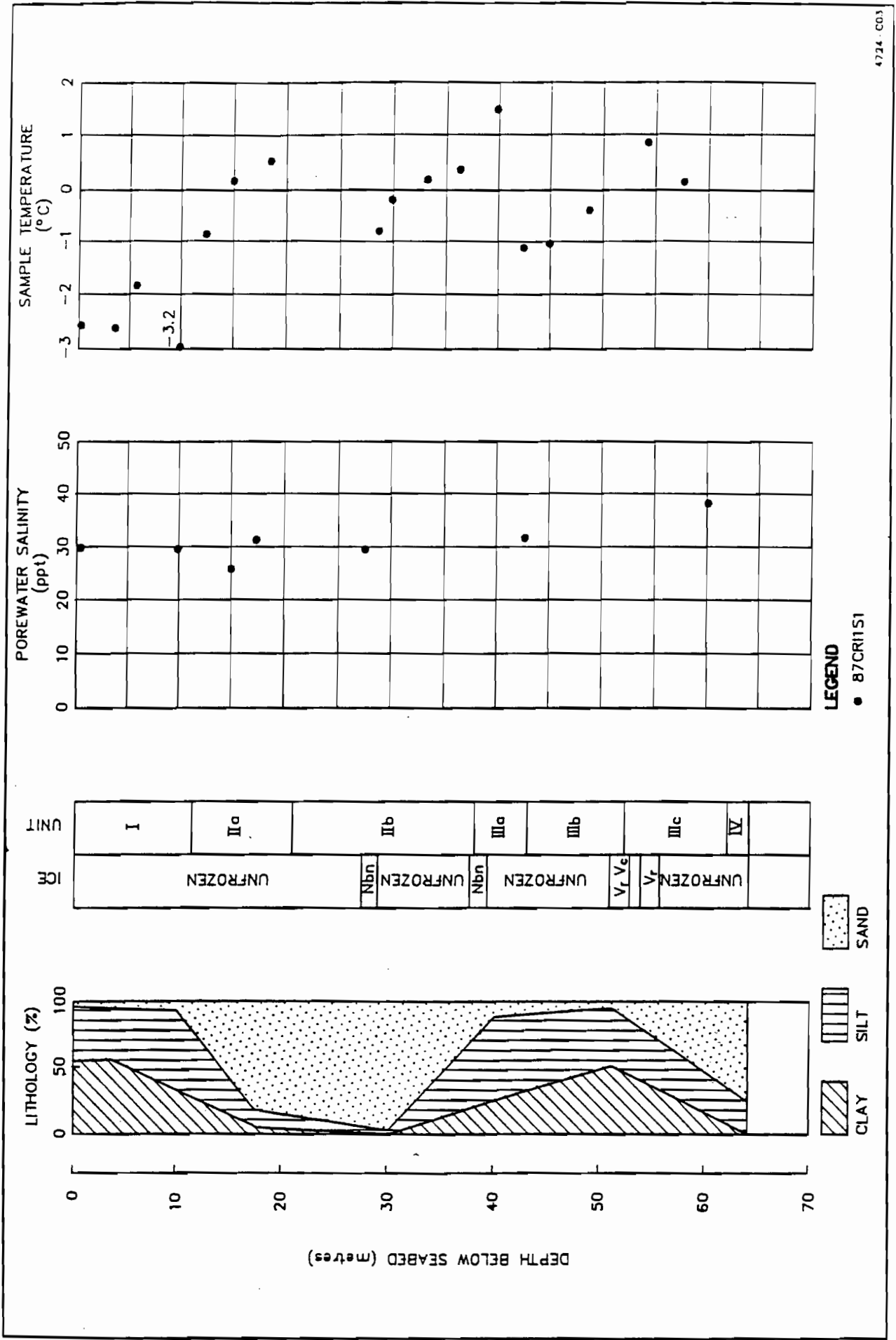
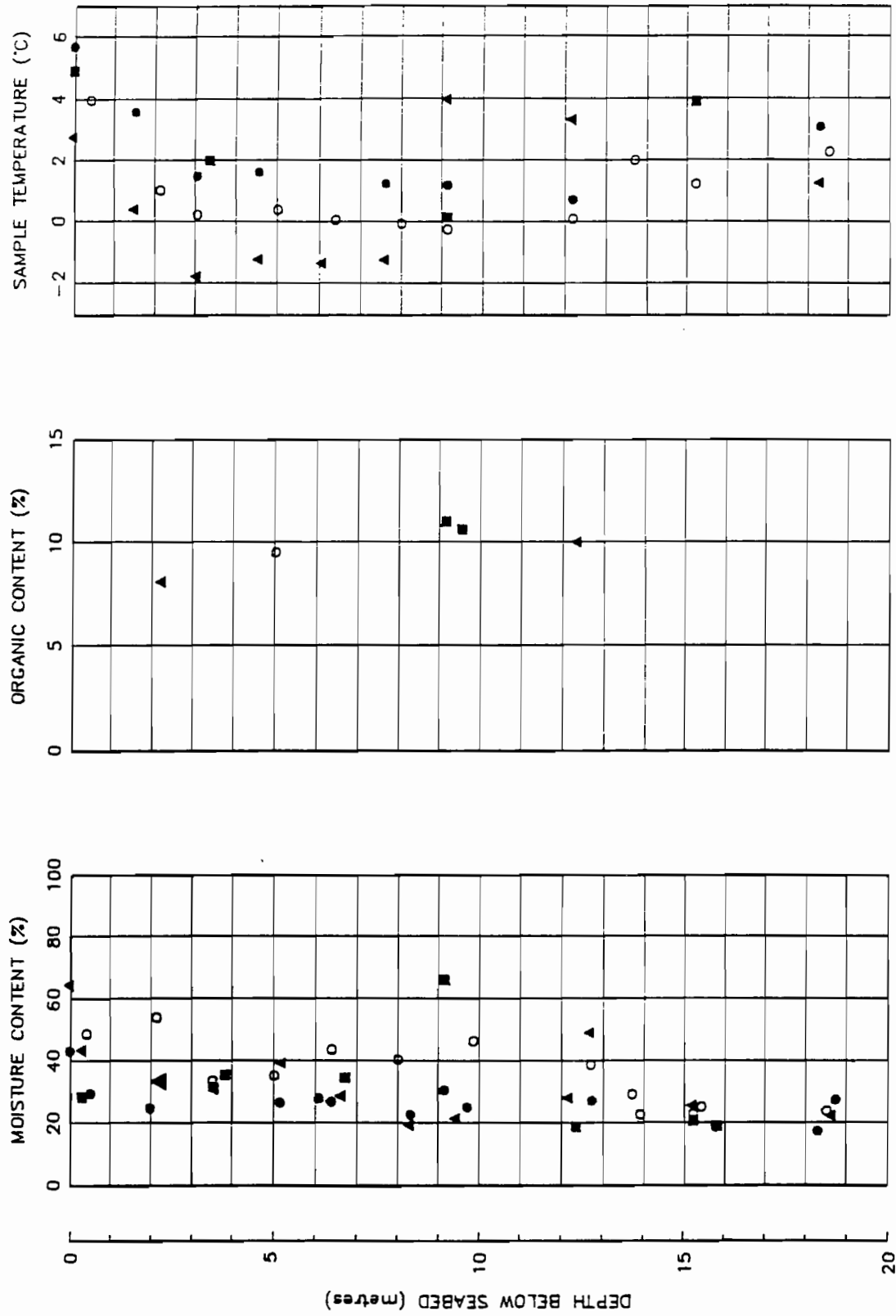


FIGURE C.3 POREWATER SALINITY PROFILE AND SAMPLE TEMPERATURE PROFILE PROPOSED AMAULGAK PRODUCTION SITE

PROPOSED PIPELINE ROUTE





LEGEND

- 87PS1S1
- 87PS2S1
- ▲ 87PS3S1
- 87PS4S1

FIGURE C.5 MOISTURE CONTENT, ORGANIC CONTENT AND SAMPLE TEMPERATURE PROFILES PROPOSED AMAULIGAK PIPELINE ROUTE

APPENDIX C

SUMMARY OF LABORATORY TESTING

- Proposed Production Site
- Proposed Pipeline Route



PROPOSED PRODUCTION SITE



SUMMARY OF TEST RESULTS

Sample Number	Depth (metres) * Sample Photographed	Unified Soil Classification	Ground Ice Description (%)	Temp. (C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density	ATTERBERG LIMITS				GRAIN SIZE DISTRIBUTION				SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS		TEST RESULTS TABLE REF
								Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₅₀ (mm)	Test	Shear Strength (kPa)	Failure Strain (%)	Consistency	P _v (kPa)	C _c	
Borehole 87CR1111																					
1A B	0.0 - 0.05				90.9																
1B T	0.05 - 0.45			-2.7																	
1C B	0.45 - 0.51	CH			78.6																
2A T	3.05 - 3.91			-2.7																	
2B B	3.91 - 3.96	CH			48.8																
2C G	3.91 - 3.96																				
3A T	6.09 - 6.60			-1.8																	
3B B	6.60 - 6.65				46.6																
4A T	9.14 - 10.00			-3.2																	
4B B	10.00 - 10.05	CH			46.5																
4C G	10.00 - 10.05																				
5A B	12.19 - 12.34			-0.78																	
5B B	12.34 - 12.45																				
5C B	12.45 - 12.75				18.8																
6A B	15.24 - 15.39	SM		+0.04	21.9																
6B B	15.39 - 15.64				24.1																
6C B	15.64 - 15.77	SM																			
6D B	15.77 - 16.03																				
7A B	17.67 - 17.83																				
7B B	17.83 - 18.06	SM		+0.53	31.8																

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 : Minivane
 FC : Fall Cone
 TV : Torvane
 PV : Pilcon Vane
 RV : Remote Vane

UU : Unconsolidated Undrained Triaxial
 UUp : UU Triaxial with Pore Pressure Measurements
 CU : Consolidated Undrained Triaxial
 CUup : CU Triaxial with Pore Pressure Measurements
 CD : Consolidated Drained Triaxial

O : Organic Content
 S : Salinity
 TS : Thaw Strain
 SG : Specific Gravity

Project Number: 0101-4724

Reviewed By: _____ P. Eng.

PROPOSED PIPELINE ROUTE



SUMMARY OF TEST RESULTS

Sample Number	Depth (METERS) *Sample Photographed	Unified Soil Classification	Ground Ice Description (%)	Temp. (C)	Moisture (%)	Frozen Moisture (%)	Bulk Density	GRAIN SIZE DISTRIBUTION				SHEAR STRENGTH			CONSOLIDATION CHARACTERISTICS		
								Liquid Limit (%)	Plastic Limit (%)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	D ₆₀ (µm)	Test	Shear Strength (kPa)	Failure Strain (%)
Borehole 87PS1S1																	
1A	B	0.00- 0.15		+5.70	43.1												
1B	T	0.15- 0.51															
1C	B	0.51- 0.61			29.4												
2A	T	1.52- 1.98		+3.60													
2B	B	1.98- 2.03			24.7												
3A	T	3.05- 3.51		+1.48													
3B	B	3.51- 3.56			31.4												
4A	T	4.57- 5.18		+1.62													
4B	B	5.18- 5.23			26.4												
5A	B	6.10- 6.15			27.9												
5B	B	6.15- 6.40			26.7												
5C	B	6.40- 6.50															
6A	T	7.62- 8.33		+1.25													
6B	B	8.33- 8.38			22.6												
7A	T	9.14- 9.70		+1.20	30.6												
7B	B	9.70- 9.75			25.0												
8A	B	12.19-12.42		+0.72													
8B	B	12.42-12.73															
8C	B	12.73-13.03			27.1												
9A	B	15.24-15.47			20.7												

LEGEND AND NOTES	
B	Bag Sample
G	Gas Sample
L	Linear Sample
P	Piston Sample
NR	No Recovery
NS	No Sample Remaining
C	Frozen Core
PW	Porewater Sample
T	Sample Stored in Tube
W	Wand Sample
RC	Radioactive sample
MV	Minevene
FC	Fall Cons
TV	Torvene
PV	Piston Vane
RV	Remote 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

SUMMARY OF TEST RESULTS

Sample Number	Depth (meters) *Sample Photograph	Unified Soil Classification	Ground Ice Description (%)	Temp. (C)	Moisture Content (%)	Frozen Moisture Content (%)	Bulk Density	ATTERBERG LIMITS				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 _v (kPa)	C _c		
Borehole 87PS3S1																						
1A	B	0.0 - 0.05		+2.77	64.5			49	27	46.5	51.0	2.5	-	2.5		PV	20.0		Soft			
1B	T	0.05 - 0.31			43.5																	
1C	B	0.31 - 0.38		+0.40	33.4																	
2A	T	1.52 - 2.23		-1.78	30.9																	
2B	B	2.23 - 2.28																				
3A	T	3.05 - 3.56		-1.23	39.2			50	27	48.8	50.6	0.6	-	2.0		PV	30.0		Firm			
3B	B	3.56 - 3.61			28.6																	
4A	T	4.57 - 5.23		-1.23	19.3																	
4B	B	5.23 - 5.28																				
5A	R	6.10 - 6.66		-1.34	21.5																	
5B	B	6.66 - 6.71			28.1																	
6A	B	7.62 - 8.33		+3.99																		
6B	H	8.33 - 8.38																				
7A	B	9.14 - 9.45		+3.33																		
7B	R	9.45 - 9.55																				
8A	B	12.19 - 12.34			49.1			42	22	36.0	57.4	6.6	-	5								
8B	R	12.34 - 12.70			25.5																	
8C	B	12.70 - 12.85																				
9A	R	15.24 - 15.85																				
10A	B	18.29 - 18.64		+1.25																		

