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### SUSITNA HYDROELECTRIC PROJECT

1982 SUPPLEMENT

TO

THE 1980-81 GEOTECHNICAL REPORT

VOLUME 2
APPENDICES
DECEMBER 1982

Prepared by:



ALASKA POWER AUTHORITY

### SUSITNA HYDROELECTRIC PROJECT

1982 SUPPLEMENT

THE 1980-81 GEOTECHNICAL REPORT

VOLUME 2
APPENDICES
DECEMBER 1982

Prepared by:



ALASKA POWER AUTHORITY \_\_

APPENDIX A
WATANA RELICT CHANNEL/
BORROW SITE D-DRILLING LOGS

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALG , NEW YORK

DRILLING REPORT LEGEND SHEET (EXPLANATION IN ITALICS)

CLIENT

ALASKA POWER AUTHORITY

JOB NO.

P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO.

AH-D-27

SITE

Borrow Site D

SHEET NO. 1 OF 13

contractor: Denali Drilling Inc.

STARTED

5:30 P.M. September 5 19 82

METHOD

FINISHED 3:00 P.M.

September 17 19 82

Rotary Casing; 3-7/8 and SOIL

CASING DIAM. HW, 4-1/2" O.D. 4" I.D.

OF

2-15/16" Tricone

ROCK NQ Core Barrel with Diamond Bit CORE DIAM. NO, 1-7/8"

DRILLING:

LOCATION:

N 3,231,126LATITUDE

ELEVATIONS: DATUM

Ground Surface 2148.8

DEPARTURE E '49,709

DRILL PLATFORM

2148.8\*

BEARING INITIAL DIP 90°

GROUND SURFACE ROCK SURFACE

CTHER DIPS None

BOTTOM OF HOLE WATER TABLE

1953.81

ALL DEPTHS VERTICAL FROM TOP OF GROUND

ОЕРТН	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STAUCTURE, WATER CONTENT, PLASTICITY, COMPACTHESS,	\$ A M P L E					PENETRATION
(FEET)		WATER LOSS OR GAIP, ETC.	NO.	TYPE	Size	DEPTH	RET'D	TZST
0 1	Surficial Deposits	Tundra vegetation and surficial soils					ERED	. SAMP- N V AC- 586-67
-2				METHOD ELOW)	DIAMETER OF SAMPLE (INCHES)	<i>р</i> ЕРТН Т)	LE RECOVERED ES)	DRIVE 3" 0.0. /300# HAMMER. CALCULATED IN WITH ASTM D15.
<del>-</del> 3		SOIL DESCRIPTION		SAMPLING METHOD (SEE BELOW)	WETER O	SAMPLE (FEET	OF SAMPLE (INCHES)	TO DRIVE "W/300# IS CALCU ICE WITH
-4 -5				•	†Ia		LENGTH	BLOWS TO LER 6" W/ VALUE IS CORDANCE
<del>-</del> 6	Sand	Brown, gravelly. Little silt. Mostly fine grained with some coarser sand.	'LE JER	NER SE	2-1/2	5.0 to	5	16 13 7 7
<b>-</b> -7		Coarse, subangular gravel. Medium density. Moist. Temperature 4°C.	SAMPLE	3 8		7.0		7 (2) (2) (3) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4
8 9				SHIPPING (SEE				
	MPLING METHOD	SHIPPI	NG CONT			Lancena	<u> </u>	

D - CORE BARREL

A - SPLIT TUBE B - THIN WALL TUBE

E - AUGER F - WASH

M - INSERT

R - CLOTH BAG S - PLIOFILM REA

P - WATER CONTENT TIN Q - GLASS JAR

INSPECTOR

E.J. Kleinkauf

LOGGED BY

R.G. Adams

APPROVED

DATE

12/6/82

CLIENT

ALASKA POWER AUTHORITY

JOB NO.

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-15

<del>4:--2-15</del>

SITE

Borrow Area D

SHEET 120. ] OF 6

SITE

Borrow Area D

PROJECT Susitna Hydroelectric Project

CONTRACTOR: Denali Drilling Co.

STARTED 7:15 A.M. FINISHED

July 13 7:30 A.M. July 19 CASING DIAM.

1\$82 1982

PENETRATION

6

P5700.55

METHOD

soil Hollow Stem Auger

90°

CORE DIAM.

OF DRILLINS: LOCATION:

ROCK

BEARING

INITIAL DIP

LATITUDE N 3,235,761 DEPARTURE E 750,190

ELEVATIONS: DATUM

Ground Surface DRILL PLATFORM 2313.91

GROUND SURFACE 2313.91

ROCK SURFACE

OTHER DIPS None BOTTOM OF HOLE 2229.9' WATER TABLE DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE,
WATER CONTENT, PLASTICITY, COMPACTNESS,
WATER LOSS OR GAIN, ETC. SAMPLE DEPTH SOLL TYPE NO. TYPE SIZE DOPTH RET'D Surficial Boulders with organics. Deposits roots. Peat to 1 ft depth.

No Sampling 2 Sand Light brown to tan, silty, AQ 2-1/2 2.5 17 28 . 3 clayey, non-plastic. Water to 23 content approximately 9%, poorly graded. Occasional gravel throughout. 4.0 14 (Outwash) 5 AQ 2-1/2 5.0 18 5 5 6 to 5 7.0 6 AQ 2-1/2 7.0 17 5 to 8 6

SAMPLING METHOD

A - SPLIT TUBE

A - SPLIT TUBE

B - THIN WALL TUBE

C - PISTUM SAMPLER

D - CORE BARREL

INSPECTOR E.J. Kleinkauf LOGGED BY R.G. Adams

SHIPPING COUTAINER M - IMSPOT

O - TUBE P - WATER CONTENT TIN Q - GLASS JAR

DATE 12/7/82

A - CLOTH BAS S - FLIOFILM BAG Z - DISCARDED

9.0

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALD , NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY

F5700.55

SHEET NO. 2 OF 6

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTUST WATER CONTENT, FLASTICITY, COMPACTHESS.			SAMPL	Ł		PERETRATION
		WATER LOSS OR GAIN, ETC.	HQ.	TYPE	SIZE	DEFTH	RETE	TEST
-10	Sand	Brown to gray brown, silty, clayey, some gravel. Gravel rounded to subangular.	4	AQ	2-1/2	9.0 to	14	U5 67
11 12 13			5	AQ	2-1,2	11.0 to 13.0	3	5 7 10 11
-14 15			6	AQ	2-1/2	13.0 to 15.0	12	5 4 7 15
-1° -17		Cobbles in spoon causing poor recovery.	7	AQ	2-1/2	15.0 to 17.0	81	14 14 15 22
−18 19			8	AQ	21/2	17.0 to 19.0	15	2 2 2 7 2 7 2 7 2 7 2 7 2 7 2 7 2 7 2 7
-20 -21	Silt	Gray brown, with many cobbles and boulders, dense. Coarse fraction subangular	9	AQ	2-1/2	19.0 to 21.0	18	9 13 19 11
-22 -23	•	to subrounded. Moisture content approximately 10%.	10	AQ	2-1/2	21.0 to 2	11	7 9 12 17
-24 -25			11	AQ	2-1/2	23.U to 25.0	15	20 15 50 50/.1

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-15

SITE Borrow Area D

SHEET NO. 3. OF 6

CEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPRCTNESS.			SAMPL	E		PENETRATION
· <u>·····</u>		BATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	RET'D	TEST
25 -26	Silt (cont)	Boulder zone 25 to 29 ft. One boulder approximately 3 ft in diameter.						
-27		3 it in traneter.		Nо	Samplin	g Due		
				Į	o Bould	ers	-	
-28								
-29			12	A	2-1/2	29.0	0	22
30						to 31.0		38 30 38
-31						а		
32		Cobbles and boulders jamming sampling spoon, therefore, poor recovery.	13	AQ	2-1/2	32.0	3	23
-33					: "	to 34.0		17 19 16
34			14	AQ	2-1/2	34.0	14	3
35	Clay	Gray with trace sand and other fine gravel. Stiff to very stiff, some mottling,				to 35.5		9
36		water content approximately 30%. Temperature approximately 7°C.	15	AQ	2-1/2	35.5 to	24	7 10
37		Ice Lenses At:	3.5	40	0.770	37.0	-	11
38		35.5 ft - 2 inches 36.5 ft - 3-1/2 inches 37.0 ft - 3 inches	16	AQ	2-1/2	37.0 to	24	6 4 4 8
39		39.5 ft - 1 inch				39.0		) 
40			17	AQ	2-1/2	39.0 to	24	4 4 5
43	1					41.0		8

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CLIENT ALASKA POWER AUTHORITY

JOB NO. ₹5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 44-0-15

SITE Borrow Area D

SHEET NO. 4 OF 6

DEPTH	SOIL TYPE	OSSCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMICTNESS.			SAMPL	£		PENETRATION
-34		WATER LOSS OR GAIN, ETC.	#CL	TYPE	SIZE	DEPTH	RETT	TEST
-42 -52	Clay	Gray, stiff, moist to wet, plastic. Contains thin tan interlaminations. Moisture content 35%.	18	AQ	2-1/2	41.0 to 43.0	73	3 5 8 9
-43 -44 -45		(Lacustrine)	19	Α(	2-1/2	43.0 to 45.0	ii i	3 5 6 8
-46 -47		Trace fine sand in thin interlaminations.	29	AQ	2 1/2	45.0 to 47.0	2	4 6 9 11
-48 -49			21	ΑQ	2-1/2	47.0 to 49.0		3 6 6 8
-50 -51		Frozen at 50 ft, temperature -2°C.	22	AQ	2-1/2	49.0 to 51.0	A.	3 4 6 7
~5 <b>∠</b> ~53			23	AQ	2-1/2	51.0 te 53.0	24	3 7 6 13
54 55			24	AQ	2-1/2	53.( to 55.0	24	4 5 6 9
–56 –57		Becomes varved, pronounced laminations.	25	AQ	2-1/2	55.0 to 57.0	24	7 8 8 10

ALASKA POWER AUTHORITY CLIENT

JOB NO. P5700.5F HOLE NO. AH-D-15

ALASKA POWER AUTHORITY

JOB NO. 75700.55

PROJECT Susitna Hydroelectric Project

PROJECT Susitna Hydroelectric Project

HOLE NO. 44-5-15

SITE Borrow Area D

SHEET NO. 5 OF 6

SITE Borrow Area D

CLIENT

SHEET NO. & OF 6

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNERS,			SAMPL	E		PENETRATION	
57		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	KET'D	TEST	
3/	Clay	Gray, stiff, laminated with	26	AQ	2-1/2	57.0	24		
-58	,cont)	thin layers of fine sand, moist, water content 28%.	20	AŲ	4-1/4		24	6 7	
		morse, water content 20%.				to		8	
-59						59.0		11	
_72									
4-			27	Q.K.	2-1/2	59.0	24	3	
-60						to		7 11	
						61.0		21	
-61									
			28	ΑQ	2-1/2	61.0	24	5	
-62						to		8	
		•			•	63.0		11 18	
-63									
			29	AQ	2-1/2	63.0	24	6	
-64			23	תע	2-:/2		24	9	
						to		16	
65						65.0		19	
0.5									
-			30	AQ	2-1/2	65.0	24	8 12	
						to		12	
		在本种各种 人名英格兰				67.0		24	
-67									
			31	AQ	2-1/2	67.0	24	8	
-68						to		12	
		Cray, stiff, mottled with increased gravel content.			in jar	69.0		16 24	
-69		mer cased graver content.					ļ		
ð			32	AQ	2-1/2	69.0	16	7	
-70						to 70.4		15 50/.4	
				ļ		70.4		30/ -4	
<b>-</b> 71									
70									
<del>-</del> 72	Gravel	Gray-brown, alternating	33	AQ	2-1/2	72.0	15	10	
<del>-</del> 73		layers of sand, gravel, and				to		41	

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			3 A H P L	Ė	ə	PERTRATION
72		WATER LOSS OR GAIK, ETC.	Ya	TYPE	SIZE	DEPTH	RETO	TEST
73	Grave1	cobbles, subrounded to sub-	33	(con	tinued)	73.5		50/.3
-74	(cont)	angular.					merenezer, 22	
-7.4			34	AQ	2-1/2	74.0- 74.5	* פֿר	3
<b>-</b> 75			35	AQ	2-1/2	74.5 to	9	5 7
-7 <sub>0</sub>				17-10-24	14 Eresphit, plant from the part	76.0		L companies service
-77								
-78			36		0.740	76.0		
-79		Refusal encountered due to		A	2-1/2	76.0	Q.	Refusal
80		numerous cobbles. No samples obtained.					1	
						•	Work and	, 1
81			erann telutatepe a	<b> </b>	-2		weeker to the	- 131 m
82								
83			37	A	2-1/2	81.0	0	Refusal
84	artenania and paintenania and an artenania	Bottom of Hole 84 Ft.						
85		(Not Bedrock)						
86								
87								
88								
89								

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS

BUFFALO , NEW YORK

DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

P5700.55 JOB NO.