LEGEND AND NOTES

R	Reg Sample	C	Frozen Core	MV	Minivane	UU	Unconsolidated Undrained Triaxial	O	Organic Content
G	Gas Sample	PW	Porewater Sample	FC	Fall Cone	UU _p	UU Triaxial with Pore Pressure Measurements	S	Salinity
L	Liner Sample	T	Sample Stored in Tulle	TV	Torvane	CU	Consolidated Undrained Triaxial	TS	Thaw Strain
P	Piston Sample	W	Was-not Sample	PV	Piston Vane	CU _p	CU Triaxial with Pore Pressure Measurements	SG	Specific Gravity
NR	No Recovery	RC	Radiorcarbon sample	RV	Remote Vane	CD	Consolidated Drained Triaxial		
NS	No Sample Remaining								

Project Number: 0101-4724 Reviewed By: _____ P. Eng. Page 3 of 4

APPENDIX D

PARTICLE SIZE ANALYSIS

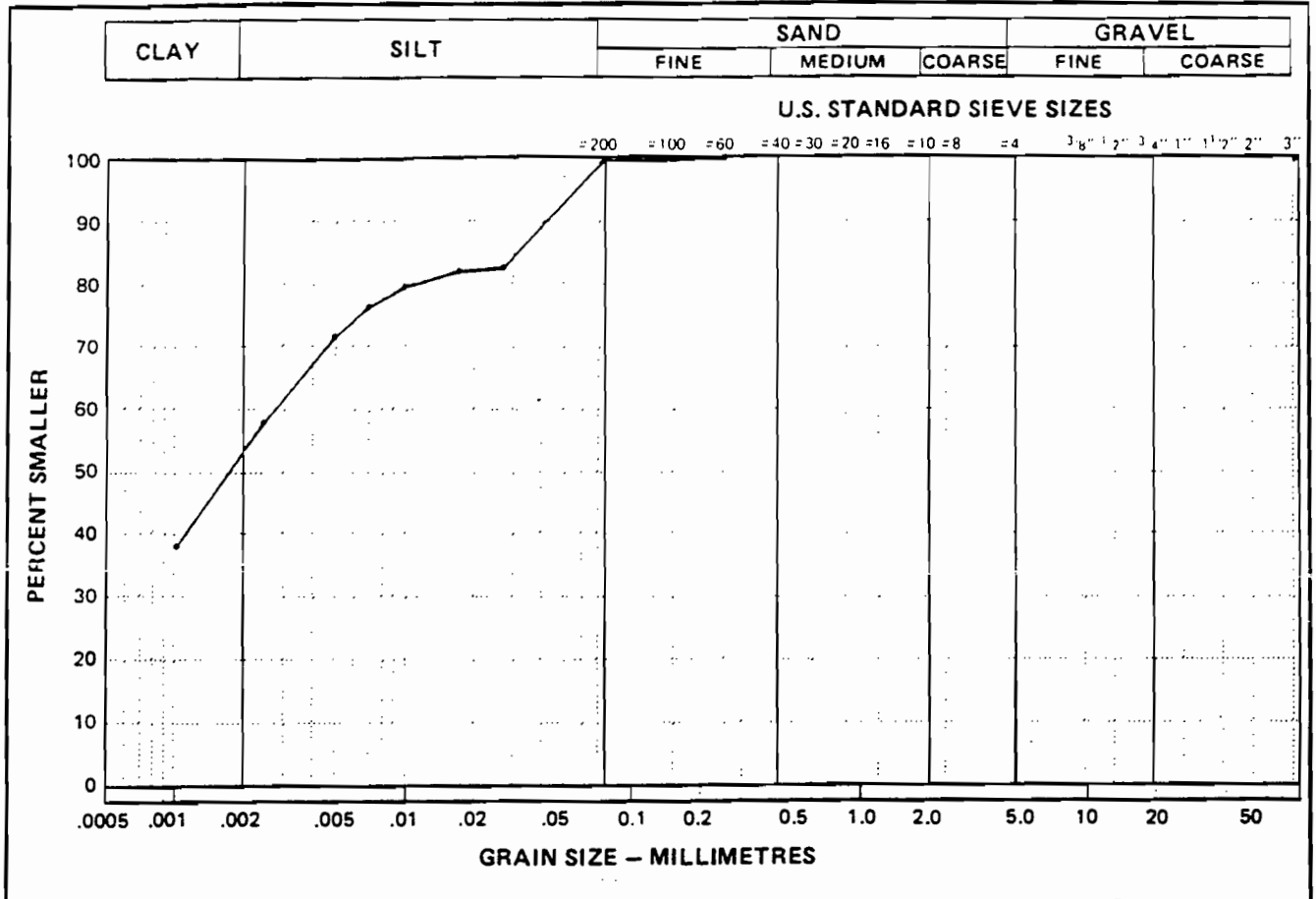
- Proposed Production Site
- Proposed Pipeline Route



PROPOSED PRODUCTION SITE



PARTICLE - SIZE ANALYSIS OF SOILS

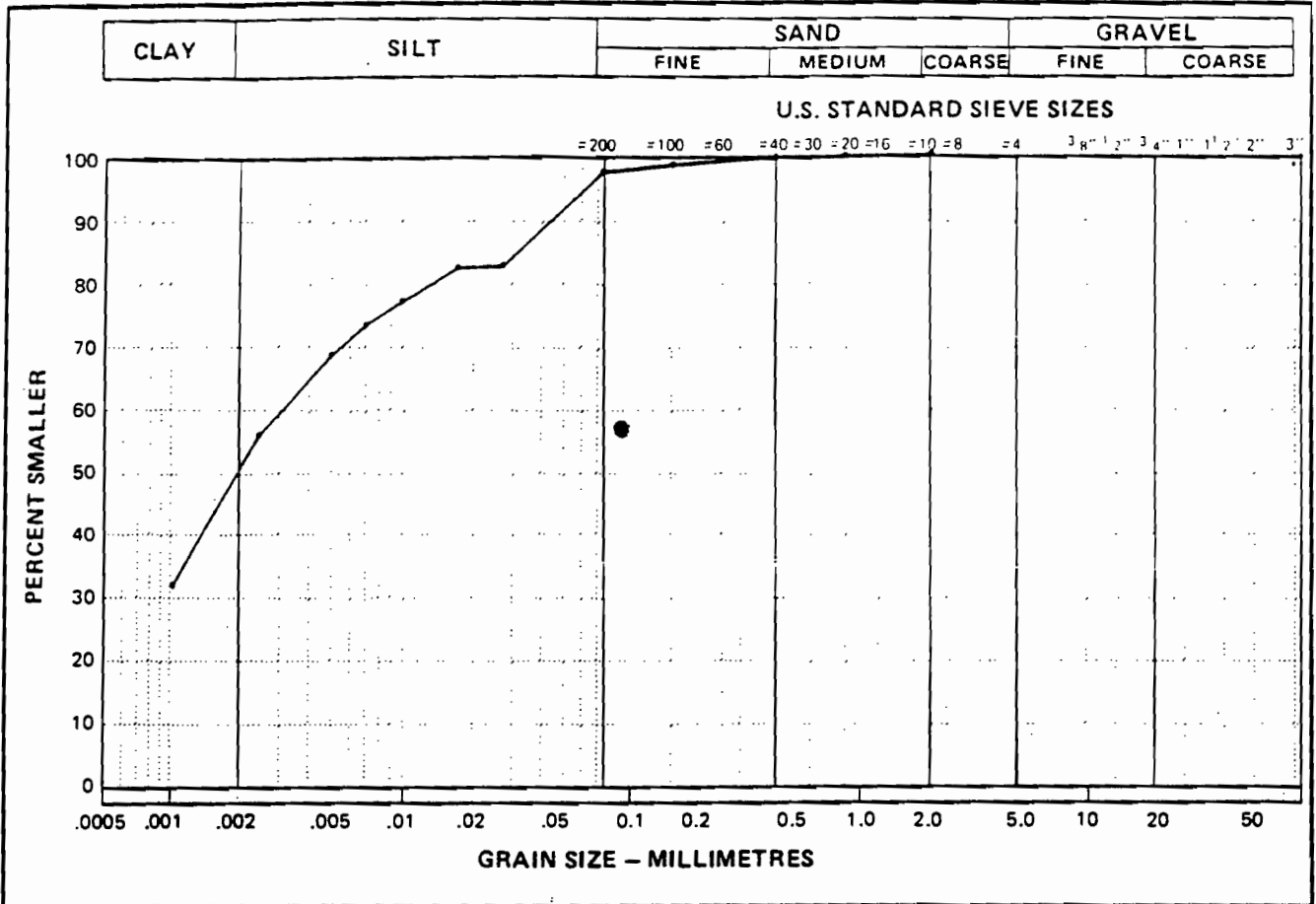


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	B7CRI1S1	.49 - .55	53.6	46.1	.3	0.0	-	-	-

JOB NO. 101 -4724

DATE 87-10-13

PARTICLE - SIZE ANALYSIS OF SOILS

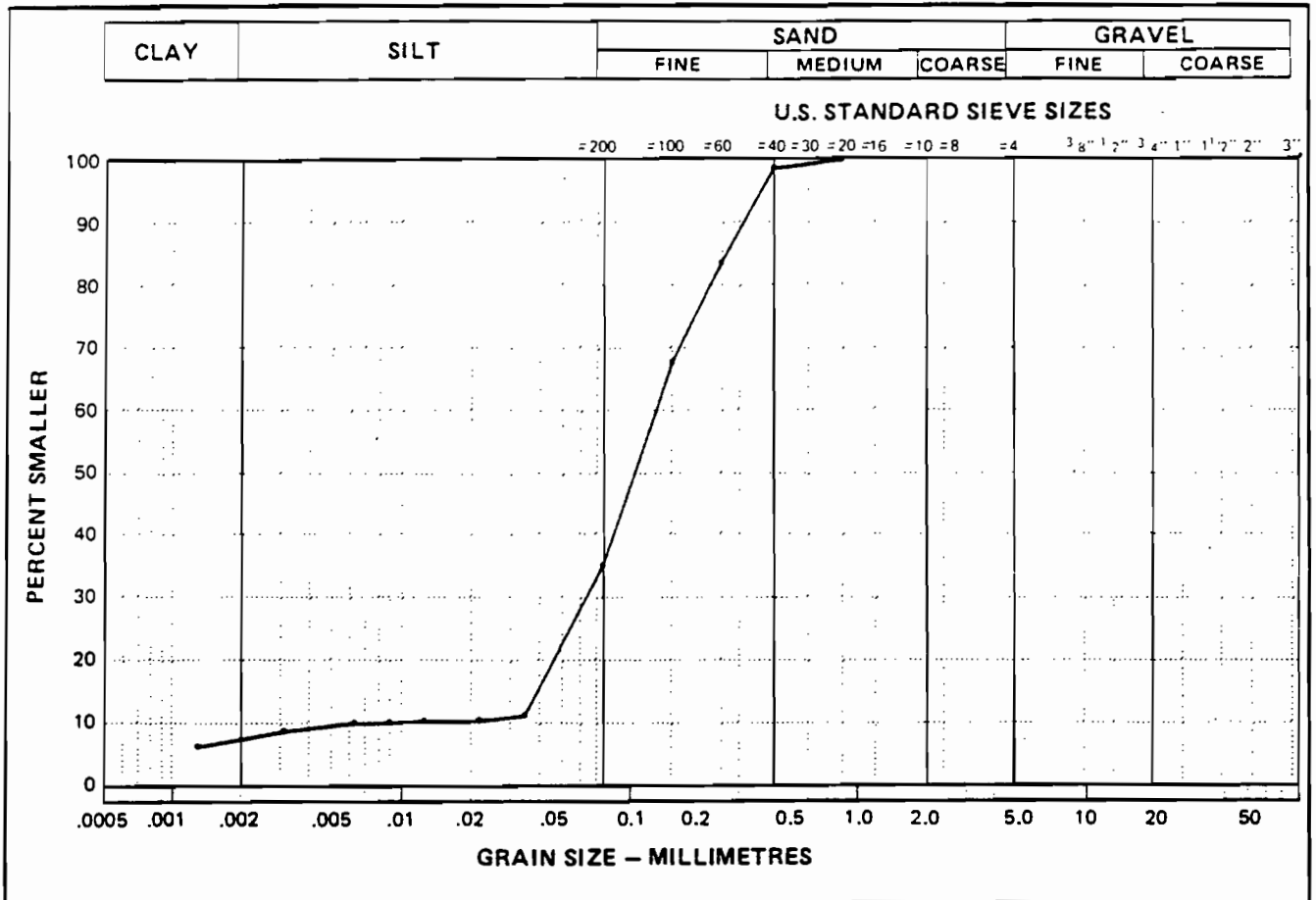


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87CRI1S1	9.76 - 10.04	50.4	47.0	2.6	0.0	-	-	-

JOB NO. 101 -4724

DATE 87-10-13

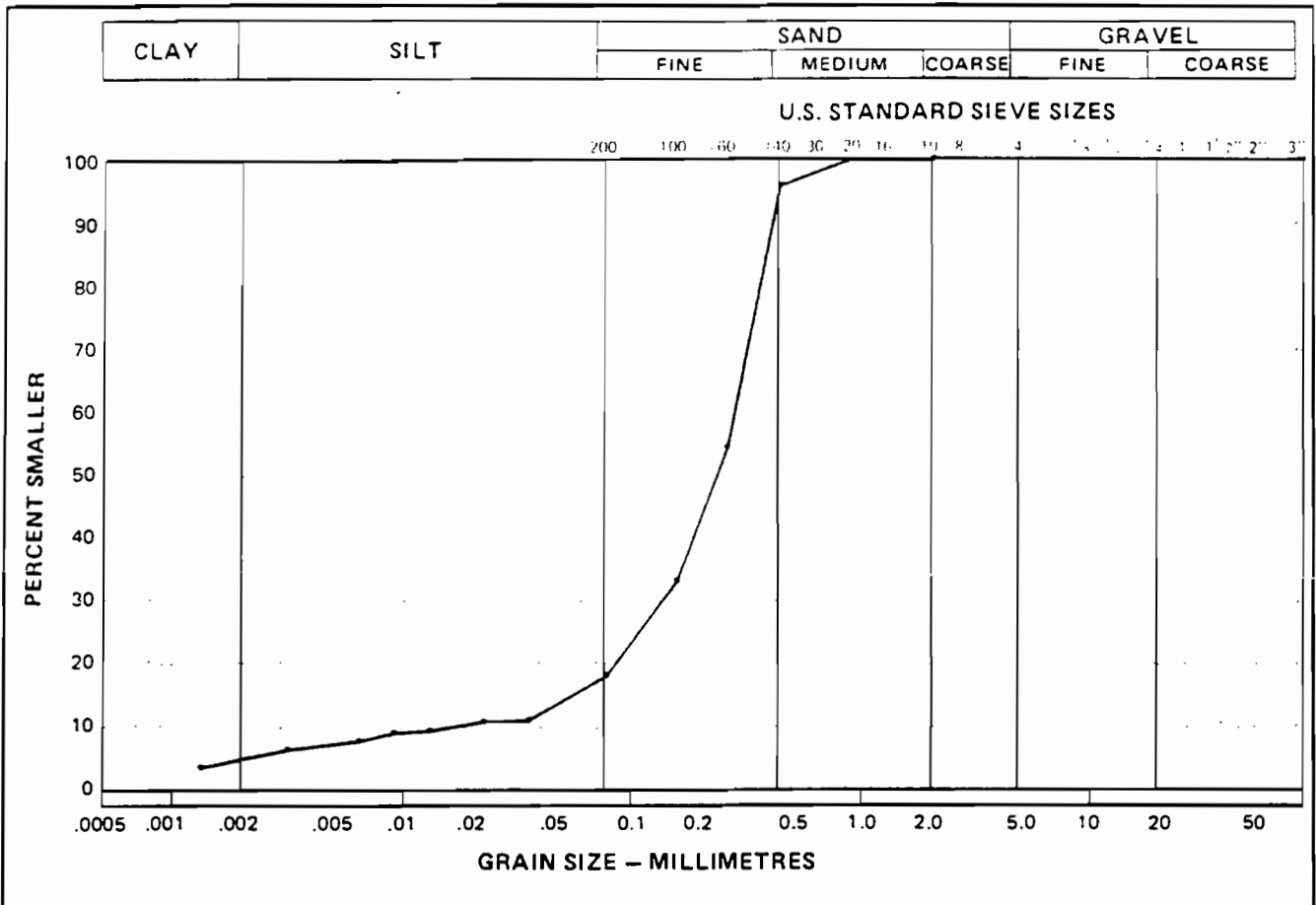
PARTICLE - SIZE ANALYSIS OF SOILS



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87CR11S1	15.63 - 15.78	7.5	27.4	65.1	0.0	20.4	5.0	SM

JOB NO. 101 -4724 DATE 87-10-14

PARTICLE SIZE ANALYSIS OF SOILS

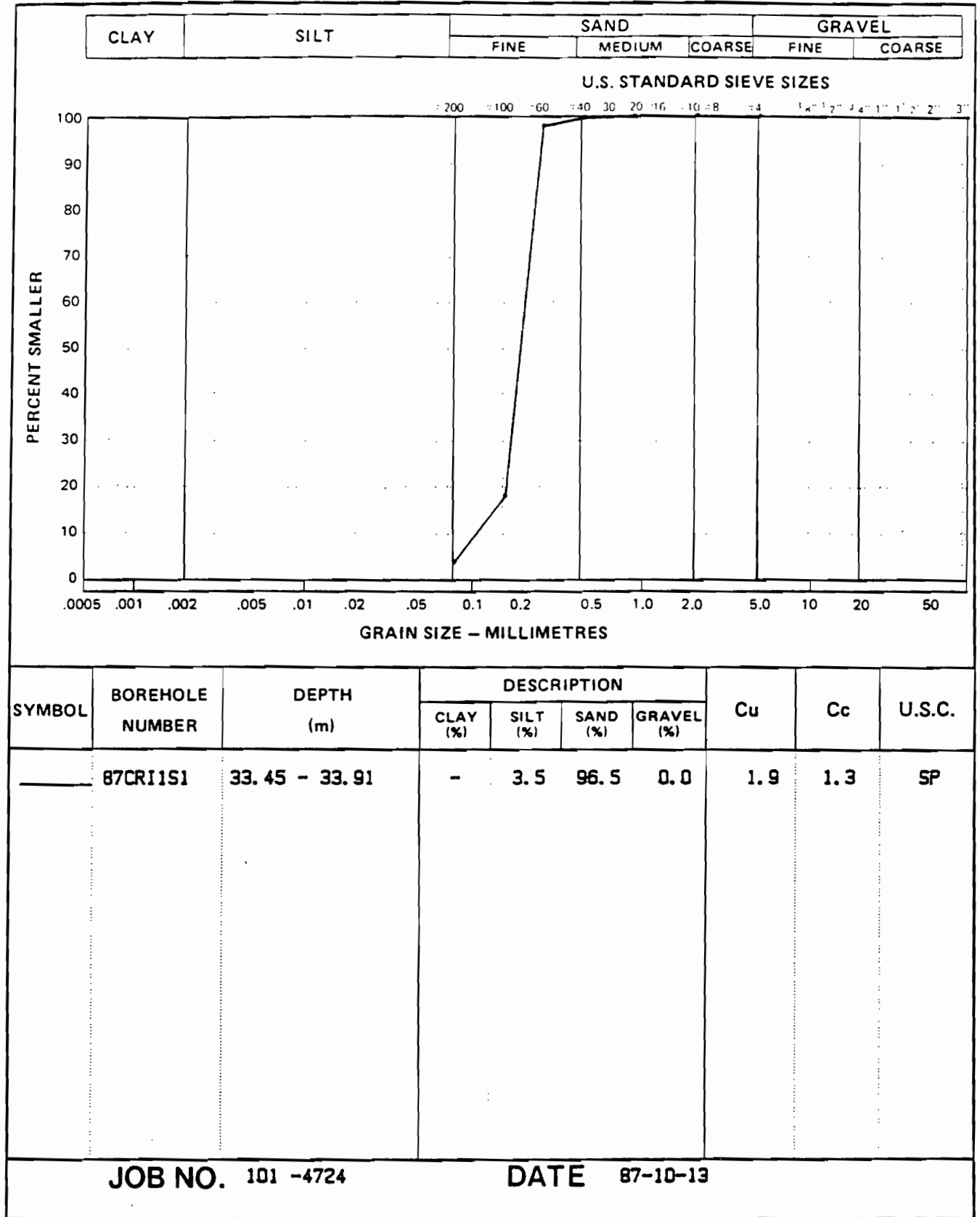


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87CRI1S1	18.03 - 18.25	5.3	12.7	82.0	0.0	17.9	4.2	SM