Susitna Hydroelectric Project PROJECT

AH-D-16

SITE

Borrow Site D

HOLE NO. (A&B) SHEET NO. 1 OF 13

CONTRACTOR: Denali Drilling Inc.

STARTED 2:45 P.M. FINISHED 3:30 P.M.

19 82

METHOD

19 82

soil Hollow Stem Auger (to 22 ft) c Rotary Casing and 3-7/8" Tricone

2:45 P.M. July 15 3:30 P.M. July 27 CASING DIAM. HW 4" I.D.

OF DRILLING:

LOCATION:

ROCK NQ Core Barrel With Diamond Bit CORE DIAM. 4-1/2" C.D. LATITUDE N 3,233,517 DEPARTURE E 751,997

ELEVATIONS: DATUM

Ground Surface DRILL PLATFORM 2271.3'

BEARING -INITIAL DIP 90° OTHER DIPS None

GROUND SURFACE 2271.3' ROCK SURFACE 2100.81 BOTTOM OF HOLE 2078,31

WATER TABLE

12/7/82

Tan, loose to graded, moist gravel throug	organic silts.  medium, well Cobbles and hout. Moistur	1	AS	512E	3.0 to 5.0	13	3 5 9
Tan, loose to graded, moist gravel throug centent appro Temperature a	medium, well . Cobbles and hout. Moistur oximately 12%.	1	AS	2-1/2	to	13	5 9
graded, moist gravel throug centent appro Temperature a	. Cobbles and hout. Moistur eximately 12%.	1	AS	2-1/2	to	13	5 9
graded, moist gravel throug centent appro Temperature a	. Cobbles and hout. Moistur eximately 12%.	1	AS	2-1/2	to	13	5 9
graded, moist gravel throug centent appro Temperature a	. Cobbles and hout. Moistur eximately 12%.	1	AS	2-1/2	to	13	5 9
graded, moist gravel throug centent appro Temperature a	. Cobbles and hout. Moistur eximately 12%.	1	AS	2-1/2	to	13	5 9
Temperature a	pproximately				""	1	1 =
							8
		2	AS	2-1/2	5.0 to	1:5	4 3
					7.0		5 5
		3	AS	2-1/2	7.0 to	4	10 50/2
			<del>                                     </del>		7.7_		
DE E-AUSER L'YUSE F-WASH LMPLER	H •	- INSERT - TUBE - WATER C	ONTENT T	5	- PLIOFILM	BAG	
		ME E-AUGER H L TURE F-WASH O MAPHER RREL Q  .J. Kleinkauf	THOD SHIPPING CO	THOD  ME E-AUSER H-INSERT L TUSE F- WASH O-TUSE MAPLER P-WATER CONTENT T RREL Q-GLASS JAR	THOD  SHIPPING CONTAINER  ME E-AUSER M-INSERT R L TUSE F-WASH O-TUSE S MPLER P-WATER CONTENT TIN Z  RREL 0-GLASS JAR	THOD  SHIPPING CONTAINER  RE E-AUSER N-INSERT R-CLOTH B L TUSE F-WASH O-TUSE S-PLIOFILE BAPLER P-WATER CONTENT TIN Z-DISCARD  REL Q-GLASS JAR  J. Kleinkauf	THOD  SHIPPING CONTAINER  ME E-AUSER H-INSERT R-CLOTH BAG L TUSE F- WASH O-TUSE S-PLIOFILM BAG MAPLER P-WATER CONTENT TIN Z-DISCARDED  RREL Q-GLASS JAR

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

408 NO.

P5700.55 1H-D-16

PROJECT Susitna Hydroelectric Project

HOLE NO.

q&B)

Borrow Site D

SHEET NO. 2 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPRCTNESS,			SAMPL	Ε		PENETRATION	
9		WATER LOSS OR SAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET 2	TEST	
-10 -11	Sand (cont)	Tan, fine to coarse with gravel and cobbles throughout. Coarse fraction subangular to subrounded.	4	AS	2-1/2	9.0 to 1.0	<b>*</b> **	3 5 8 8 8 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
-12			5	AS	2-1/2	11.0 to 13.0		6 8 11 15	
-13			6	AS	2-1/2	]3.0- ]3.5	5	9/6	
-14									
<del>-</del> 15		Frequent refusa! due to numerous cobbles.	7	AS	2-1/2	] <u>ξ</u> .γ		2071	
-16									
<del>-</del> 17		Temperature 9°C	8	AS	2-1/2	17.0- 17.2	-	2172	
-18									
<del>-</del> 19		Temperature 9°C.	9	-A5	2-1/2	19.0- 19.7	*	19 27/2	:
-20									
-21									
-22 -23		Temperature 11°C.	10	AS	2-1/2	21.8 to 23.0		21 50 32/2	
-24									
-24 -25			11	AS	2-1/2	24.0 to 25.4	3	35 43 53/5	

P5700.55 AH-D-16

SHEET NO. 3 OF 13

HOLE NO. (A&B)

PROJECT

Susitna Hydroelectric Project PHOJECT

CLIENT

Susitna Hydroelectric Project

ALASKA POWER AUTHORITY

JOB KJ. 7:5700.55 %H-D-16 HOLE MO: 4&8)

Borrow Site D SITE

CLIENT

Borrow Site D SITE

ALASKA POWER AUTHORITY

SHEET NO. 4 OF 13

ОЕРТН	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, MATER CONTENT, PLASTICITY, FOMPACTHESS.			SAMFL	£		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	MET'O	TEST
25	Sand	Tan, fine to medium with	11	(con	tinued)			
-26	(cont)	angular and subangular						
-20		gravel. Moisture content					<u> </u>	
		approximately 11%. Tempera- ture 11-15°C. 4 inch gravel	12	AS	2-1/2	26.2	18	18
-27		laver at 26 ft.	· •			to		31 31
						28.2		49
-28			-1-5		0 170	70.0		
			13	AS	2-1/2	28.2- 28.6	3	57/5
-29								
-23	Clay	Gray, silty with gravel	14	A.C	2-1/2	20.0	18	7.7
		throughout. Gravel sub-	14	AS	2-1/2	29.0	18	17 29
-39		angular to subrounded. Some gravel striated. Clay mat-				to		35
		rix stiff, temperature 11°C.				37.0		41
-31	<b>]</b>	Moisture content approxi-						
		mately 13%.	15	AS	2-1/2	31.0 to	15	43 50,/5
-32			-			31.9		30, 5
-32	1.							
-33			16	AS	2-1/2	33:4-	2	55/5
						33:4		
-34				L				
			17	AS	2-1/2	34.C	18	30
-35			17	, AS	2-1/2		10	24
-33						to		45
						26.0		€2
-36				<u> </u>				
			18	AS	2-1/2	36.0	24	15
-37		Boulders and cobbles through-				to		31 47
		out. Clay matrix very stiff.				38.0		82
-38								
JO			19	BS	3	38.0- 38.2 38.2-	2	N/A
			20	AS	2-1/2	<u> 38.2-</u>	12	26
-39		Temperature 7°C.				39.2		84
							1	
<del>-4</del> 0				ļ. <u>.                                   </u>			<u> </u>	
			21	AS	2-1/2	40.0 to	24	5 38
_41	L		ŀ			42.0		30

DEPTH	SOIL TYPE	DESCRIPTION: EGLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	É		PENETRATION
41		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RETT	TEST
-42	Clay (cont)	Gray, silty with subangular gravel throughout. Very stiff, temperature O°C.	21	(con	tinued)			55 89
		f	22	AS	2-1/2	42.0	22	37
-43						to 43.5		33 95
-44	Sand	Tan, with alternating layers of gravel and cobbles 6 to	Sec ±6	A 2000	entageneyanan (da i kati kanan kapa) ka yar in	TO A O		33
-45		10 inches thick. Temperature 3°C, moisture content approximately 13%.	23	ΛS	2-1/2	44.0 to 45.6	24	20 28 83 50/1
-46			aansen is a	-		-		
-47			24	AS	2-1/2	46.0 to 47.9		15 34 46
-48			25	AS	2-1/2	48.0	_	50/1 26
-49		Gravel portion subrounded to	<b></b> ,	, no	L-1/L	to 49.5	*	38 61
-50		subangular. Stratification of fine and coarse sands.	26	AS	2-1/2	49.5 to	.÷	35 41
-51			27	ĀS	2-1/2	50.8	= .	70/3 40/4
-52			28	AS	2-1/2	51_3_		
-53			an Australia	7,5		52.0- 52.7		50/2
-54					en avviggelich aufbrijver Sige	arth air our againmia.		
		Gravel layer 54.2 to 54.9.	29	AS	2-1/2	54.0 to	13	22 33
-55			e e e e e e e e e e e e e e e e e e e			55.7		58 50/2
-56 -57			30	AS	2-1/2	56.0- 56.8	ě	35 50/3

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS

BUFFALO , NEW YORK

DRILLING REPORT

## ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

DRILLING REPORT

JOB NO.