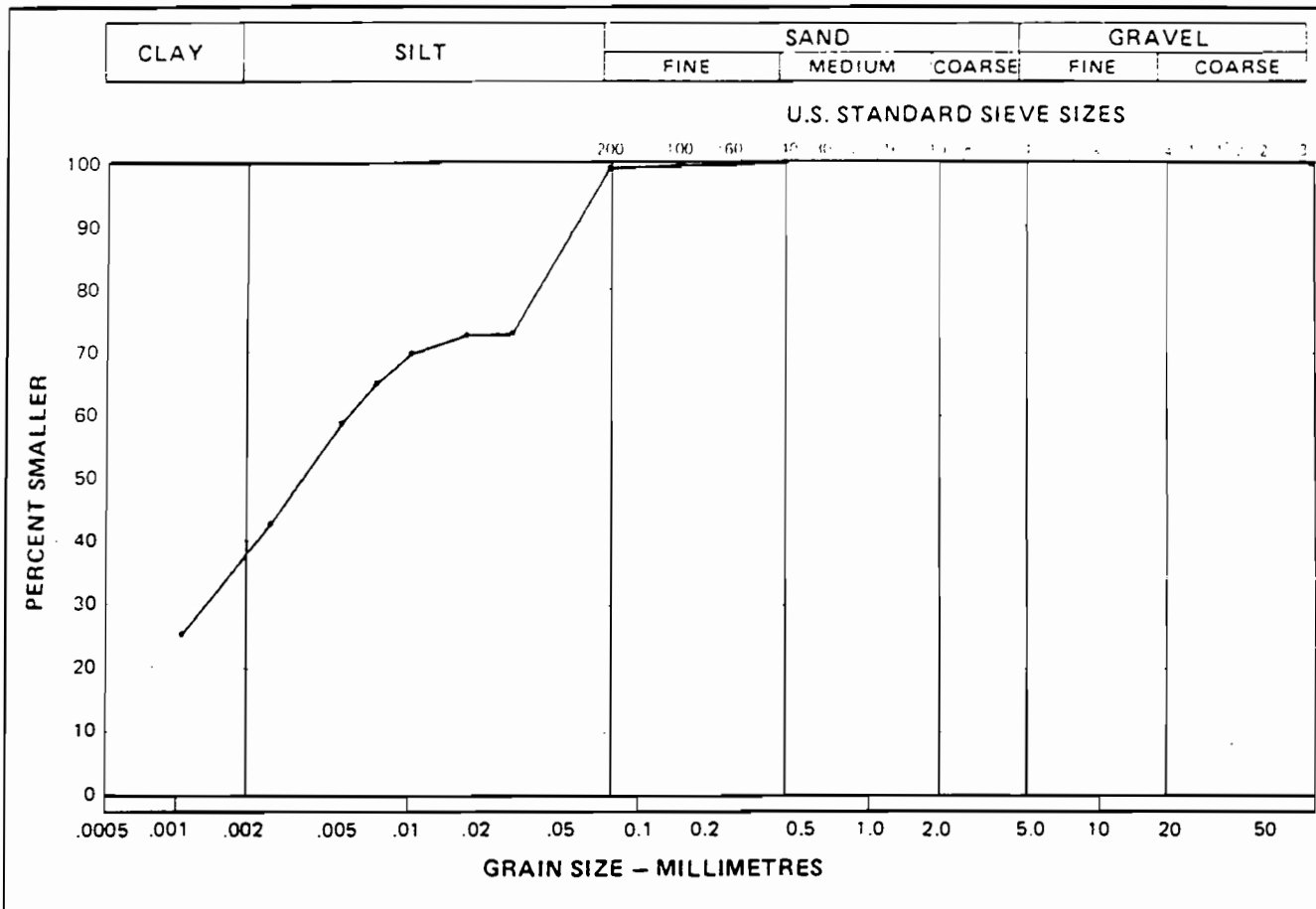
JOB NO. 101 -4724

DATE 87-10-13

PARTICLE - SIZE ANALYSIS OF SOILS



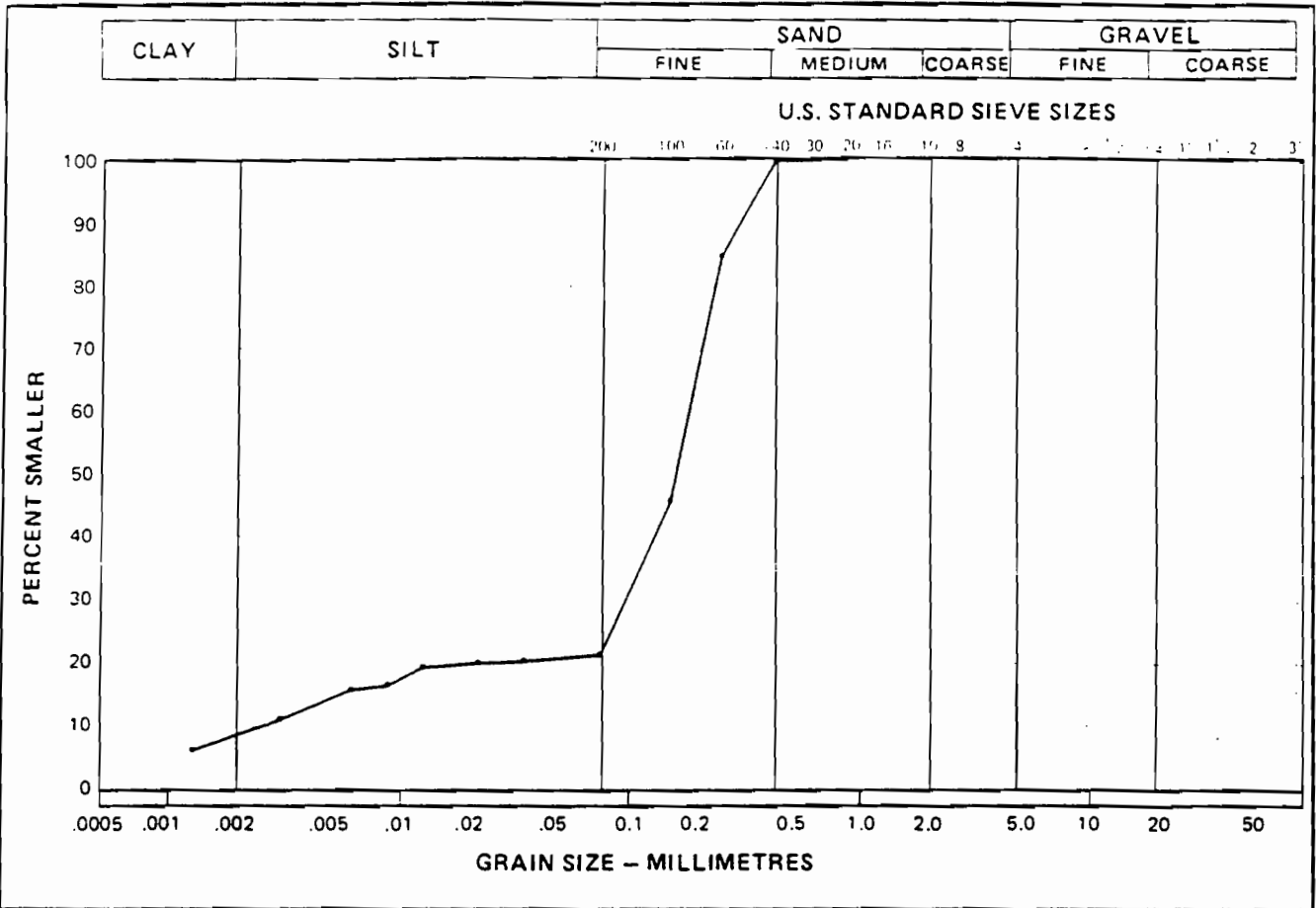
PARTICLE SIZE ANALYSIS OF SOILS



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87CR11S1	46.22 - 46.34	38.1	61.1	.8	0.0	-	-	-

JOB NO. 101 -4724 DATE 87-10-13

PARTICLE - SIZE ANALYSIS OF SOILS



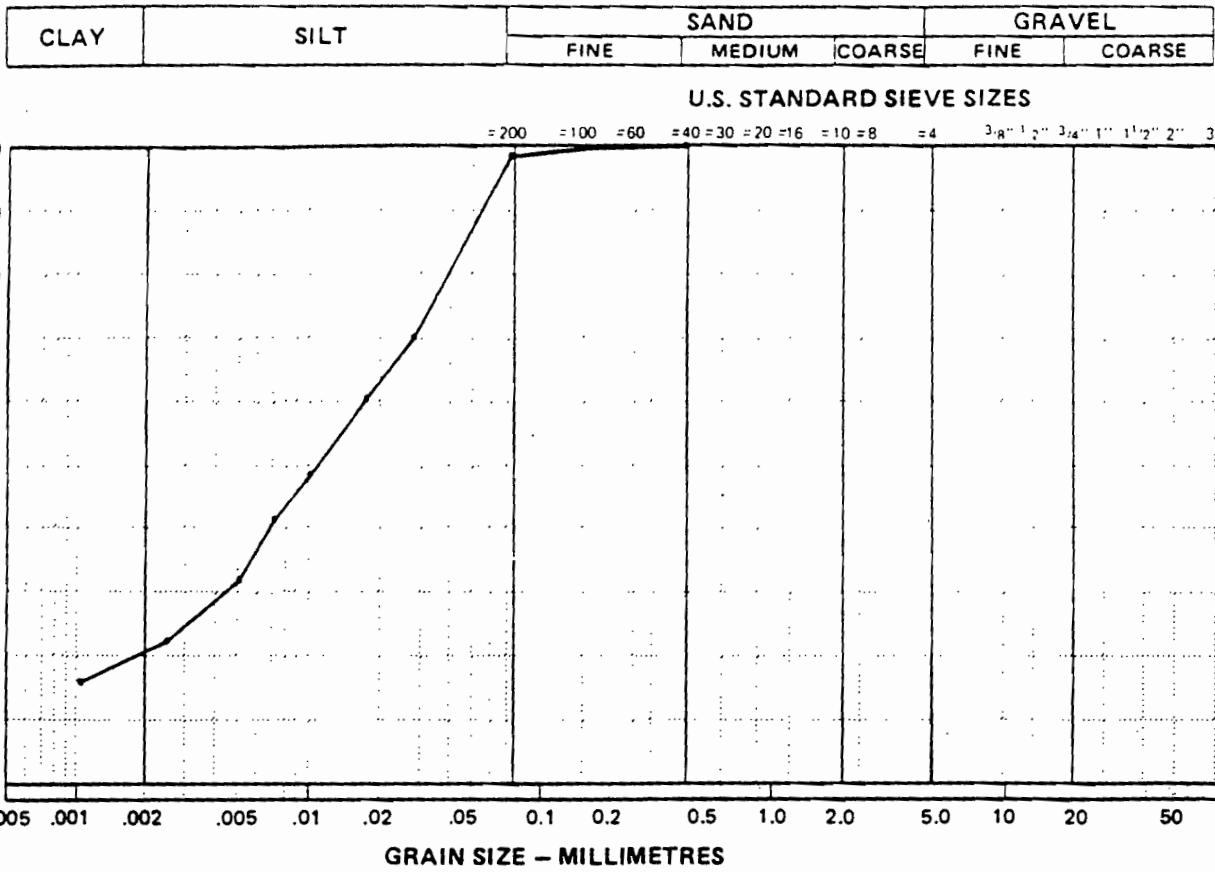
SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87CRI1S1	63.86 - 63.92	8.7	12.6	78.7	0.0	71.9	19.8	SM

JOB NO. 101 -4724 **DATE** 87-10-13

PROPOSED PIPELINE ROUTE



PARTICLE - SIZE ANALYSIS OF SOILS

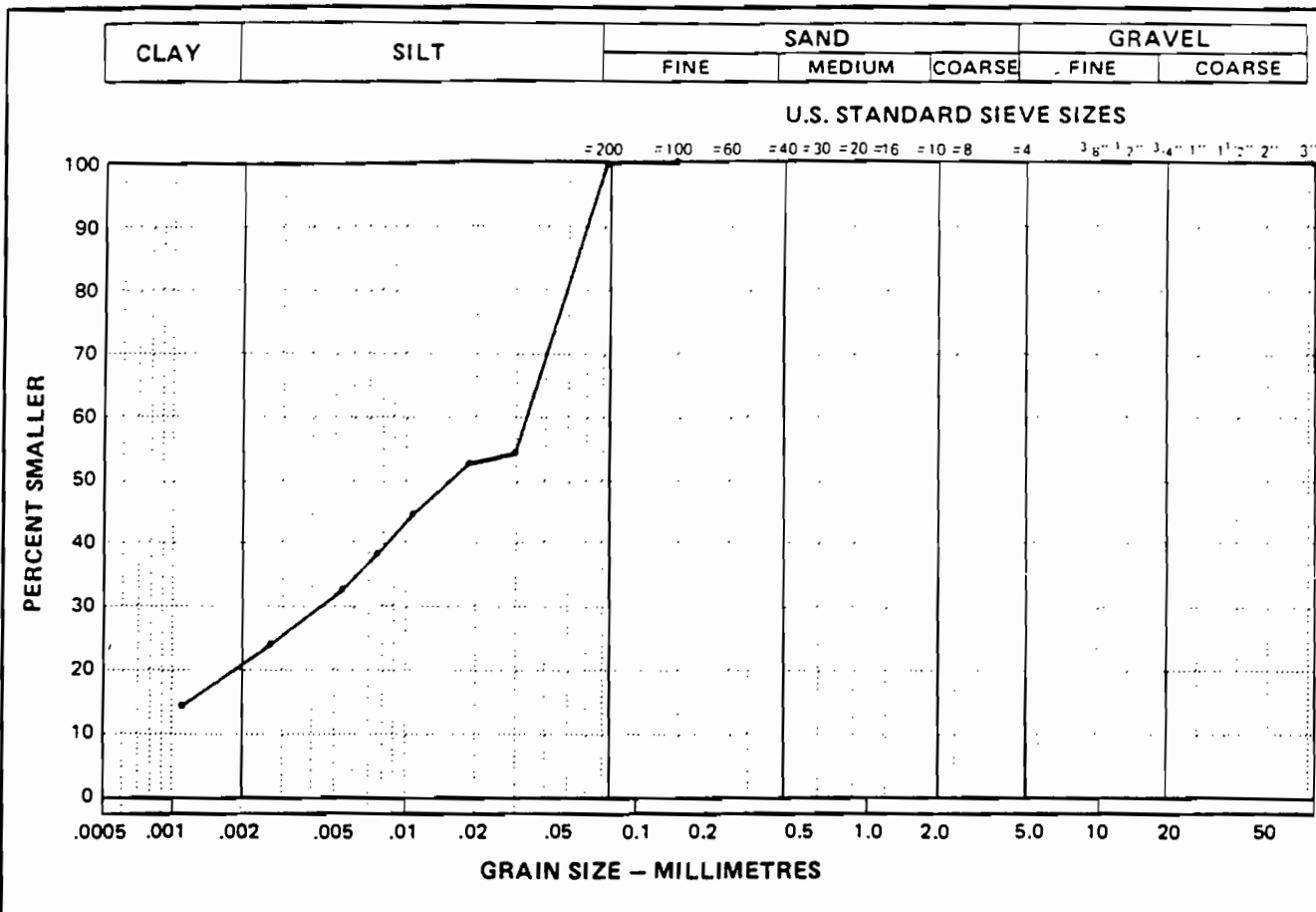


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS1S1	.55 - .61	20.4	78.0	1.6	0.0	-	-	-

JOB NO. 101 -4724

DATE 87-10-26

PARTICLE - SIZE ANALYSIS OF SOILS

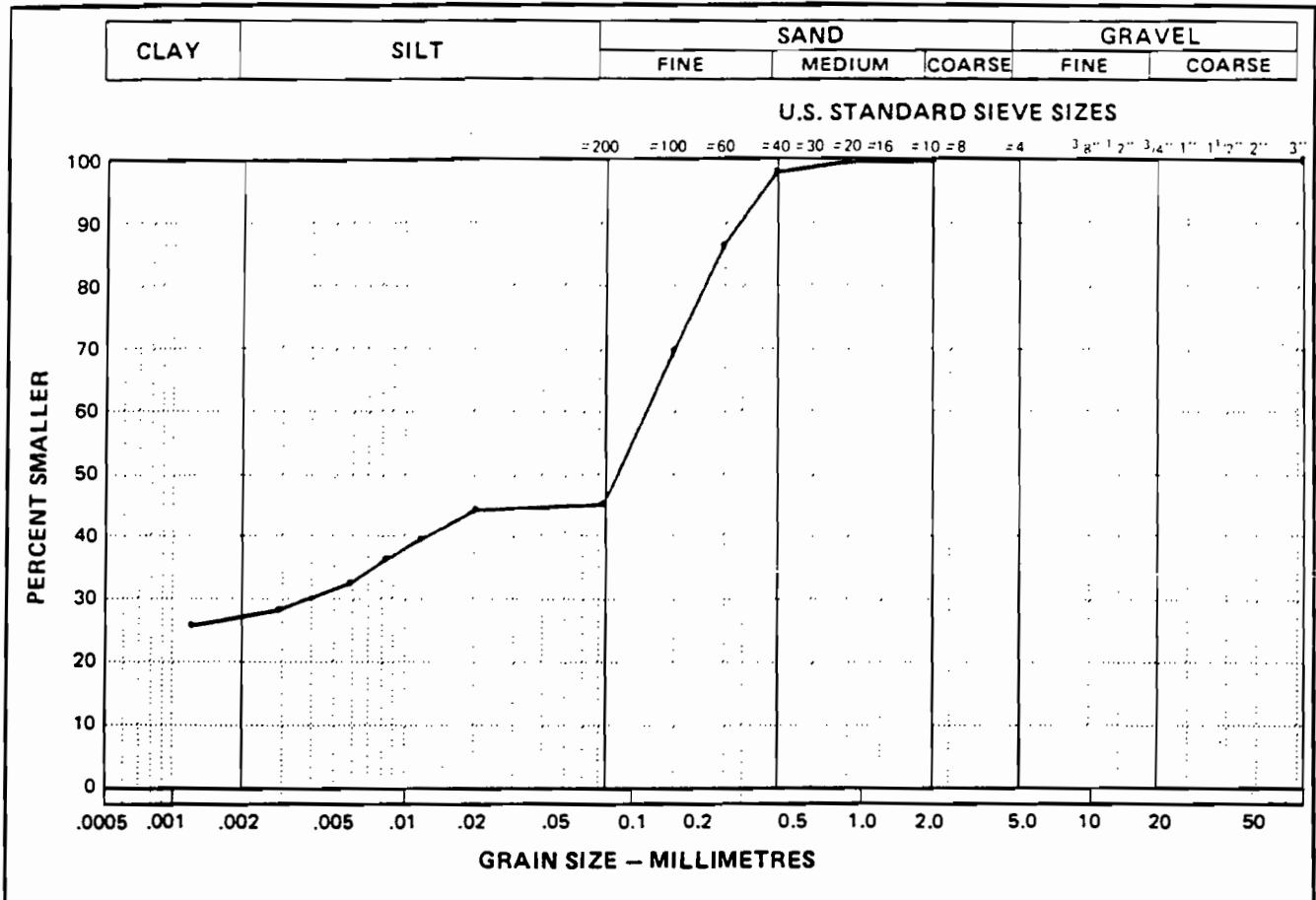


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS1S1	8.33 - 8.38	20.4	79.3	.3	0.0	-	-	-