P5700.55 AH-D-16

PROJECT Susitna Hydroelectric Project

ALASKA POWER AUTHORITY

HOLE NO. (A&B)

SITE Borrow Site D

SHEET NO. 5 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTEST, PLASTICITY, COMPACTNESS.			SAMPL	E		
		WATER LOSS OR GAIN, LETC.	NQ	TYPE	SIZE	KT430	RET'D	16 32 41 50/4 38 37 60/4 18 50 55/3 41 63 72 61
58	Sand (cont)	Tan with alternating gravel layers, wet.						
59 ——			31	AS	2-1/2	58.0 to	15	32
60	Sand	Tan, fine to medium, silty, laminated, wet to saturated. Occasional gravel, dense.				59.8		
61		details.	32	AS	2-1/2	60.0 to 61.3	8	37
62 63			33	AS	2-1/2	61.5 to 62.8	5	50
64	•		34	AS	2-1/2	63.0 to 65.0	7	63 72
65 66 67 ——		Silty, sandy clay layer 65 to 67 ft, laminated, very stiff.	35	AS	2-1/2	65.0 to 67.0	17	16 22
68 69	Sand	Gray brown, fine to coarse with subrounded to subangular gravel throughout. Temperature approximately 2°C, moisture content approximately 18%.	36	AS	2-1/2	67.0 to 69.0	18	9 22 31 42
70		mucciy (as.	37	AS	2-1/2	69.0 to 71.0	24	7 24 45 61
71 72			38	AS	2-1/2	71.0 to 73.0	17	2 15 16 31

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

Borrow Site D

JOB NO. \$5700.55

44-0-16 HOLE NO: 448)

PROJECT Susitna Hydroelectric Project

SHEET NO E OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETALTION
73		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH.	BE 20	TEST
73	Sand	Gray brown, fine to coarse,	39	Α	2-1/2	73.0	*	30
-74	(cont)	silty with gra el throughout.				to	1	32
		Moisture content approxi- mately 5%.				75.0		41
-75						/5.0		49
_/·3			40	.AS	2-1/2	75.0	•	c
			70	.٦٥	2-1/2			8 25
-76				•		to		23
						77.0		26
-77			- meline merine		with marsham trasperson		٠.	
-78								•
'0	Sand	Greenish gray, silty, clayey	8.					
7.0		with numerous cobbles,						
-79		boulders. Coarse fraction						
		subangular. Very dense to hard. MoistLre content						
80		approximately 12%.			- Acide Maries and		-	
			47	AS	2-1/2	80.0 to	12	28
-81						81.5		28 75/.5
			-		Transport per distribution			: 0/ . 0
00			42	AS	2-1/2	81.7-		50/.3
-82			en, sipe, o <del>m bligtilg gete</del>		THE RESERVE AND THE PERSON			
-83			ner et e e e e e e e e e e e e e e e e e		Property and State Later Medical Principles			
			43	AS	2-1/2	83.0	18	57
-84		Numerous cobbles and boulders				to 84.3		53 90/.3
								20/13
-85								
-03			44	AS	2-1/2	85.0	11	40
						to		50/.2
-86				<del> </del>		85_7		<u> </u>
			45	AS	2-1/2	86.0-	9	26
- 87			46	AS	2-1/2	87.0°	3	26 70/ 5 68/:5
			70	73	4-1/6	87.0 87.0- 87.5		68/.5
-88					1			
-00								
_89								

DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

JOB NO. P5700.55 AH-D-16 HOLE NO. (A&B)

PROJECT Susitna Hydroelectric Project

SITE

Borrow Site D

SHEET NO. 7 OF 13

CEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTMESS,			SAMPL	E		PENETRATION TEST	
<del></del>		WATER LOSS OR GAIN, ETC.	NQ.	TYPE	SIZE	DEFTH	RET'D		
	Sand	Greenish-gray, silty, very	47	AS	2-1/2	89.0- 89.3	3	50/.3	
90	(cont)	dense to hard. Numerous cobbles and boulders throughout. Moisture content							
91		approximately 8%.	40		0.740	03. 7		,	
00			48	AS	2-1/2	91.3 to 92.0	5	47 50/.2	
92						92.0			
93								'.	
94									
<b>3</b> 4			49	AS	2-1/2	94.0 to	3	30 50/.2	
95		Difficult sampling due to numerous cobbles.				94.7			
96			50	AS	2-1/2	06.0	2	E0 / 4	
			50	AS	2-1/2	96.9-	2	50/.4	
97						·			
98			51	AS	2-1/2	98.0- 98.5	2	65/.5	
99						98.5			
. <b></b>									
100		Clayey, silty, 100 to 102 ft.							
101			52	AS	2-1/2	100.3 to 101.6	7	25 69 80/4	
102								30/1	
103			53	AS	2-1/2	102.0 to 102.8	2	40 80/4	
	1	Silty.							
104			54	AS	2-1/2	104.0-	2	48	
105	<u>.                                    </u>			<u> </u>		104.8		50/3	

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

Borrow Site D

SITE

JOB NO. D5700.55 AH-D-16 HOLE NO. 48E)

PROJECT Susitna Hydroelectric Project

SHEET NO. E OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTEST, PLASTICITY, COMPACTNESS,			SAMPL	. E		PENETRATION
<u>-</u>		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RETUR	TEST
105	Sand (cont)	Gray, silty, gravelly. Very dense to hard. Moist.						
-106		106.5-169.5 Gravelly.						
-107			55	AS	2-1/2	106.5 to 107.2		46 50/
-108			56	AS	2-1/2	108.0 te	-	31
-109			***********			108.7		65/3
-110				4			Comment of the Commen	
-111							mass. The risk on one production	
-112	Clay	Dark gray, silty with some fine to coarse sand, gravel to 2 inches. Very stiff.	57	AS	2-1/2	112.0- 112.6		33 .50/1
-113		Moisture content 22%.		A CONTRACTOR OF THE CONTRACTOR			A CASA MANAGEMENT OF THE STREET	
-114								
-115								
-116		Thinly laminated clay.						- E-A-B-C-Market - State - Sta
-117		Temperature 11°C.	58	AS	2-1/2	116.0 to 118.0	The state of the s	11 14 18 26
-118 -119		Silty. Occasional over- consolidated clay pieces.	59	AS	2-1/2	118.0		10 13
-120		Temperature 9°C.				to 120.0	Charles of particular	20 25
- 120		remperature 9 t.	60	AS	3	120.0- 121.6	13	N/A

CLIENT

ALASKA POWER AUTHORITY

PROJECT Susitna Hydrorlectric Project JOB NO. P5700.55 AH-D-16 HOLE NO. (A&B)

SITE

Borrow Site D

SHEET NO. 9 OF 13

<b> </b>	Γ							
DEPTH	SOIL TYPE	OESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPRETNESS, WATER LOSS OR GAIN, ETC.	MQ.	TYPE	S A M P L	DEPTH	RET'O	PENETRATION TEST
121	Clay	I fight to doub own along		<b></b>		DEFIN	MEIU	
122	(cont)	Light to dark gray clay. Silty. Thin to medium lam- inations present in some zones. Very stiff. Moisture content 31%. Temperature	60	(con	tinued)			
123		10°C at 124.						ur ur Harina da H
124				ļ				
-125			61	AS	2-1/2	124.0 to	24	10 15 19
126						126.0		32
127		Lamination more pronounced.				:" .		
128		Medium to thin in thickness.						
129			62	AS	2-1/2	to	19	10 15 25 38
-139						130.0		38
131								
132			63	AS	2-1/2	132.0 to	18	10 13
+133						133.5		23
-134								
135								
136		Temperature 9°C.	64	AS	2-1/2	136.0	18	9
137	<u> </u>					to 137.5		13 23

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT :

ALASKA POWER AUTHORITY

JOB NO. 35700.55

PROJECT Susitna Hydroelectric Project Borrow Site D

HOLE NO. - 255)

SHEET NO. 12 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: CULOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,	SAMPLE					PENETRATION
137		WATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	REY'S	TEST
13/	Clay	Light to dark gray clay.	64	(cor	tinued)			
138	(cont)	Silty, laminated (medium to thin). 2-inch piece of over-						
	ĺ	consolidated clay present in						-
1 <del>1</del> 139		sample. Very stiff.			-			
T133		Moisture content 32%.						
140			65	AS	2-1/2	140.0	13	10
			Ų3	n.s	2-1,2	to		10
141								16
			and the second section is	<u> </u>		141.5		19
142		Laminations range from thin						•
		to medium in thickness.						
143								1
-144								
'			66	AS	2-1/2	144.0	3.8	10
345						to		14
145						145.5		22
		Silty, medium laminated. Moisture content 28%.	na dirimbi bir di	and here when	with the second			
146		moisture content 28%.						
-147		The state of the s						
100	Silt	Dark gray silt. Fine to coarse sands and gravels						
-148		present. Denst to very	e in manimeter			and the second second		18-13   <del></del>
		dense. Moisture content 19%.	67	A5	2-1/2	149.0		8
149		Gravel is subrounded to angular.				to		76
		ungu / ut v		10 11		149.2		50/2
150								
7150								
-151			68	AS	2-1/2	151.0	10	24
		Clayey, trace fine to coarse	100			to		88
1152		sand. Faint laminations.		<del> </del>		152.0		
-153			1					
F133	<u> </u>	<u> La companya di manggirang di manggirang di manggirang di manggirang di manggirang di manggirang di manggiran</u>		<u> </u>	L	<u> </u>		

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

P5700.55 AH-D-16

Susitna Hydroelectric Project PROJECT

HOLE NO. (A&B)

Borrow Site D SITE

SHEET NO. 11 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMP	. ε		PENETRATIO
153		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
154	Silt (cont)	Gray silt. Clayey. Some to trace of sand (fine to coarse grained, trace subrounded to	69	AS	2-1/2	153.0 to 154.4	17	24 29 60/5
155 156		subangular gravel. Moisture content 15%.	70	AS	2-1/2	155.0 to 156.0	12	22 65
157	Clay	Olive gray clay. Silty.						
158		Little fine to coarse sand; trace fine gravel. Very stiff to hard. Mottled. Gravel to 2 inches in size.	71	AS	2-1/2	157.0 to 158.5	18	20 21 65
159			72	AS	2-1/2	350.0	7.0	
160			1.6	A3	2-1/2	159.0 to 160.9	19	16 24 47 50/5
161								
163 164		Gravel to 1 inch; subangular to angular.	73	AS	2-1/2	163.0 to	10	12 21 50/1
165								
166								
167	Silt	Olive gray silt, clayey.	74	AS	2-1/2	167.0	37	73
168		Trace fine to medium grained sand. Occasional layers of dark yellow to orange over consolidated clay.	74	N3	c-1/2	to 168.4	17	11 25 50/5

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY

Borrow Site Do

JOB NO.

PROJECT Susitma Hydroelectric Project

P5700.55 AH-D-16 (A&B) HOLE NO.

SHEET NO. 12 OF 13

ОЕРТН	SOIL TYPE	DESTRIPTION: COLOR, CONSISTENCY, STRUCTURE, MATER CONTENT, PLASTICITY, COMPACTNESS,			SAMP	E		PENETRATION
169		WAYER LOSS OR GAIN, ETC.	NQ.	TYPE	SIZE	DEPTH	RETTO	TEST
	Silt (cont)	Clayey with trace sand.						
-170								
-171	Bedrock/	dr. annual a			1			
	Quartz Diorite		75	I A	2-1/2	171.0- 171.1		40/1
-172								
170								
-173		Quartz diorite. Weathered, fractured. Light gray,					The state of the s	
-174		medium to coarse grained. 10 to 15% quartz.			***			-16 %s. 4% <b>- 34.</b>
175		RQD 10%.	7.					
			76	DY	1-7/8	174.0	GU.	
176		Fresh to slightly weathered at end of run.				to		
177						179.0		
-177								
178								
		V						
179		Weathered, fractured.	e reservations, se	-Wigness in -				The second se
180		RQD OS.						
			77	DY	1-7/8	179.0	<b>5</b> 0	
181	1	Decomposed zone; sandy.				to		
182	Mafic Dike	Dike material very fractured				183.3		
•		and highly weathered.						
183		armore specials. Colley radia? Aprilla 1677/a success species over a state out on manus specials out of the	evil sits, her basis	ļ	<del>alan ar antologi</del> e (1845 1875)	Windows and and a second con-		ga (Mo- <del>danaga garanga</del>
***	Argiliite	Dark gray, fine-grained, fractured. RQD 0%. Ironing	78	DY	1-7/8	183.3	60	
184		staining on some fractures.				to		
185						188.3		

CLIENT

ALASKA POWER AUTHORITY

PROJECT Susitna Hydroelectric Project

JOB NO. P5700.55 AH-D-16 ноше NO. (A&B)

SITE

Borrow Site D

SHEET NO. 13 OF 13

DEPTH	SOIL TYPE	OESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMICTNESS,			SAMPL	£	<del></del>	PEHETRATION
106		WATER LOSS OR GAIN, ETC.	NO.	YPE	SIZE	DEPTH	RET'D	TEST
185	Argillite (cont)	Full recovery this run.	78	(con	inued)			
-186								
187				Ì				
		Less weathered.						
-188								
189		Dark gray, fracture', re- crystallized. Less fractur-						
-190		ing in this run. Iron staining present on some	79	DY	1-7/8	188.3	57	<u>.</u>
		ractures. Slightly weatherea.	- P			to		
191						193.0		
-192								
3.00		Bottom of Hole	] 					
193	A STATE OF THE STA	193 ft						
-194		* Piezometer installed in						
-195		hole at 150 ft.						
-130								
196								
-197								
198								
199								
200								
	1							

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-17

SITE

Borrow Site D

SHEET NO. 1 OF 15

CONTRACTOR: Denali Drilling Inc.