JOB NO. 101 -4724

DATE 87-10-25

PARTICLE - SIZE ANALYSIS OF SOILS

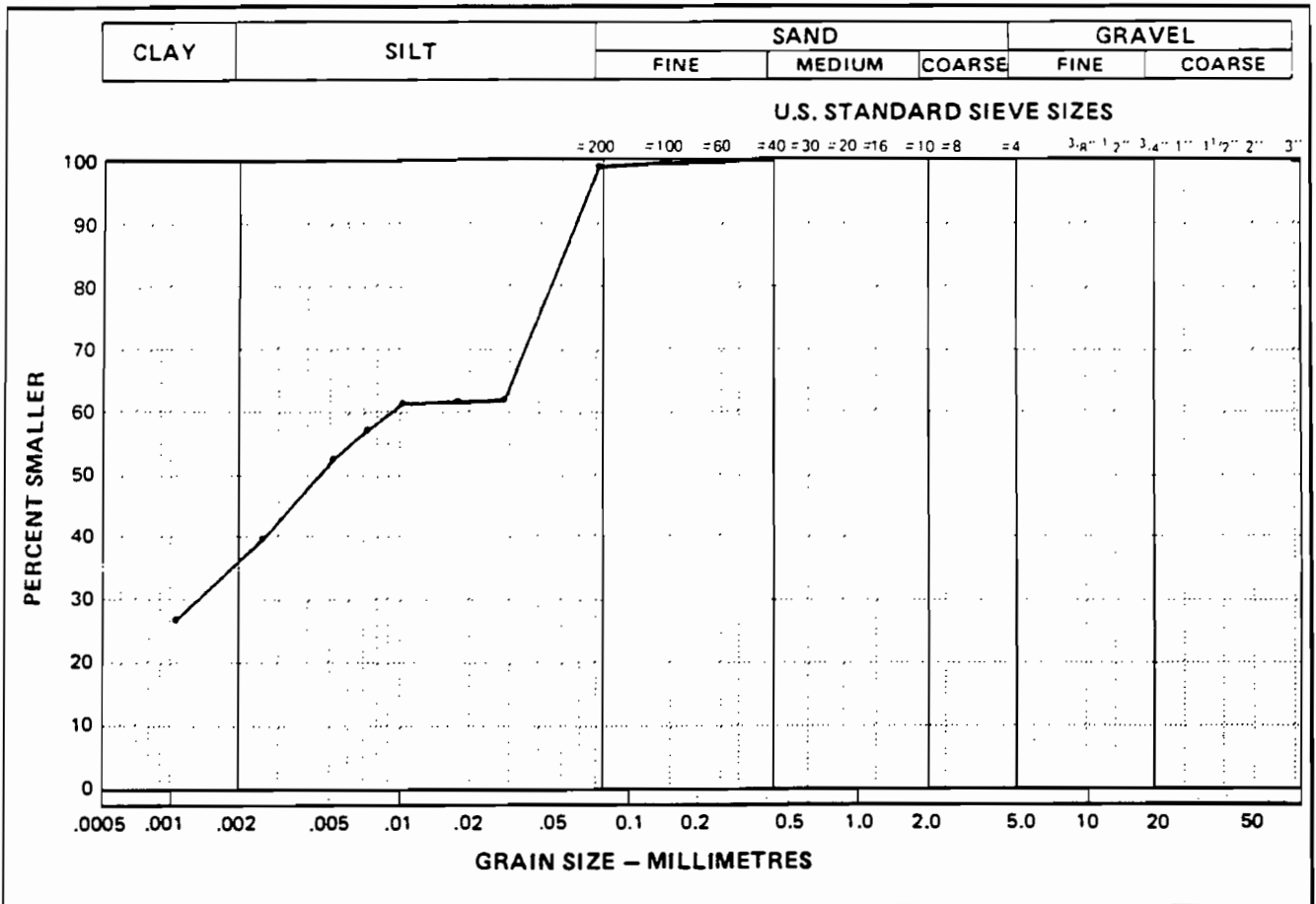


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS1S1	18.29 - 18.72	27.4	17.9	54.7	0.0	-	-	-

JOB NO. 101 -4724

DATE 87-10-23

PARTICLE - SIZE ANALYSIS OF SOILS

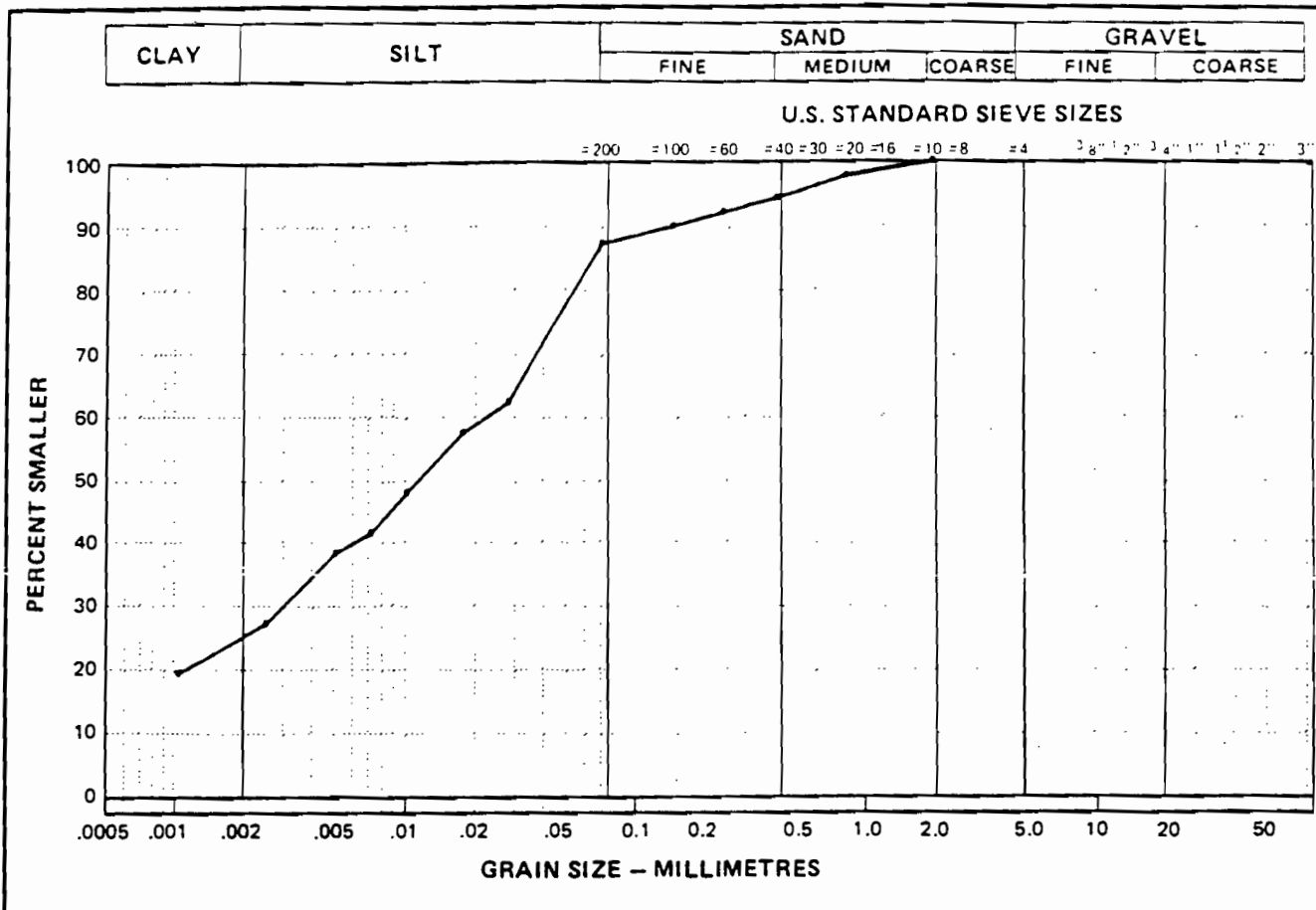


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS2S1A	6.69 - 6.81	35.6	63.4	1.0	0.0	-	-	-

JOB NO. 101 -4724

DATE 87-10-24

PARTICLE - SIZE ANALYSIS OF SOILS

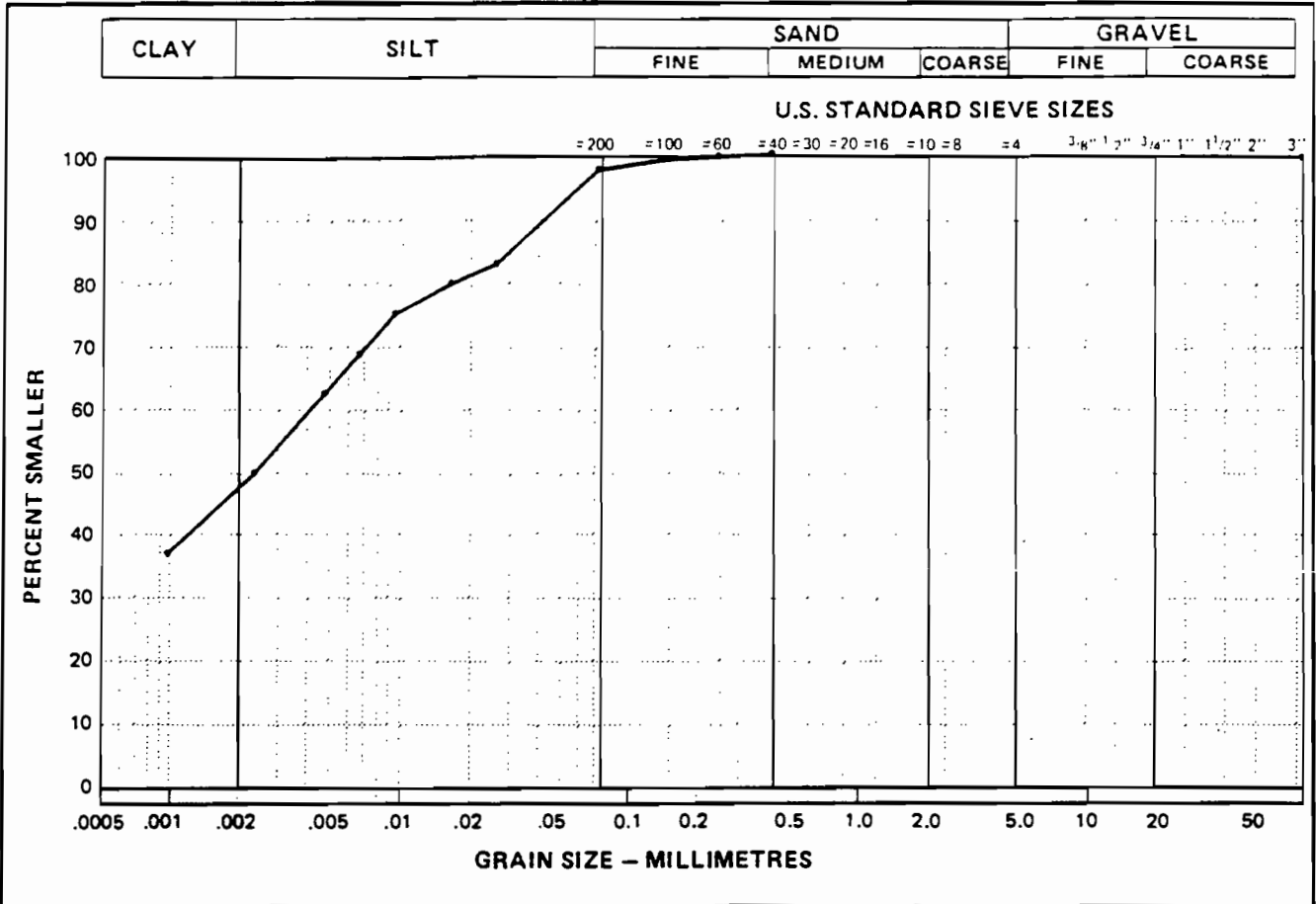


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS2S1A	9.12 - 9.31	24.4	62.7	12.9	0.0	-	-	-