METHOD

STARTED 4:30 P.M. July 19 19 82 19 82

FINISHED 11:30 A.M. August 1 soil Rotary Casing and 3-7/8" Tricone casing DIAM. to 198.0'; 2-15/16" Tricone

HW, 4" I.D.

DRILLING:

LOCATION:

ROCK NO Core Barrel From 198.0'

CORE DIAM.

4-1/2" O.D. NQ, 1-7/8"

to 217' ELEVATIONS: DATUM

Ground Surface

LATITUDE N 3,237,891 DEPARTURE E 752,193 BEARING

DRILL PLATFORM 2383.1 GROUND SURFACE 2383.1' ROCK SURFACE 2165.11

INITIAL DIP 90° OTHER DIPS None

BOTTOM OF HOLE 2153.11 WATER TABLE

DEPTH	SCA), TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,		SAMPLE PENETRAL			PENETRATION	
		WATER LOSS OR GAIN, ETC.	¥0,	TYPER	SIZE	DEPTH	RET'D	1651
0 1 - 2	Surficial Deposits	Boulders, cobbles, organics. Roots. Fiberous.		No	Samplin	g		
- 3 - 1	Silt	Brown to tan, sandy, gravelly, trace clay. Sand is fine to coarse grained. Gravel subrounded to angular to 2 inches. Unsorted.	1	AS	2-1/2	2.0 to 4.0	14	3 3 4 4
- 5	Sand	Light brown to tan, silty. Fine to coarse grained. Well graded. Moist. Medium consistency.	2	AS	2-1/2	4.0 to 6.0	16	8 11 9 9
- 7 - 8	ene was a	Gravelly, silty. Gravel is subrounded to subangular and fine to medium grained. Moist.	3	AS	2-1/2	6.0 to 8.0	15	6 7 6 10
_ 9	Silt	Brown to tan, sandy, gravelly Well graded. Stiff.	4	AS	2-1/2	8.0- 10.0	15	10 9

SAUPLING METHOD

A - SPLIT TUBE
E - THIN WALL TUBE
C - PISTON SAMPLER
D - CORE BARREL

E - AUGER F - WASH

SHIPPING CONTAINER N - INSERT O - TUBE P - WATER CONTENT TIN

R - CLOTH BAS S - PLIOFILM BAS Z - DISCARDED

INSPECTOR E.J. Kleinkauf

LOGGED BY R.G. Adams

DATE 1 /1/82

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO.

P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-17

Borrow Site D SITE

SHEET NO 2 OF 15

	DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.						PENETRATION TEST
1	9		WATER WAS ON BAIR, EIC.	NO.	TYPE	SILE	DEPTH	סייושה	16.51
	-10	Silt (cont)	Brown to tan, sandy, gravelly. Sand fine to coarse grained. Fine sub-	4	(co	ntinued	)		12 16
	-11		angular gravel. Well graded. Moist. Very stiff.	5	AS	2-1/2	10.0	<b>P</b>	12 20
							to 12.0		24 34
	-12		Brown, gravelly, sandy. Very stiff to hard.	6	AS	2-1/2	12.0		19
	-13		very successful to have.				to 13.9		35 32 50/.4
	-14		Poorly graded.	 7	x.c	0.740			
	-15			1	AS	2-1/2	14.0 to 15.3	*	16 38 50/.3
	-16						que	etas en espesadore.	the state of the s
	-17		Brown, gravelly, sandy. Sand fine to coarse grained. Gravel medium grained,	8	AS	2-1/2	16.1) to	* *	16 34
	-18		angular to subrounded. Poorly graded. Very stiff to hard. Moist.				17.3		50/.3
			to hard. Poist.	9	AS	2-1/2	18.0 to 18.8	1/2	26 50/.3
	-19			naigen introvide (in	editoral arago, cu				Polit of Control
	-20		Rock fragments present in sample.	70	AS	2-1/2	20.0- 20.6	8	24 50/ 1
	-21								ekan jeneralen
	-83		Brown to gray, gravelly, sandy. Sand medium to	11	AS	2-1/2	22.0	- John Mark Statement	18
	-23		coarse grained. Gravel fine to coarse grained (sub-rounded to subarrular).	· · · · · · · · · · · · · · · · · · ·	unin Mi, defuge		to 22.7		50/.2
	-24		Poorly graded. H.rd. Moist.	12	AS	2-1/2	24.0	16	
	25			16	no.	c-1/2	to 26.0	10	18 29

## ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-17

SITE

Borrow Site D

SHEET NO. 3 OF 15

DEPTH	SCIL TYPE	DESCRIPTION: COLOR, CONSISTENCY STRUCTURE, WATER CONTENT, PLASTICITY, CON ACTRESS,			SAMPL	Ε		PENETRATION
25		WATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	RET'D	TEST
-26	Silt (cont)	Brown to gray, gravelly, sandy. Medium grained	12	(con	tinued)			
-27		gravel subrounded to angular. Sand medium to coarse grained. Poorly graded. Hard. Moist.	13	AS	2-1/2	26.0 to	16	37 33 42 44
28		Trace clay. Gravel is sub-	3.4	200	0.370	06.0		
29		rounded to subangular.	14	AS	2-1/2	26.0 to 29.3	8	33 45 50/.3
30								
			15	AS	2-1/2	30.0 to 30.7	7	14 50/.2
31								
32		Gravel subrounded to angular.						
-33			16	AS	2-1/2	32.0 to 33.3	16	31 47 50/.3
-34		Brown, hard, moist. Poorly graded.				33.3		
·		Boulder from 34.8 ft to 36.8 ft.	17	AS	2-1/2	34.0 to 34.7	8	20 50/.3
-35								
-36								
37								
38								
39	Sand	Gray brown, silty, gravelly. Trace clay. Gravel mostly angular. Some cobble frag- ments at 40.0 ft. Very hard.						
40								1
40 41			18	AS	2-1/2	40.0 to 41.0	12	63 90/.5

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NC. 95700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 44-0-17

SITE Borrow Site D

SHEET NO. 4 OF 15

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPLETINESS,		70 TH 1944-16-16-16-16	SAMPL	٤		PENETRATION
41		WATER LOSS OR GAIN, ETC.	ra	TYPE	SIZE	DEPTH	RETO	TEST
-42	Sand (cont)	Gray-brown, graveliy. Some silt. Trace clay. Sand fine to coarse grained.						
-43		Cobble fragments. Very hard. Boulder 42.9 ft to 45.3 ft.	19	AS	2-1/2	42.0 to 42.9		31 80/.4
173			en in transfer tre ≈ m	# W				
-44								
-35								
-46		Gravel angular to subangular. Ve , nard. Cobble fragments present throughout.	20	AS	2-1/2	45.3- 45.7		100/.4
		Present till oughout.						
-47								
48		48.0-53.0 ft Occasional cobbles. Gravel content	21	AS	2-1/2	48.0-		50/.4
-49		increased.	eti Hati tusk se			48.4		÷ 125
50								
-51								
-52						•		
-53		Tan-gray, silty gravelly.						
		Trace clay. Fine to coarse grained. Gravel fine to	22	AS	2-1/2	53.0- 53.7	8	30 50/.2
-54		coarse grained and angular to subangular. Occasional cobbles. Very hard.	of the thin decision			A STATE OF THE STA		
-55		committees, very nard.					A 150 A . A A A A A A A A A A A A A A A A A	
-56							e de la constante de la consta	
_57						,		

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

Susitna Hydroelectric Project PRWECT

HOLE NO. AH- D-17

SITE

Borrow Site D

SHEET NO. 5 OF 15

	DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS.			SAMPL	E		PENETIK TIOH
_	<del></del>		WATER LOSS OR GALM, ETC.	NO.	TYPE	\$IZE	DEPTH	RET'D	TEST
5		Sand (cont)	Tan-gray, gravelly, silty. Trace clay. Fine to coarse grained. Gravel fine to coarse grained (angular to						
-5	9		subangular). Occasional cobbles. Very dense.	23	А	2-1/2	58-0- 58-7	0	50/.1
-6	0								
-6	1			24	AS	2-1/2	60.0- 60.8	10	35 <u>50/.3</u>
-6	9		Devilden and salidar						
			Boulders and cobbles.						
-6:	3								
-6	4								
-6	5			- 3E -		מיד מ	- <u>2</u> - 1 -		<b>50.7</b> *
	_			25	A	2-1/2	65.1- 65.5	0	50/.4
-6	b								
-6	7		Rocks in hole causing no						
-6	8		recovery in samples.						
-6	9			- : . - :					
-7	0			26	А	2-1/2	78:9-	0	50/.2
-7									
7				27	A	2-1/2	72.0 to 73.3	0	22 48 50/.3

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

FET00.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. 44-0-17

SITE

Borrow Site D

SHEET NO. 5 OF 15

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	٤		PERETRATION
		WATER LDSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	RET'S	. TF
73	Sand	Tan-gray, gravelly, silty.	27	(con	tinued)			
	(cont)	Trace clay. Both sand and	- September 1997			-tongulari beropinanga piano	epitalisas i .	A., 120; decimando
-74	(00110)	gravel fine to coarse						
<i>7</i> T		grained. Very dense.						
		Numarous cobbles.			Ì			de la
-75		1121121 003 0005,031						
			28	Α	2-1/2	75.0- 75.3		507.3
						13.3		<b>.</b>
-76								
	Sand	Gray-brown. Fine grained.						*.
		Laminated with thin layers						E. Company
-77		of clay and silt. Trace	29	AS	2-1/2	77.0	3 ·	·
	1	medium grained gravel.	23	lus :	2-1/2	77.0 to	3	507.3
		Medium dense to dense.		<u> </u>		77.8	L	
-78	l	Moist.						
	l							
79			Ì	1				4
				1			į	\$
00								
-80		Fine to coarse grained.		<del> </del>				
		Well graded. Trace gravel.	30	AS	2-1/2	80.0	2	25
-81								35
-01		81.0-81.7 ft Clayey,				to		45
		poorly graded. Gray-black.				81.7		50/.2
-82		Moist.		<u> </u>	A CONTRACTOR OF THE CONTRACTOR		Ĺ	
UL.	1 : 1	110136.						
			}	1			Ĭ.	
-83	1						1	1
							1	\$ 3
-84		Gray, clayey, gravelly.	ļ		1			3
		Fine to coarse grained.					1	7
	İ	Gravel is subangular to sub-					1	
در"-		rounded and fine to medium	<u> </u>	┼			1	***
		grained. Poorly graded.	31	AS	2-1/2	85.0	27	11
	1	Moist to wet. Dense.				to	1	17
-86				1				32
1.54			1		1	86.9		50/.4
67				1	-	ļ	<b></b>	<del>}</del>
-87			<b></b>	1			1	J
	The Earline		32	AS	2-1/2	87.0	24	30
-88	1			1		to		32
_0¢	The State of				1			29
	1		1	1		89.0		34
T89	<u> </u>	1	1	<u>L</u>		1	ŧ.	ÿ.