JOB NO. 101 -4724

DATE 87-10-25

PARTICLE - SIZE ANALYSIS OF SOILS

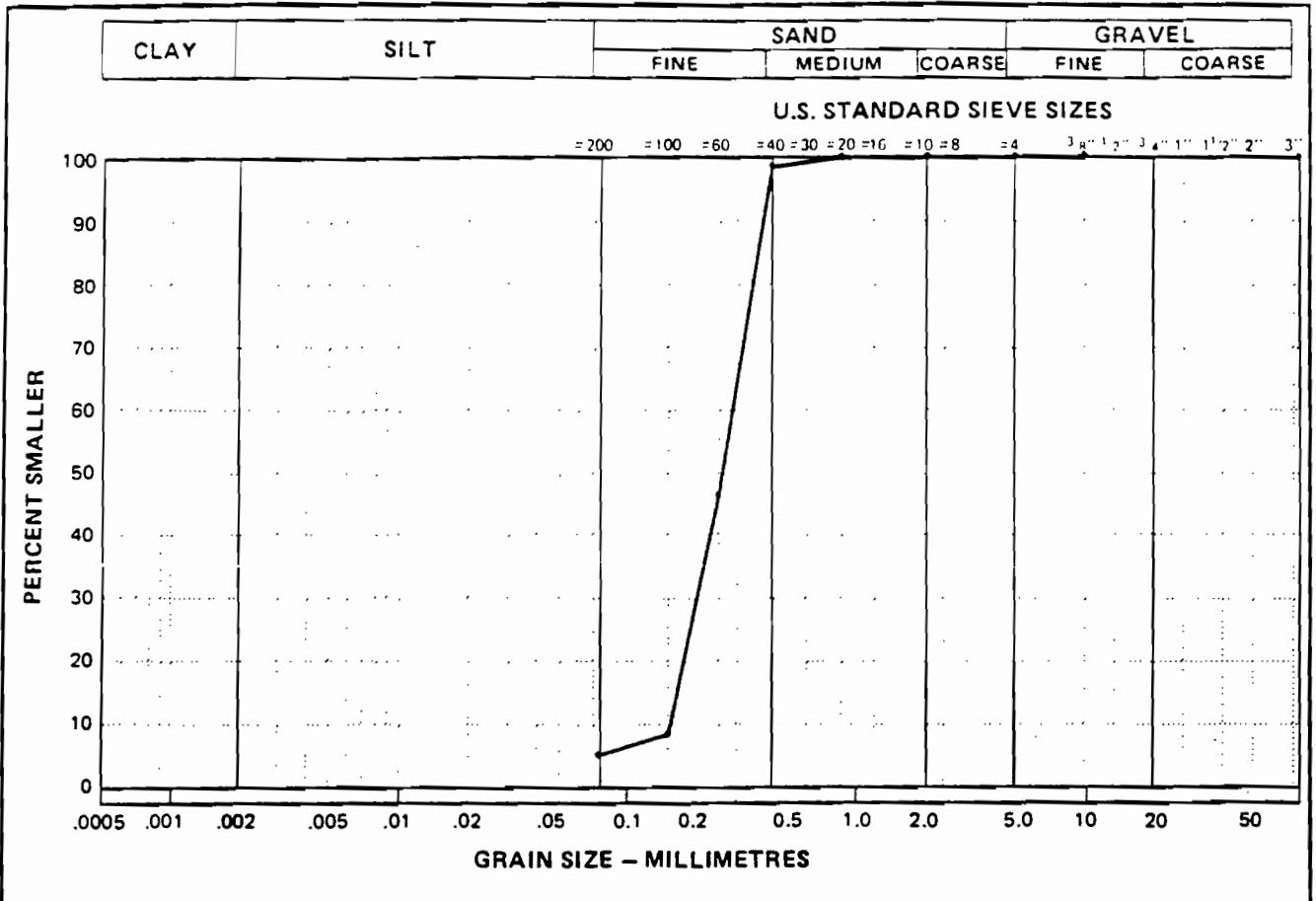


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS3S1	.06 - .30	46.5	51.0	2.5	0.0	-	-	-

JOB NO. 101 -4724

DATE 87-10

PARTICLE SIZE ANALYSIS OF SOILS

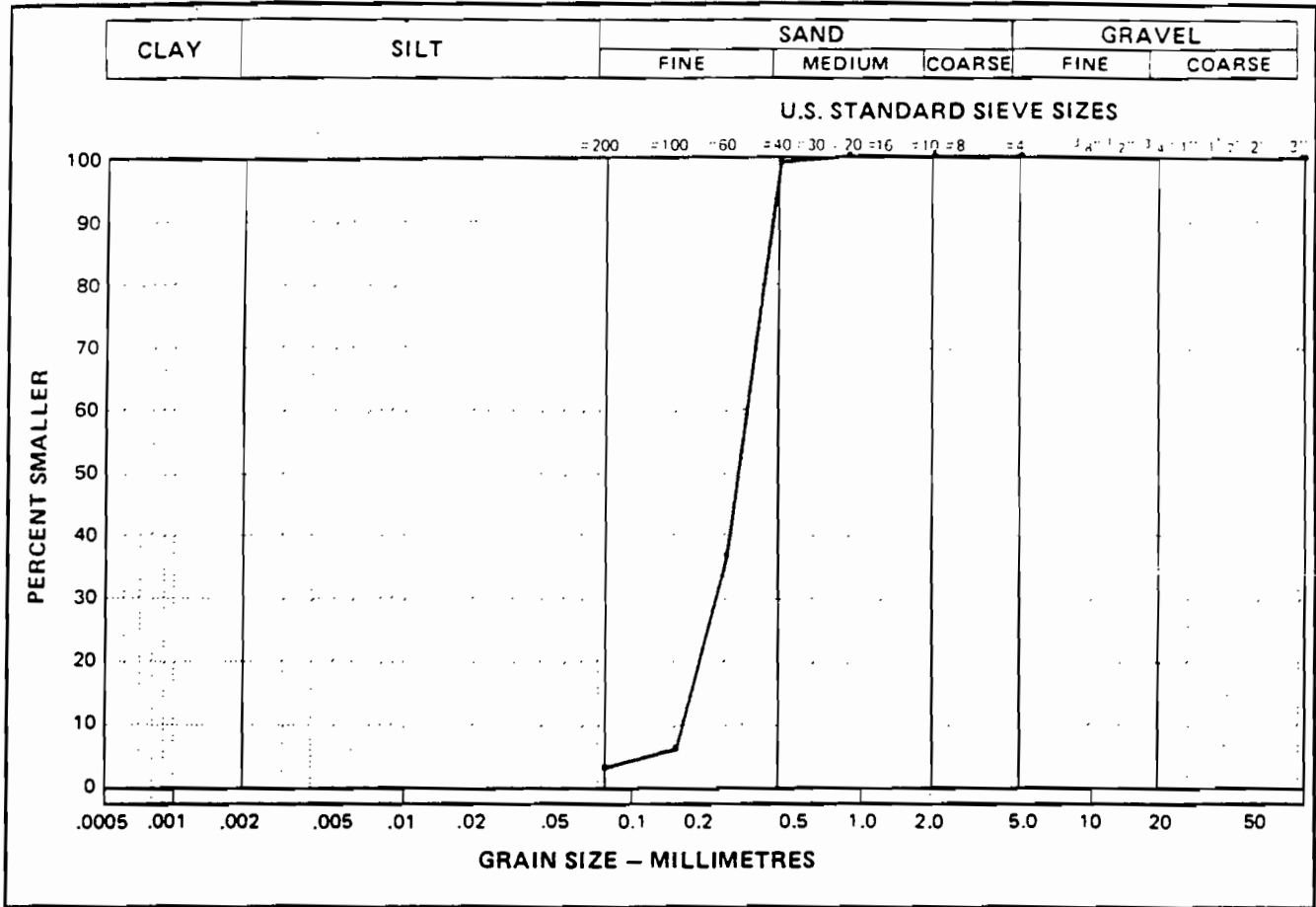


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS3S1	9.14 - 9.45	-	4.8	95.1	.1	1.9	.9	SP

JOB NO. 101 -4724

DATE 87-10-22

PARTICLE - SIZE ANALYSIS OF SOILS

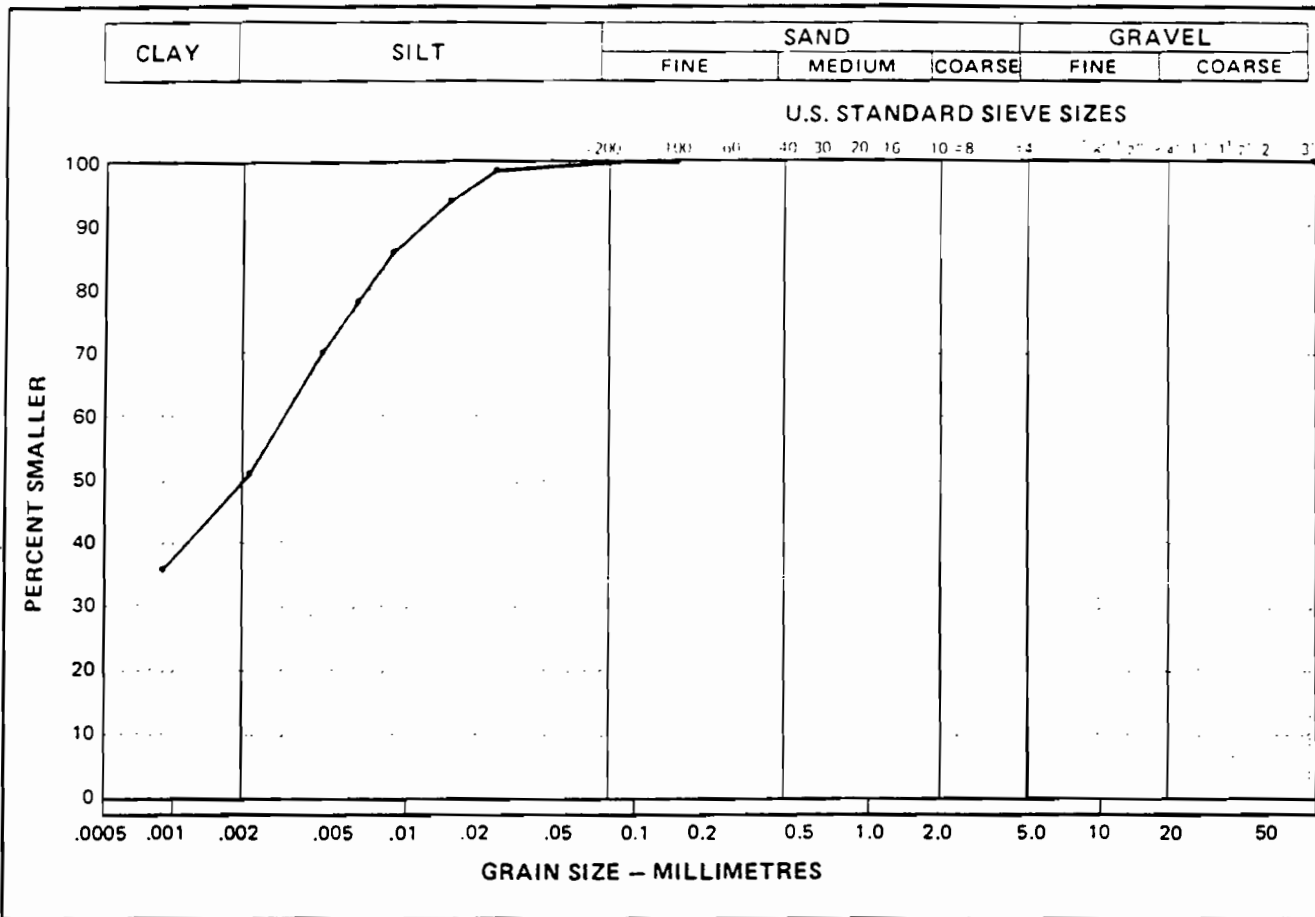


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS3S1	18.64 - 18.90	-	2.7	97.3	0.0	1.9	1.0	SP

JOB NO. 101 -4724

DATE 87-10-22

PARTICLE SIZE ANALYSIS OF SOILS

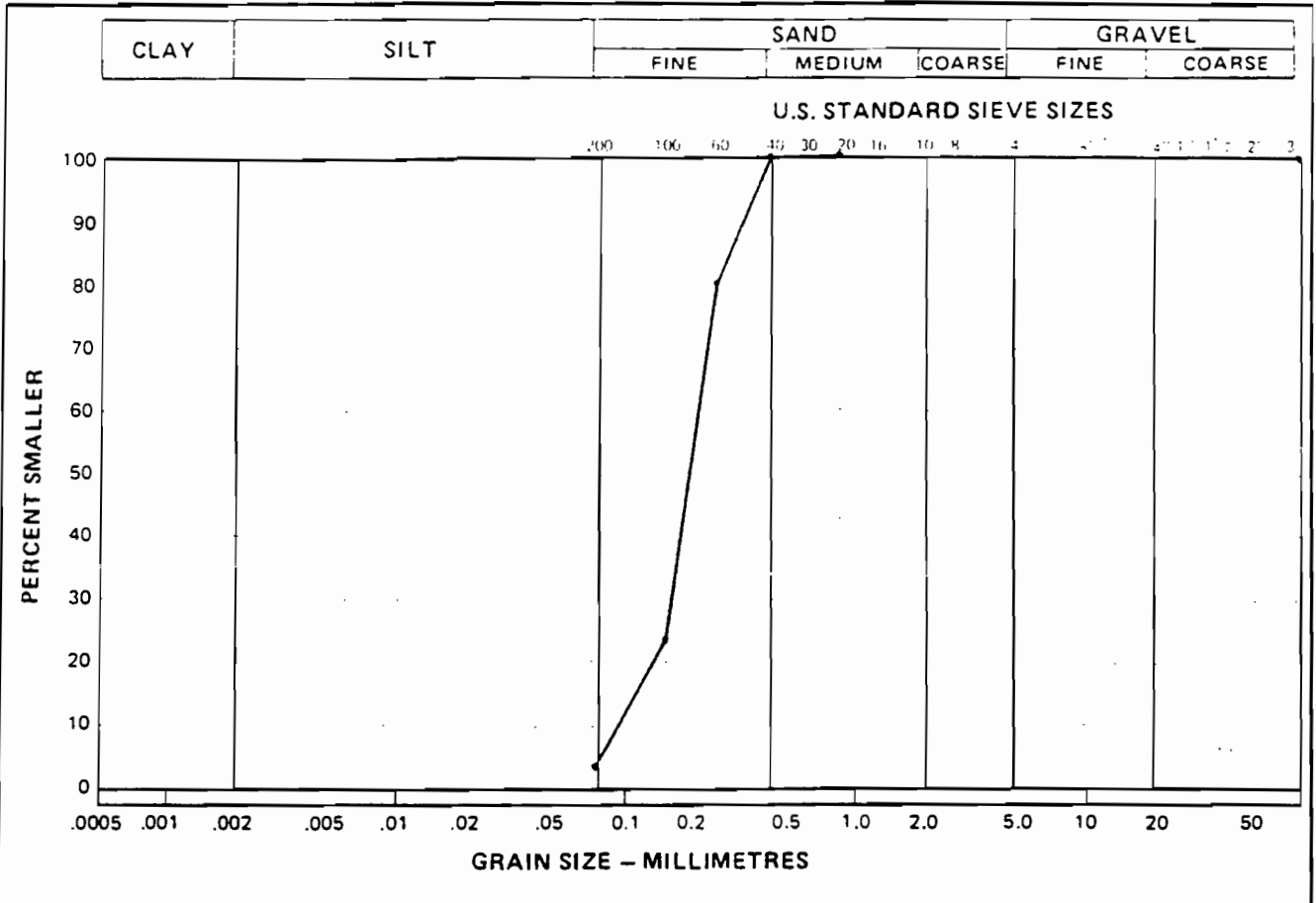


SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS4S1	5.02 - 5.16	49.1	50.8	.1	0.0	-	-	-

JOB NO. 101 -4724

DATE 87-10-22

PARTICLE - SIZE ANALYSIS OF SOILS



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C.
			CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)			
	87PS451	13.92 - 14.20	-	2.9	97.1	0.0	2.2	1.3	SP

JOB NO. 101 -4724

DATE 87-10-22

APPENDIX E

CONE PENETRATION TEST RESULTS

- Proposed Production Site
- Proposed Pipeline Route



PROPOSED PRODUCTION SITE

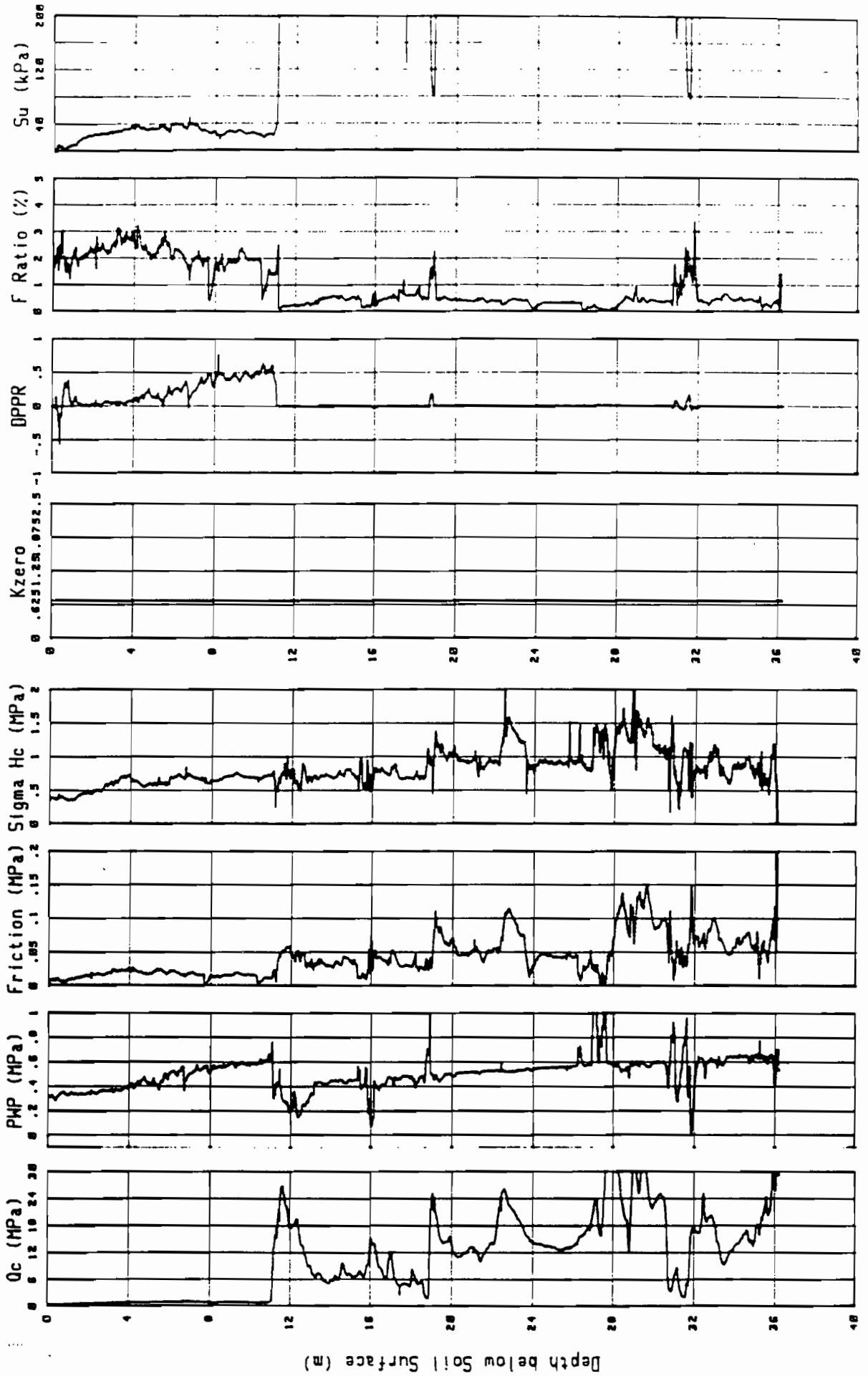


GULF CANADA RESOURCES

Site: 87CR11
 Page: 1 of 1
 Date: 05 SEPT 87

Depth to Soil (m): 31.4
 Depth to WL (m): 0
 Reference Elev. : MSLlevel

Results of Cone Penetration Test : 87CR11C2



zeroing depth: 30.4(m) Notes: 1. Measurements referenced to 2. soil density taken as 17 kN/m³ 4. Su calculated by traditional 'Nk'
 start push at: 38.4(m) 3. Kzero determined from estimated average value (.7) atmospheric pressure.

const: 3844
 file name: 87CR11C2 type: 4Chr: 87ver

PROPOSED PIPELINE ROUTE



GULF CANADA RESOURCES

Site: 87PSI

Page: 1 of 1

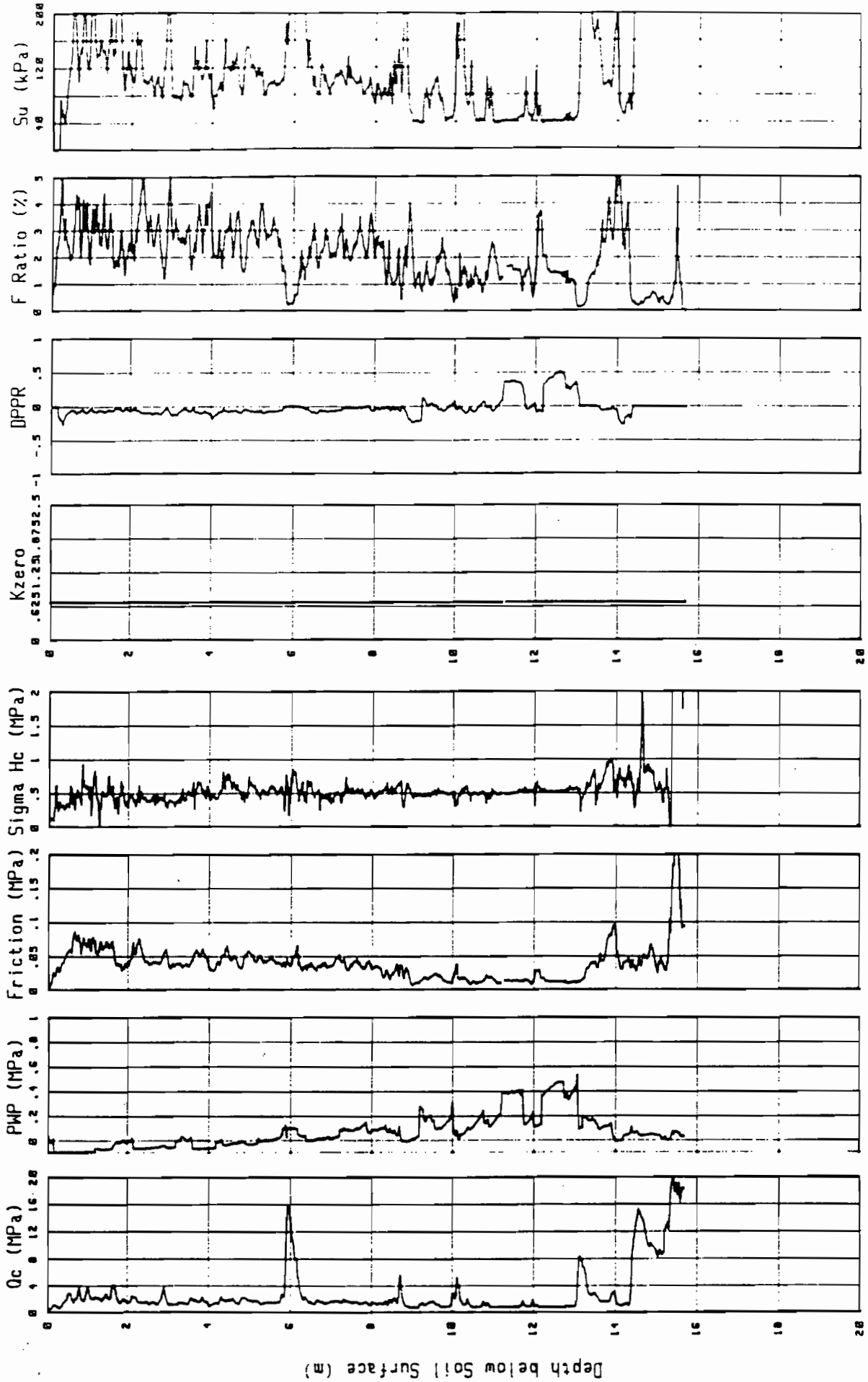
Date: 02 SEPT 87

Depth to Soil (m): 5.6

Depth to HL (m): 0

Reference Elev. : MSLlevel

Results of Cone Penetration Test : 87PSI01



file name: 87PSI01 const: 3814 zeroing depth: 4.2(m) start push at: 4.2(m) Note: 1. Measurements referenced to 2. soil density taken as: 17 kN/m³ 3. Su calculated by traditional 'Fn' atmospheric pressure.