CLIENT ALASKA POWER AUTHORITY

P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-17 PROJECT Susitna Hydroelectric Project

SITE Borrow Site D

SHEET NO. 7 OF 15

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION TEST
89		WATER LOSS OR GAIN, ETC.	жо.	TYPE	SIZE	DEPTH	RET'D	TEST
. 03	Sand	Gray with brown areas, silty,	33	AS	2-1/2	89.0	19	17
- 90		clayey, gravelly. Poorly graded, unsorted. Moist.				to		25
30		90.0 ft change to dark gray				90.6		49 50/.1
67		color.				70.0		00/11
- 91		Cobbles encountered.	34	A	2-1/2	81.8-	0	50/.4
		comples elicodifice ed.				91.4		
- 92	7							
- 93	1		Ì	l				
								i.
- 94		Dark gray, clayey. Trace						
		gravel. Fine to coarse	35	AS	2-1/2	94.0	13	13
OE .		grained. Poorly graded.		53	2-1/2	to	13	50
- 95		Dense. Moist.				95.2		50/.2
			<b></b>	<del> </del>				
96			<del> </del>	<del> </del>				
	Sand and Clay	Gray, gravelly. Sand fine to coarse grained. Trace	36	AS	2-1/2	96.0	23	15
- 97	0.2,	silt. Poorly graded. Moist.				to		26 32
						97.9		50/.4
- 98								
-	Sand	Gray, clayey, gravelly.	37	AS	2-1/2	98.0	19	19
- 99		Trace silt. Fine angular to				to		27 50
- 99		subrounded gravel. Poorly graded. Dense. Moist.				99.7		50/.2
		gradus pendes PUIDL						
-100			38	A	2-1/2	100.0	C	19
			"	^	[	to		46
101						101.3		50/.3
				<b> </b>				
-102								
			39	AS	2-1/2	102.0	7	44 5 <sup>0</sup> /.3
-103						102.8		5 7.3
-103 ****	Cobbles	Cobbles and boulders. No	T. ***	T				
	and	sampling due to coarseness						
-104	Boulders	of material.						
***								
105	<u> </u>		<u> </u>	L				

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

Borrow Site D

JOB NO. 75700.55

HOLE NO. 44-D-17

SHEET NO S OF 15

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION
105		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	HE T	TEST
-106	Cobbles and Boulders (cont)	Cobbles and boulders. No sampling due to coarseness of material.					A CONTRACTOR OF	
-107 -		p., 3.)	400 <b>0</b> 00,000,	**: ***:	- Marchael Colonia Mary 1715		<b>.</b>	
-108	Gravel	Gray, cobbly. Cobbles are small to large. Gravel ranges 1 to 2 inches and is subangular to subrounded.	39A	DS	1-7/8	107.0	A A A	-
-109		Very dense, coarse material. Sampling unproductive. Tri- coned to 120 ft.				110.0		
110			the second					- co <del>s</del>
-111								
-112								
113	The state of the s				·			
-114								
-115								
-116					-			
I-117								
-118								S. S
-119 -120								Construction of Property of Pr
-121	Clay	Light gray. Laminated thinly with silt. Trace sand.	40	AS	2-1/2	120.0 120.7	6	507.2

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-17

SITE

Borrow Site D

SHEET NO. 9 OF 15

DEPTH	SOIL TYPE	DESCRIPTION: COLUR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAHPL	ε		PENETRATION TEST	
121		water loss or gain, etc.	NQ.	TYPE	SIZE	DEPTH	RET'D	1634	
121	Clay	Light gray. Laminated							
100	(cont)	thinly with silt. Trace							
-122		fine grained sand. Firm.	41	AS	2-1/2	122.0	3	31	
		Slightly plastic. Moist.				to	7	50/.3	
-123						122.8			
124									
167		Dry to slightly moist.	42	h	2-1/2	124:8-	0	75/.5	
-125	Gravel	Cobble and gra.el. Zone is							
725	and	very dense. No sampling to							
	Cobbles	136.0 ft.							
126							 i		
127									
							la de la companya de		
128									
-129									
-			100				!		
							1.		
130									
				•					
-131				ĺ					
-132									
-136									
-133									
-134									
-135									
-136				<u> </u>					
	Sand	Gray, silty, clayey, gravel-	43	AS	2-1/2	136.0-	5	50/.4	
-137		ly. Poorly graded. Moist		1		136.4		1	

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

Borrow Site D

FE700.55

PROVECT

SITE

Susitna Hydroelectric Project

HOLE NO. 4-2-17

SHEET NO. 17 OF 15

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTEST, PLASTICITY, COMPACTNESS.	SAMPLE				were 1			SAMPLE		
179		WATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	HET'D	TEST				
137	Sand (cont)	Gray, silty, clayey, gravelly. Fine to medium										
-138	(	grained. Gravel angular to 1-1/2 inches. Dense.	44	A ***	2-1/2	[38.0-	G	327.4				
120		Poorly graded. Moist to		COLOR. ROM		138.4		<b>4</b> 4(3664				
-139		wet.										
-140 — -								A ORDER				
-141	Sand	Brown, trace silt. Fine to medium grained. Soft. Well graded. Moist.	45	AS	2-1/2	140.0 to 140.8	9	45 85/.3				
-142												
174			45	A	2-1/2	142.0-	ਦ	37				
-143			13		2-1/2	142.9		85/.4				
100		Cobble zone. Triconed to less dense material.				:		1.				
-144												
-145								1				
				ĺ		·						
-146	1											
2.67												
-147	Sand	Brown, gravelly, silty.	47	AS	2-1/2	147.0-	emittyi	57				
-148		Fine to coarse grained. Gravel (subangular to sub-	- Dalipse, specialização di			147.8	ona op w−1.	507.3				
-149		rounded) to 1/2 inch. Poorly graded. Medium con- sistency. Wet.										
-150												
-151			<b></b> _									
-152			48	A	2- 2	151.0 to	0	48 76				
153		1-1/2 inch Gravel pieces causing sample recovery		<del> </del>	<b></b>	152.2		50/.2				

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

### DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

Susitna Hydroelectric Project

JOB NO. P5700.55

PROJECT

SITE

Borrow Site D

HOLE NO. AH-D-17

SHEET NO. 11 OF 15

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, MATER CONTENT, PLASTICITY, COMPACTNESS,						PENETRATION TEST
<b></b>		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	
153	Sand	Brown, gravelly, silty.						
	(cont)	Fine to coarse grained.						
<b>-</b> 754		Gravel angular to 1-1/2 inch.						
		Poorly graded. Wet. Dense.						
<b>-</b> 155								
-155			49	Α	2-1/2	155.0-	0	50/.2
			"	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	-1/2	155.2		307.2
-156	•				<b> </b>	-		<del> </del>
				ŀ				•
-157								İ
						·		1
1 50					1			
-1.58								
-159			. :					ļ
133								1
								ļ
-160	1		•				ŀ	1.
	Cobbles	No sampling due to						
	and	coarseness and density of					1	
-161	Gravel	mater 1.	1					
-162					}			
								1
-163								}
								ì
-164 <i>-</i>								
104	Sand	Gray, clayey. Trace of	50	AS	2-1/2	164.0-	6	78/.5
		silt and gravel. Dense.				164.5		
-165		Moist. Poorly graded.						
			-	1				<b>!</b>
	1.			1				
-166					<u>.</u>			
					1	•		
			[					
-167						]		
		Very cobbly.						
160								
-168	1				1	1	1 12 11	
169	<u> L</u>			1		1		

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

#08 NO. PSTIT. 55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AM-1-7

SITE

Borrow Site D

SHEET NO. 12 SF 15

DEPTH	SCIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PERMIN
169		WATER LOSS OR GAIN, ETC.	NO	TYPE	BIZE	DEPTH	MET'D	TESG
109	Clay and	Gray, gravelly (to 2 inch subrounded). Slightly sandy.	51	AS	2-1/2	169.0- 169.3	3	3
-170	Silt	subrounded). Slightly sandy.				103.3	PHOTO STORES	
.,,		Hard. Moist.						
							,	
-171							. 1	
	Cobbles and	Very difficult drilling.	-					
-172	Boulders	No sampling due to coarse- ness and density of						
		material. Triconed hole						
172		ahead to material change.						
-173							1	
							1	
-174							2	
						:	ŀ	
-175								
			52	A	2-1/2	175.0- 175.5	ο,	\$ .5
						1/3.3	To the second se	H
175								
-177								
-178							1	
110	1 1						. 200	
-179								
180							ž.	
,							i	
						. [		
181							1	
182								
						- 1		
183								
100	H							
							i	
184				per a				
						1	į	
-185	1 ·				. 1			

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-17

SITE

Borrow Site D

SHEET NO. 13 OF 15

	WOTTOO	arte D				SHEET	NO,	3 OF 13
DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, P. ASTIGITY, COMPACTNESS,			SAMPL	£		PENETRATION TEST
100		WATER LOSS OR GALW, ETC.	NQ.	TYPE	\$tZE	DEPTH	RET'D	1431
185	Clay	Gray and light gray.	53	AS	2-1/2	185.0	17	12
-186		Laminated with 1/4 inch		1		to		24
'00		layers of silt. Trace to some sand. Some gravel.				186.8		43 50/.3
707		Dry to slightly moist.				100.0		307.5
-187		Hard.		1				
		1/4 / 44 / 44 / 44 / 44 / 44 / 44 / 44						1.5
-188	Cobbles	Very difficult drilling.						
	and Boulders							
-189	bourders							
-190				]				
-191								
[13]		Dark gray, coarse gravel and cobbles. Gravel ranges	54	DS	1-778	191.0- 191.6	7	
100		from 1/2 inch. Very hard.		<del> </del>		191.0		
192		Cored through rock 191.0-						
		191.6 ft.						
-193								
-194								
-195				}				
1.50								
<del> </del> 196							(	
196								1.1
	Tana da Sinta							
-197								
-198		Cobbles and boulders.				ĺ		
				1				
-199								
		Registrate, with the second						
-200								
200								
201								

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. 75700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-17

SITE

Borrow Site D

SHEET NO 14 OF 15

DEPT	н	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PERETRATION
007			WATER LOSS OR GAIN, ETC.	ÄÜ	TYPE	BIZE	DEFTH	****	TEST
201		Cobbles and	Very rocky. Difficult drilling. No sampling						
-202		Boulders	due to coarseness and density of material.						
-203									
-204									
							1,11		
-205		\$							
						•			
-206									
-207			207.0 - 210.0 Boulder						1 1
-208									
-209									
-210		•							
-211			Hole advanced with 2-15/16 inch roller bit.						
									- 1
-212									
030									
-213								***	
-214									
-215		5			3			and an article	
-216			Same material.					ŀ	
-217									

DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

JOB NO. P5700.55

Susitna Hydroelectric Project PRIJECT

HOLE NO. AH-D-17

Borrow Site D SITE

SHEET NO. 15 OF 15

		TYPE MATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PENETRATION	
DEPTH	SOIL TYPE	HATER CONTEST, PLASTICITY, COMPACTACES,	NO.	TYPE	SIZE	DEPTH	RET'D		
217	Cobbles &		55	D	1-7/8	217.0	36	DOD	
	Boulders (cont)					+0		RQD 93%	
218 —	(cont)		L			to		33%	
	Bedrock	Gray, 20-30% Mafics	Ì			220.0			
070	Diorite	(biotite and hornblende).							
219		Medium grained plagioclose feldspar. No visible quartz	1						
	Ī	Fresh to slightly	1						
220		weathered. Very hard.				200 0	60	RQD	
		med sites of the site of the s	56	D	1-7/8	220.0	60	22%	
-221						to			
-221			Ì						
				1		225.0			
-222		222.0 - 224.7 Fracture/ shear zone. Vertical				1		1	
		joints. Trace slickensides.				1			
-223		Some iron oxide staining on				1			
-223		joint surfaces.							
						ľ			
-224									
-225						┼	-		
- 223			57	D	1-7/5	225.	0 60		
			2/	J D	1-110	LLU		RQD	
-226						to		44%	
-227						230.	וט	1	
2,						1			
	1.						1	1	
-228		228.3 - 229.4 Trace clay							
		on joint surfaces.			1		1		
-229									
				-   -			- 1	. 1	
-			$\dashv$	$\dashv$	+	$\top$	$\top$		
-230		Bottom of Hole: 230 ft							
-231			1			1			
			1				1		
000									
-232								-	
-233									

DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

JOB NO. P5700.55

Susitna Hydroelectric Project PROJECT

HOLE NO. AH-D-18

SITE

Borrow Site D

SHEET NO. 1 OF 13

19 82

cc'.TRACTOR: Denali Drilling Inc.