GULF CANADA RESOURCES

Results of Cone Penetration Test : 87PS2C1

Depth to Soil (m): 10.2

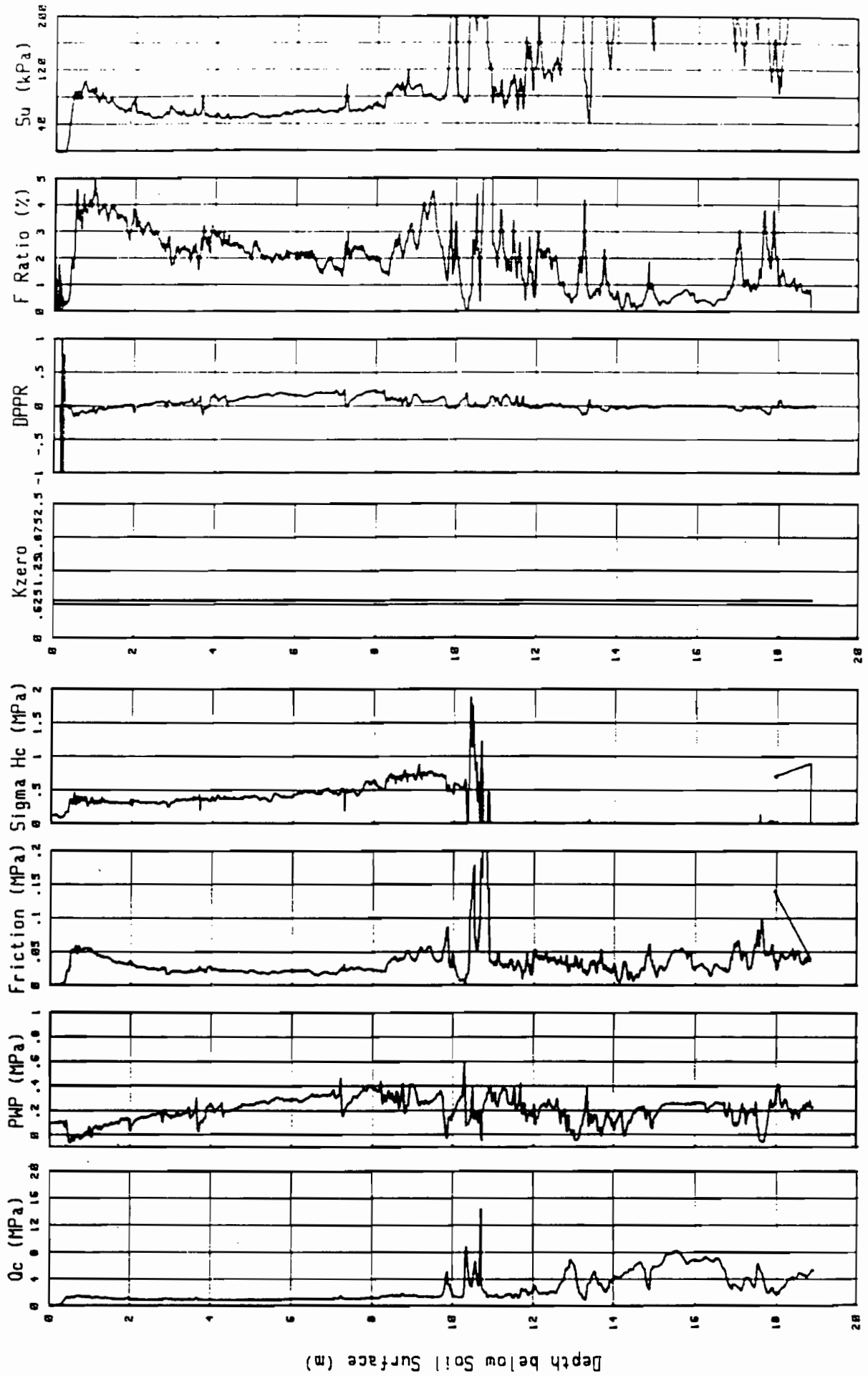
Depth to ML (m): 0

Reference Elev. : MSLlevel

Site: 87PS2

Page: 1 of 1

Date: 01 SEPT 87



Notes: 1. Measurements referenced to 2. soil density taken as: 17 kN/m³ 4. Su calculated by traditional 'Nk' zeroing depth: 9(m) atmospheric pressure 5. Vertical axis: 1000 kPa/m
 cone: 3849
 type: CH: 87ver
 file name: 87PS2C1
 start push at: 9(m)

GULF CANADA RESOURCES

Depth to Soil (m): 14.3

Depth to WL (m): 0

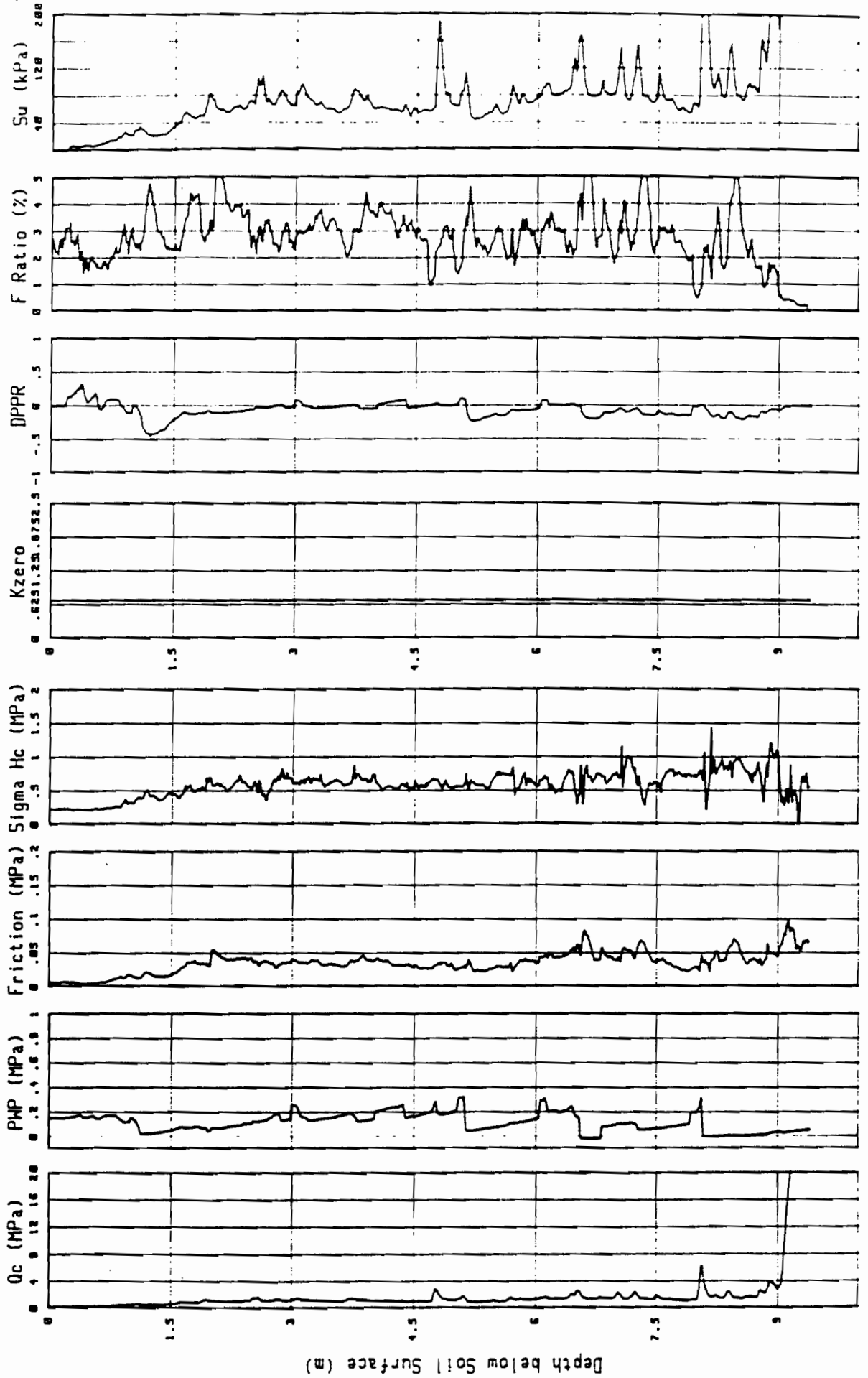
Reference Elev. : MSLlevel

Site: 87PS3

Page: 1 of 1

Date: 83 SEPT 87

Results of Cone Penetration Test : 87PS3C2



cone:3844
type:Qc:87ver
zeroing depth: 13.3(m) Notes: 1. Measurements referenced to 2. soil density taken as: 17 kN/m³ 4. Su calculated by traditional "mk"
start push at: 13.3(m) 3. Kzero determined from estimated average value (1.7)

GULF CANADA RESOURCES

Site: 87PS4

Page: 1 of 1

Date: 11 SEPT 87

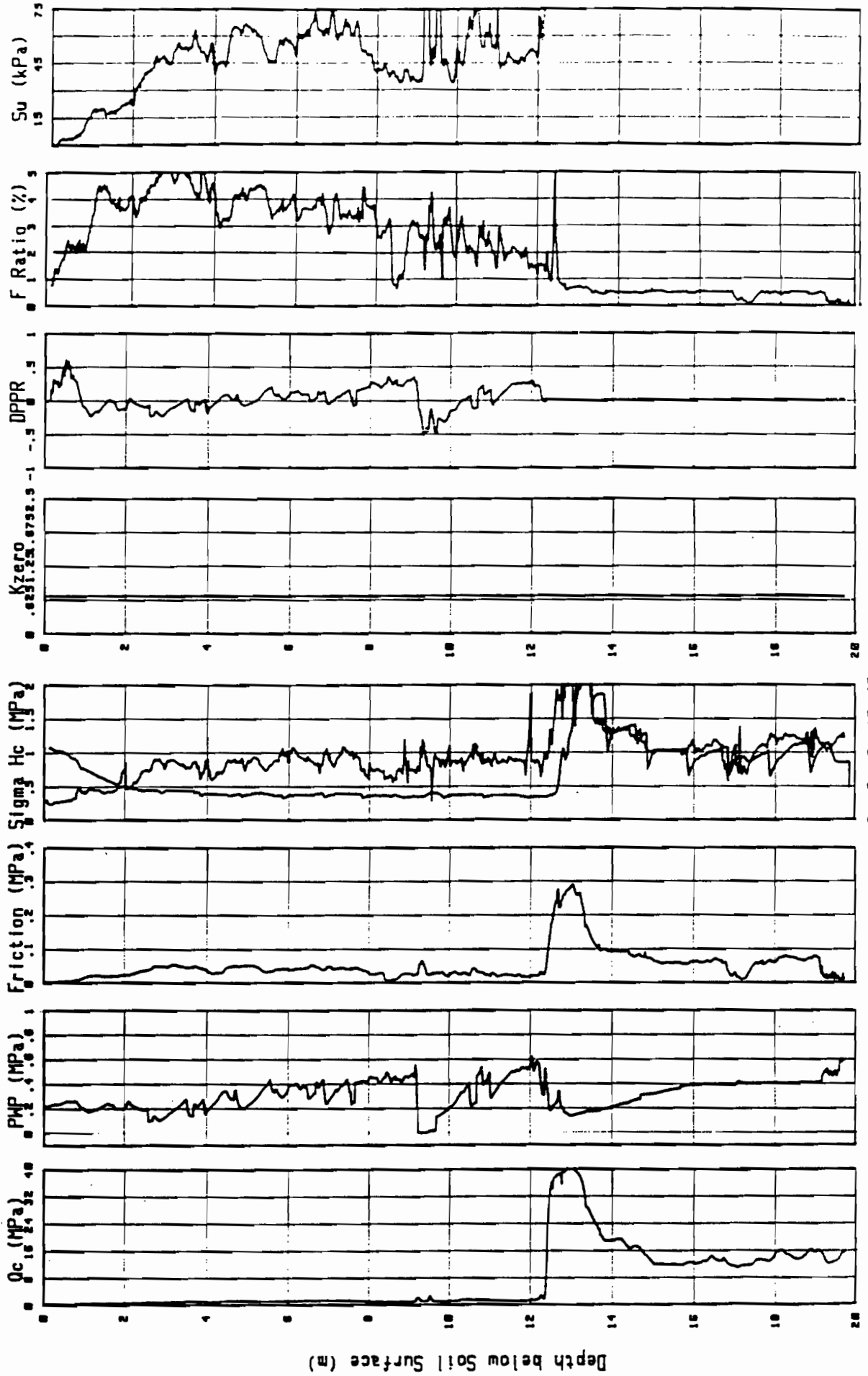
Depth to Soil (m): 22

Depth to HL (m): 8

Reference Elev. : MSL+level

Results of Cone Penetration Test : 87PS4C2

Pipeline Investigation - Site 4



Notes: 1. Measurements referenced to 2. Soil density taken as 18 kN/m³. Su calculated by traditional 'Mc' start push at: 21'm atmospheric pressure. 3. Kzero determined from estimated average value (1.7)