July 29 STARTED FINISHED

SCIL Rotary Casing w/3-7/8"

August 19 82 .H. HW, 4" I.D. 4" O.D. CASING DIAM.

METHOD Tricone Bit

ри CORE DIAM.

DRILLING: LOCATION:

LATITUDE N 3,235,590 ELEVATIONS: DATUM

**Ground Surface** DRILL PLATFORM 2341.4"

DEPARTURE E 754,176 BEARING

GROUND SURFACE 2341.41

INITIAL DIP 90° OTHER DIPS None

ROCK SURFACE -**BOTTOM OF HOLE** 2152.1 WATER TABLE

DEPTH	BOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,	SAMPLE					PEHETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEFTH	RET'D	12.51
0	Surficial Deposits	Silt, cobbles, and boulders with organics.						
2			-					
3	Sand	Gray brown, dense, with						
4 /	Janu	little clayey silt, cobbles, and gravel. Subangular, well graded. Moisture content	1	AS	2-1/2	3.5 to	12	29 40
5		approximately 13%.				5.5		20 10
5			2	AS	2-1/2	5.5	19	6
7						to 7.5		9 18 14
•		Cobbles and gravel through-	3	AS	2-1/2	7.5	10	17
8				١٨٦	2-1/2	to 8.5		17

A- SPLIT TUBE B- THIN WALL TUBE C- PISTON SAMPLEN D- CORE BARREL

H - FISERT O - TUDE P - WATER CONTENT TIN Q - BLASS JAR

INSPECTOR E.J. Kleinkauf LOGGED BY R.C. Powell

DATE 12/7/62

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

₹5700.55 JOB NO.

PROJECT Susitna Hydroelectric Project

HOLE MO: 34-D-18

SITE Borrow Site D SHEET NO. 5 OF 13

DEPTH SOIL TYPE		DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, OIL TYPE WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	e		PEKETRATIO
		WATER CONTENT, FLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, 270.	NQ.	TYPE	SIZE	DEPTH	RE"S	TEST
9	Sand	Gray-brown with silt, gravel,						
10	(cont)	and cobbles. Well graded, dense.	4	AS	2-1/2	9.5 to 10.4		16 50/.4
11				-				
							<u>L</u>	
12			5	AS	2-1/2	12:5-	i i	50/1
12								47
13						¥		}
14		Continually drilling through					And of the last of	# •
15	•	gravel and cobbles.	L	<u> </u>		Appropriate windy year	- Companyor Co	4
			6	AS	2-1/2	15.0 to	74	33 46
16						16.3		50/4
17								
17								* 多次市場
18		Thin ice lenses < lmm found	7	AS	2-1/2	18:9-	13	15
•.		below 17 ft.		1	ļ	110	<b>†</b>	1
-19								Mark Company
20								
21								appay theatra
-22					ļ			1
-23			8	AS	2-1/2	22.0 to 23.3	12	13 26 50/4
			-	-	1		<del> </del>	<b>†</b>
-24								
25	1							1

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

Susitna Hydroelectric Project PROJECT

HOLE NO. AH-D-18

SITE

Borrow Site D

SHEET NO. 3 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, PATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PERETRATION
25		WATER LOSS OR GAIN, ETC.	NO.	TYFE	SIZE	DEPTN	RET'D	TEST
25	Silt	Gray, clayey with little	9	AS	2-1/2	25.0	24	10
-26		sand, frozen, very dense.				to		19
-20		Moisture content approxi- mately 12%.				27.0		23 27
14		musery raps	·			27.0	}	21
-27			10	AS	2-1/2	27.0-	0	50/2
				<del> </del>		27.0- 27.2		
-28								
-29								
			11.	AS	2-/12	29.0	20	12
-30						to		30 29
						31.0		28
-31				<b> </b>				
			12	AS	2-1/2	31.0	15	11
-32						to	, , ,	39
JL			٠.					15
						33.0		22
-33							<b> </b>	
•			13	AS	2-1/2	33.0	10	Not
-34						to		Recorde
						35.0		
-35								
	1		14	AS	2-1/2	35 0	15	17
ne.				'"	. ,,~	to		32
-36	<b>]</b> .					36.5		50/6
			÷				<b></b>	
-37								
			15	AS	2-1/2	37.0	10	16
-38						to 38.4		37 50/5
						50. 1		30,3
70								
-39				-	0.346	200	<b> </b>	
			16	AS	2-1/2	39.0 to	11	12 38
-40						40.4		50/5
45							<u> </u>	
41	L			1	1		]	

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

₹₹₹₽₽.55 JOB NO.

PROJECT Susitna Hydrnelectric Project

HOLE NO. 14-2-18

SITE Borrow Site )

SHEET NO. 4 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPRCTNESS,			****	£		PENETRATION
41		WATER LOSS OR GAIN, ETC.	NC	TYPE	MIXE	DEPTH	RETO	TEST
-42 -42	Silt (cont)	Gray, clayey, with little sand. Very dense, frozen. Moisture content 15%.	37	AS	2-1/2	41.0 to	<u>:</u>	16 30 46
-43			omposite in a diff	nija siperdiaya n		43.0		46
-44			18	AS	2-1/2	43.0 to		14 29 29
-45				eller Britten ton 1	7 s — roome reinsen b	45.0		27
-46	Sand	Brown, with gravel and cobbles, very dense. Coarse						
<del>-4</del> 7		Contract to the contract to th	19	AS	2-1/2	50:0- 50:8	c	60/4
<b>-48</b>			-					
- <b>4</b> 9								
-50 -51			20	AS	2-1/2	54.0 to 50.8		14 60/4
-52		Numerous cobbles and boulders		**************************************	nament Transie 1200 PAM 407 August			
-53		causing difficulty in sampling.						
-54								
-55			21	AS	2-1/2	54:9-		30/3
-56						erederale de la companya de la compa	A CONTRACTOR OF THE PARTY OF TH	
-57								

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-18

SITE

Borrow Site D

SHEET NO. 5 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTHESS,	SAMPLE					PENETRATION
		WATER CONTENT, PLASTICITY, COMPACTHESS, WATER LOSS OR GAIN, ETC.	NO.	TYPE	\$IZE	DEPTH	RET'D	TEST
-58	Sand (cont)	Brown, with numerous cobbles and boulders.						
<b>J</b> U								
-59	. 1.							
-60			24	AS	2-1/2	59.0 to	0	7 30/3
-61				<del>                                     </del>		60.3		,
-62				. :				
-63								
-64		Very rocky, cannot drive	- 2					
		sampler.						-
65			23	AS	2-1/2	65.0- 65.3	0	30/3
-66								
67								
<b>CO</b>								
68								
69								
<del>.</del> 70				<u> </u>				
			24	AS	2-1/2	70.0	9	17
71						to 71.3		40 60/4
72								
73				ļ				

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY

JOB NO. \$5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 44-0-18

Borrow Site D

SHEET NO 5 OF 13

DEPTH SOIL TYPE				SAMPLE				
<u> </u>		WATER LOSS OR GIN, ETC.	Ma	TYPE	SIZE	DEPTH	METTO	TEST
	Sand	Brown, very dense to hard with numerous cobbles and						200
-74	(cont)	with numerous cobbles and boulders.						k d
74		bourders.						: # :
-75			25	AS	2-1/2	75 0-	ļ	507.3
				L	- 1/-	75.0- 76.0	ļ.,	- 40° + 2
-76		Some cobbles, subrounded to						# #
		rounded.				İ		
ing ing								
-77								
			•					1
-78								2
		•						
70								
-79								
-80								
				}		<u> </u>		1
0.5								!
-81			ļ					
-23-								
				į				
-83				) {				
						1		
-84								
e et en en Georgia en en	le state in		1					
			1					
-85			<u> </u>			a state		
				}			)	
-86								
07								
-87	1 1							
-88		Losing approximately 50% of		1				
		drill water.						
-89							1	

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-18

SITE

Borrow Site D

SHEET NO. 7 OF 13

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SABPL	E		PENETI-ATION TEST	
89		WATER LOSS OR SAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	1831	
89	Sand	Brown with numerous cobbles				-			
90	(cont)	and boulders.							
90								-	
					-				
91									
92			٠.						
20									
93		Performed falling head test and then mudded hole.							
O.A.									
94								-	
95									
							-		
96									
07									
97						•			
ani na isa mwakani safawa ini									
98	Silt	Gray, clayey, with some fine to medium sand. Laminated,							
		stiff to very stiff with	26	AS	2-1/2	98.0	24	25	
99		occasional red-brown staining			- "	to		46	
		on laminations. Water con-				}		34 51	
		tent approximately 182.				100.0		51	
00			27	AS	2-1/2	100.0	5	22	
					_ ,, _	to 100.9		75/5	
01						100.9			
								4.4	
02									
· - <del>-</del>			28	AS	2-1/2	102.0	3	32	
inn						to 103.0		76	
103						1113.0			
104			29	AS	2-1/2	104.0-	2	76/6	
						304.5	L		
105	<u></u>		<u> </u>						

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. 315700.55

PROJECT Susitna Hydroelectric

HOLE NO. 44-0-18

Borrow Site D

SHEET NO. 1 OF 13

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, MATER CONTENT, PLASTICITY, COMPACTNESS,		PEHETRATIO				
100	<u> </u>	WATER LOSS OR GALH, ETC.	HQ.	TYPE	SIZE	DEPTH	BETT	TEST
105	Silt	Gray, clayey, very dense,						**************************************
106		Tamtitaceu.		<b>.</b>	-	a de Merid - pri passe	L	
	the state of the s	- Lander of the Control of the Contr	30	15	2-1/2	106.0	18	13
107						to		13
						107.8		31 60/4
108						107.0		00/4
100		Some fine, angular grave; included.	31	AS	2-1/2	188:9-	4	45
		incraded,	h	ļ		108./_	<b>_</b>	5072
109					-			
								1
110			32	-	0.1:5	1	L., .	1
			32	AS	2-1/2	110.C to		17 63
111						111.2		50/2
112				AND THE PARTY OF T				
114		Becomes sandy at 112 ft, olive gray, wet, dense.	33	1.0	2-1/2	112.0	ار	i ke disandahan
		Weakly laminated.			<b>L</b> -85£	1	•4.	8 31
113						to		57
						113.8		50/3
114			ele sa i			The Supplement		en en angelen.
		Alternating silt and sand	34	AS	2-1/2	114.0		7
115		Concinues.			•	to		18
						116.0		25
116						110.0		33
					Marie Andrews (All States and All States and			in a citizente que ron
117			35	AS	2-1/2	116.0	₹ <b>.</b> .	12
117						to		50 54
						118.0		80
118		Faint traces of organics.		; ; ;	the second	one or knowledge with		er over protestanting
			3£.	i as	2-1/2	118.0		14
119				Marie Marie		to		26
						120.0		47 17
120						160.6		17
					A A STATE OF CORP.	er militar (n. 1822)		No. of the Contract of the Con
21								

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-18

SITE Borrow Site D

SHEET NO. 9 OF 13

DEPTN	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	ε		PENETRATION TEST
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	AET'D	1231
121	Silt	Gray, clayey, laminated with little gravel.						
<b>–122</b>								
-123			37	AS	2-1/2	123.0- 123.4	0.	63/5
-124						_1,61,47		
-125			38	72	2-1/2	725:9-	4	75/5
-126								
-127			39	AS	2-1/2	127.0- 127.1	0	20/1
-128	Clay	Gray, silty, gravelly, with angular and subangular	4C	AS	2-1/2	128.0	0	-
-129		gravel, very stiff. Gravel mainly diorite but some andesite and argillite as	41	AS	2-1/2	129.0- 129.3	0	50/3
-130		well as gravel dispersed throughout clay matrix. Moisture content approxi- mately 13%.				129.5		
-131								
-132			42	AS	2-1/2	132.0 to	4	58 85/4
-133						132.8		
-134								
-135 -136			43	AS	2-1/2	135.0 to 136.3	15	12 22
-137			<del> </del>	<b> </b>	<u> </u>			<del> </del>

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO: AH-D-18

BOTTOW Site D

SHEET NO 10 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, O'MPACTNESS,			SAMPL	E		PENETRAZIONI TEST
137		WATER LOSS OR GAIN, ETC.	HQ.	TYPE	SIZE	DEPTH	ME " D	
137	Çlay	Gray, gravelly, sandy,	44	AS	2-1/2	137.0- 137.3	*	50/3
320	(cont)	gravel portion subangular.	erro essayada			1.272	me di gand	-
-138		very stiff, moist.						
-139								
			45	AS	2-1/2	139.0- 139.6	*	73 25/1
			mmilitario de apesa.			139.6		25/1
-140								
141	·							
-142			46	AS	2-1/2	142 0		
			**************************************	A3	2-1/2	142.0- 42.3		65/4
-143		Gravel layer 142-144 ft.			, A .			
		Losing drill water.	47	AS	2-1/2	143.0- 143.5	* 1	100/6
		acong de , , , , hade, ,	NY to kindante		· · · · · · · · · · · · · · · · · · ·	143.5	-97-1	
-144	,						- Section	1
-145								1
					5.0			
146							Glass A	
		•					in the contract of the contrac	
-147							, and the same of	1
		Many cobbles and boulders.					30 Mary 1	[
148							74.	
149							1	Ì
-150								*****
							Ī	
-151								
				r				
-152			48	AS	2-1/2	152.0-	-6-	32
150						152.0- 152.6		_50/1
153			لــــــا					

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-18

SITE

Borrow Site D

SHEET NO. 11 OF 13

חיפוני	. ]	SOIL TYPE	OESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETPATION TEST
<u></u>			WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	1621
-154	r	Clay (cont)	Gray, silty, sandy, very dense. Numerous cobbles throughout.						
-155				49	AS	2-1/2	155.0 to	0	7 50/5
-156							155.9		30,0
-157 -									
-158		Siit	Gray, sandy, gravelly, moist, very dense.	50	AS	2-1/2	157.3- 158.1	3	40 50/3
-159						."			
-160									
-100				51	AS	2-1/2	160.0- 160.4	5	62/5
-161		•				=			
-162			Difficult to sample due to	52	AS	2-1/2	162.5- 162.7	T	31 _50/2
-163			gravel and numerous cobbles.						
-164									e Service de la companya de la companya de la companya de la companya de la companya de la companya de la companya
-165									
-166				53	AS	2-1/2	166.0- 166.0	5	352 3071
-167									
-168				54	AS	2-1/2	168.0- 168.8	6	17
-169				<b> </b> -	1	<del> </del>	1.08.8		

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. 55700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 2--0-18

E Borrow Site D

SHEET NO. 12 OF 13

Silt   Gray, sandy, with subangular gravel, very dense, moist. Water content approximately	DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			3 A M P L	. ε	and the same of th	PENETRATION
170   171   172   172   172   173   174   175   175   176   177   177   177   178   179   179   180   181   181   182   183   184	160		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	ME # 5	TEST
-170 -171 -172 -173 -174 -175 -176 -177 -178 -178 -179 -180 -181 -182 -183 -184	103	Şilt	Gray, sandy, with subangular					!	
14½.  -172 -173 -174 -175 -176 -177 -178 -179 -180 -181 -182 -183 -184	_170	(cont)	gravel, very dense, moist.				t		
-171 -172 -173 -174 -175 -176 -177 -178 -178 -179 -180 -181 -182 -183 -184	-170		water content approximately			ļ	ĺ		
-172 -173 -174 -175 -176 -177 -178 -179 -180 -181 -182 -184			140,					1	*
55 AS 2-1/2 172.0 3 32 84 173.0 -174 -175 -176 -177 0ccasional weak laminations178 -179 -180 -181 -182 -183 -184	-171								
55 AS 2-1/2 172.0 3 32 84 173.0 -174 -175 -176 -177 0ccasional weak laminations178 -179 -180 -181 -182 -183 -184									
55 AS 2-1/2 172.0 3 32 84 173.0 -174 -175 -176 -177 0ccasional weak laminations178 -179 -180 -181 -182 -183 -184	-172								
-174 -175 -176 -177 -177 -178 -178 -180 -181 -182 -183 -184				55	AS	2-1/2			32
-174 -175 -176 -177 -178 -179 -180 -181 -182 -183 -184							172 O		84
-175 -176 -177 -177 -178 -179 -180 -181 -182 -183 -184	-173			erine de la grada			1/3.0	<b>-</b>	<u> </u>
-175 -176 -177 -177 -178 -179 -180 -181 -182 -183 -184			•						,
-176 -177 -178 -179 -180 -181 -182 -184	-174						•		*
-176 -177 -178 -179 -180 -181 -182 -184		August 1							
-176 -177 -178 -179 -180 -181 -182 -184	_175								
-177 -178 -179 -180 -181 -182 -184	1,3								
-177 -178 -179 -180 -181 -182 -184					1				
-177   Occasional weak laminations.   to   14   55/4	-176			- E. 4000		the majoritymatic and			
Occasional weak laminations.  -178  -179  -180  -181  -182  -184				56	AS	2-1/2	176.0	-	
-178 -179 -180 -181 -182 -184	-177						to		
-178 -179 -180 -181 -182 -184			Occasional weak laminations.				177.3		55,4
-179 -180 -181 -182 -184	178								To a combil abbid to West tracking the page against
-179 to 11 18 45/3 -180 -181 -182 -183 -184	170			F.7	20	2_1/2	778.0	edge et a	
-180 -181 -182 -183 -184				3"	1 7.3	6-1/6	i i	*	11
-181 -182 -183 -184	-179						1	e in a second	18
-181 -182 -183 -184							179.8		45/3
-182 -183 -184	-180			10 M NS (40 mA		Competition of the Control of the Control			- Inches
-182 -183 -184									
-182 -183 -184	101			ĺ					
−182 −183 −184	-101			58	AS	2-1/2	181-0-	3	80/4
<b>−183</b>				-	<u> </u>	Pitar i (na integrapia) ya santo	LOLES		
-184	-182								
-184									
-184	-183								
								in the state of	
	10/								
	104								
mixing the state of the state o	185								

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-18

SITE Borrow Site D

SHEET NO. 13 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, COMMISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PENETRATION TEST
		WATER LOSS OR GAIN, ETC.	NQ.	TYPE	SIZE	DEFTH	RET'D	1531
185	Silt	Gray, clayey, with some gravel dispersed throughout.	59	AS	2-1/2	185.0- 185.4	1	92/5
186	(cont)	gravel dispersed throughout. Very dense, moist.						
187						:		
188						) .		
100								
-189	the trace of the control of the cont		60	AS	2-1/2	]89:9-	0	65/4
190		Bottom of Hole 189.3 Ft. (No Bedrock)						
						·		
			•					

2.7

CLIENT

ALASKA POWER AUTHORITY

P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-19

SITE

Borrow Site D

SHEET NO. 1 OF 14

CONTRACTOR: Denali Drilling Inc.

STARTED 9:00 A.M. August 3 FINISHED 1:00 P.M. August 13 19 82

METHOD

SOIL Rotary Casing and 3-7/8" Tricone casing DIAM. HW, 4" I.D.

4-1/2" O.D. Bit

DRILLING:

ROCK NQ Core Barrel With Diamond Bit CORE DIAM. NQ, 1-7/8"

LOCATION:

LATITUDE N 3,233,072 DEPARTURE E 750,455

ELEVATIONS: DATUM Ground Surface DRILL PLATFORM 2261.7' GROUND SURFACE 2261.7'

BEARING INITIAL DIP 90° OTHER DIPS None

ROCK SURFACE -BOTTOM OF HOLE 2045.7 WATER TABLE

DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE.

DEPTH SOIL TYPE				7.7.7.7					
بـــننطهونت		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST	
- 1	Surficial Deposits	Sand, organics. Tundra vegetation and roots.							
- 2									
			1	AS	2-1/2	2.0	24	11	
4						to 4.0		10 12 30	
			2	AS	2-1/2	4.0	17	14	
5						to 6.0		18 12 13	
5	Sand	Brown, clayey, silty, graveily. Fine to coarse	3	AS	2-1/2	6.0	5	21 24	
,		grained. Gravel subrounded to angular. Medium to dense consistency. Poorly graded.				to 8.0		25 23	
9		Moîst.	4	AS	2-1/2	8.0 to 9.0	8	507.5	

SAMPLING METHOD

A - SPLIT TUBE
B - THIN WALL TUBE
C - PISTON SAMPLER
D - CORE BARREL

E - AUGER F - WASH

SHIPPING CONTAINER

H - INSERT O - TUBE - WATER CONTENT TIN R - CLOTH BAG S - PLIOFILM BAS I - DISCARDED

INSPECTOR E.J. Kleinkauf

LOGGED BY R.G. Adams

APPROVED DATE /2/7/82

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY

35730.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. 3-19

Borrow Site D

SHEET NO. . DF 14

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Σ		
		WATER LOSS OR GAIN, ETC.	ಖ೦	TYPE	3/2E	DEPTH	RETT	TEST
-10	Sand (cont)	Brown, clayey, silty, gravelly. Fine to coarse						
-10		grained. Gravel subrounded to angular. Poorly graded. Medium to dense consistency.	5	AE	2-1/2	10.0	19	9
-11		Moist to wet. Occasional black sporting.				to 12.0		24 13 18
-12			6	A.C.	0.1/0			(Mary and State St
-13			0	AS	2-1/2	12.0 to 13.2	14	47 32
				MICTOR COMP.	el Paggarania de La companya de la c	13.2	er een ala	50/.2
-14		Numerous rock fragments.	7	A #	n 170	74.0	~~	
-15		سي طويقو ودوم عليه جسم حسن حسن عين عين فيت سي (1950 1950)	,	AS	2-1/2	14.0 to	22	12 16 22
-16	Sand	Gray, clayey, gravelly. Trace siit. Medium to coarse grained. Gravel sub-				16.0		26
-10		rounded to angular. Loose to medium consistency.	8	AS	2-1/2	16.0	20	7
-17		Moist. Poorly graded.				to 17.8		12 50/.3
-18		مين د چې چې ښې پښې مينيو مينې مينيو مينې مينيو پې مينو د مينې د مينې پې مينو د مينې د مينې د مينې د مينې د مين		<b>-</b>		alar a seeman para a	ereziot autopag	Kir Bi ab a san khansananin
-79	Cobbles	Coarse gravel and cobble zone. Hole advanced with						
-13		tricone roller bit. No sampling due to material coarseness.						
-20		Courseiness.						
-21								
60								
-22								
-23								AND TO COMME
-24								
-25								

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-19

SITE Borrow Site D

SHEET NO. 3 OF 14

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, PATER CONTEST, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	81ZE	DEPTH	MET'D	TEST
25	Cobbles (cont)	Coarse gravel and cobbles.						
26 — —	Sand	Gray, clayey. Trace to	9	AS	2-1/2	26.0	24	14
27		some gravel. Trace silt. Fine to medium grained.	,	173	2-1/2	to	24	50 42
		Gravel generally subangular. Dense. Moist. Posrly				28.0		48
28		graded.	10	AS	2-1/2	28.0- 28.8	7	18 50/.3
29						20.0		307.3
20								
30							:	
31		Char olaron anamolan						
32		Gray, clayey, gravelly. Trace silt. Poorly graded. Very dense. Slightly moist.	11	AS	2-1/2	31.0 to	23	30 50
						32.9		53 65/.4
33 — —	Cobbles	Cobble zone 33.0 to 34.0 ft.						
34 —								
· ·	Sand	Gray, gravelly. Trace to some clay and silt. Very	12	AS	2-1/2	34.0	18	12 18
35		dense. Poorly graded. Moist.				35.8		42 50/.3
36								
37			13	AS	2-1/2	36.0 to	22	9
ວ/						38.0		21 65
38 — —	Cobble	Coanco gravel and cabbles	14	A	2-1/2	38.0- 38.3	0	50/.3
39	CODUTE	Coarse gravel and cobbles.		<u> </u>		38.3	<del> </del>	
••								
40				<u>                                     </u>	0 3 /5		<u></u>	
41	Sand	Gray, clayey, gravelly. Fine to coarse grained. Dense. Moist	15	AS	2-1/2	40.0 to 42.0	24	21 39

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. 35"30.55

Susitna Hydroelectric Project

HOLE NO. 14-2-19

SITE Borrow Site D

SHEET NO. 4 OF 14

	<del> </del>							
OEPTH	SOIL TYPE	OFFICE COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, MATER LOSS OR GAIN, ETC.		Y	SAMPL			PERMETRICITION TEST
41	Sand		NO.	TYPE	PIZE	DEPTH	RET'D	
-42 <i></i> -	(cont)	Gray, clayey, gravelly. Some orangish bands, dense, moist.	(co	AS tinu	ed)			35 48
	Cobbles	Coarse gravel and cobbles.						
-43 <i></i> -44	Sand	Gray, clayey, gravelly. Fine to coarse grained. Some silt. Poorly graded.	16	AS	2-1/2	43.0 to 44.3	15	9 45 70/.3
<del>-</del> 45		Slightly moist. Dense.						
7.0		45.3 ft ice lense (1 inch).	17	AS	2-1/2	45.0- 45.7	8	54 50/.2
-46 47								
-47			18	AS	2-1/2	47.0- 47.8	8	57 75/.3
<b>-</b> ∢8		Some yellow-brown markings.						
<b>-</b> 49	Gravel	Cobbles, boulders, and	19	A	2-1/2	49.0- 49.8		75 60/.3
-50		coa se gravel zones. Or sional 4 to 6 inch oft sand. Lenses ocky areas. No	er Tegranyiki gani San		The County of th	13.0		
-51		due to material						And the second leading of the second leading
-52								
-53								
54							-	
-,								
-55								
-56								
_57								

CLIENT ALASKA POWER AUTHORITY JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project HOLE NO. AH-D-19

SITE Borrow Site D SHEET NO. 5 OF 11

DEPTH	SOLL TYPE	PERCEIPTION: COLOR, CONSISTENCY, STRUCTURE, MATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATIO
		HATER LOSS OR GAIN, ETC.	HO	TYPE	SIZE	DEPTH	RET'D	1631
57	Gravel (cont)	Cobbles, boulders, and gravel zone. Some layers						
58	and the second	4 to 6 inches thick of softer material.				•		
59 — —	 Sand	Gray with some brownish	20	AS	2-1/2	59.0	10	51 75/.4
60		areas, clayey, silty, gravelly. Fine to coarse grained. Gravel subrounded				59.9		
<b>6</b> 1		to subangular. Poorligraded. Very dense. Moist.	21	A	2-1/2	61.0-	0	50/.4
			21	<del>  ^</del>	2-1/2	61.4	"	307.5
62								
63		Cobble zone. Hole triconed					1	
64		ahead.						
pr			2					
65			22	AS	2-1/2	65.0- 65.7	3	62 50/.
66								
67		0.113						
68		Cobble zone. Hole triconed ahead.						
69		Gravel up to 2 inches re-	23	AS	2-1/2	69.9 69.5	4	70/.
70		covered in sample. Same material as above.						
71			24	A	2-1/2	71.0	- 0	7
70	Sand	Gray, clayey, gravelly. Trace silt. Fine to medium	24	1	12-1/2	71.6		50/.
-72		grained, subrounded to sub- angular gravel to 2 inches in samples. Very dense. Moist						

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

JOB NO. P5700.55

FROJECT Susitna Hydroelectric Project

HOLE NO AH-D-19

Borrow Site D SITE

SHEET NO. 6 OF 14

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION
		MATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	WET'D	1251
73	Sand (cont)	Gray, clayey, gravelly. Trace silt. Fine to medium	25	À	2-1/2	<del>7</del> 3-9-	0	50/.4
-74	(cont)	grained. Occasional to some cobbles. Very dense. Moist.						
<del>-</del> 75		Cobble zone.						
<sup>-7</sup> 6								
77			almanikkas Optobe			in the state of th		
		Same material as above retained in sample.	26	AS	2-1/2	77.0 to	7.	25 85/.5
<b>–78</b>				****		_78.0		y Dan ye an an an an an an an an an an an an an
<del>-</del> 79							فالمحاولات والمتاثثة	
-80		Cobble zone No sampling		,		:	rot to the control of	
-81		Cobble zone. No sampling due to material coarseness.					Edward State	
-82							t a comment	
<del>-</del> 83								
-84		No reco _ry due to rock.	27	Å	2-1/2	84.0 84.6	0	19 50/,1
-85			***************************************	TO SEPHENDING THE			COLUMN AND A	30/11
-86								
87		Cobble zone. Triconed to						
		softer material.						
-88 -89								

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

DRILLING REPORT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

Susitna Hydroelectric Project PROJECT

HOLE NO. AH-D-19

Borrow Site D SITE

SHEET NO. 7 OF 14

DEPTH	SOIL TYPE	OFFICHIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION
- 776		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
89 ~ 90	Sand (cont)	Brownish-gray, clayey, silty, gravelly. Fine to coarse grained. Gravel subrounded						
- 91		to subangular. Poorly graded. Very dense. Slightly moist. Numerous cobble and boulder zones.						
- 92			. ,					
- 93			28	AS	2-1/2	93.0	19	41-
- 94						to 94.7		53 47 50/.2
<sup>2</sup> 95		Comble zone.						
- 96								
- 97			29	AS	2-1/2	97.0-	2	50/.3
- 98								
<b>~</b> 99			30	AS	2-1/2	99.0	12	49
-100						to 100.0		85/.5
-101		Cobbles, boulders, and coarse gravel zone. Hole						
-102		triconed. No sampling due to material coarseness.						
-103								
-104						State of the state		ing Like inggression
_105								

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

SITE

JOB NO.

P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 4H-D-19

Borrow Site D SHEET NO. E OF 14

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, COMBISTERCY, STRUCTURE, MATER CONTENT, PLASTICITY, COMPACTNESS.			SAMPL	. E		PENETRATION
- TXE		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RE TO	TEST
105 -106	Sand (cont)	Cobble zone to 108.5 ft No sampling due to material coarseness.		and productions of the state of				
		coursements.						
-107								
<b>–108</b>								
-109								
-105	·	Gray, silty, clayey. Trace	37	AS	2-1/2	109.0	- 3	1,-
-110		gravel in sample. Sand generally fine grained.	J	Wa	L-1/L	to 110.5		16 33 85/.5
		Very dense. Poorly graded. Slightly moist.		on aligned participal	alam month for a time	<b></b>		
-111		Stignery motse.						
-112								
-112			38	AS	2-1/2	112.0- 112.9		28 80/.4
-113			and the second second		electricity of the control of the co			
* .								
-114		ليوري تنصد بينيد سبن عديد كنف تاروه سبت ماعد بسبه حسن عبيد هماء بساء	120.500					4. + %y
-115	Sand and Silt	Gray, clayey. No visible gravel in sample. Fine	33	AS	Z-1/Z	114.0- 114.8	*	54 65/.3
		grained sand. Dense. Poorly graded. Moist.						
-116								
-117		Occasional brown silt layers	34	AS	2-1/2	117.e-	*	31
-118		approximately 1/8 inch thick.	n en en	mit is just spirit just	ekanonen postallen andla	117.8		80/.3
-119								
<b>–</b> 120								
-121 121			35	AS	2-1/2	120.0- 120.7	3	_33 _50/_2

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-19

SITE Borrow Site D

SHEET NO. 9 OF 14

реги	SOIL TYPE	CESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,	:		SAMPL	E		PENETRATIO
121		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SITE	DEPTH	RET'D	1321
122	Sand and Silt (cont)	Gray, clayey. No gravel seen in samples. Fine grained. Dense. Poorly						
  - 123 -	a space princip region where the	graded. Moist.						
124	Clay and Silt	Gray clay and brown silt with some laminations. Sandy. Dense. Slightly						
125		moist.	36	AS	2-1/2	124.0 to	17	24 54
						125.4		70/.4
126	Sand	Gray (some brownish areas), silty, gravelly. Trace clay. Fine to coarse grained.	37	A	2-1/2	126.0- 126.7	0	58 50/.2
127		Very dense. Poorly graded. Moist-						
128								
129								
130		Boulder and cobble zone. Hole triconed.						
131								
132								
133		Sand, as above.	38	AS	2-1/2	133.0- 133.8	8	45 75/.:
134	Cobbles and	Cobbles, boulders, and coarse gravel. Sand matrix.				100.0		75/
135	Boulders	No sampling due to material coarseness.						
136								
137								

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-19

SITE

Borrow Site D

SHEET NO. 10 OF 14

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, TRYER CONTENT, PLASTICITY, COMPACTNESS.			3 A M P (	. E		PENETRATION
177		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	10	TEST
137	Cobbles and	Yery coarse material. No sampling due to coarseness						
-138	Boulders (cont)	and density.	39	A	2-1/2	138:9-		50/.2
-139							-	
-140								
7 87								
-141								
-142								
-143								
-144 — -	Sand	Gray, silty, gravelly.	40	AS	2-1/2	744:g-	*	75/.5
-145		Trace clay. Fine to medium grained. Gravel subrounded to angular. Poorly graded.						
-146		Very dense. Moist. Occasion 1 to some cobbles.						
-147			   वा	 	2-1/2	7/17 75_		
740			er it agains	<u> </u>	2-1/2	147.0- 147.3	P <sup>O</sup> Conjuin	507.3
-148								
-149			42	A	2-1/2	149.0-	()	72
-150			- HARTEY 40, GARAGE	<u> </u>		149.8	The Russ	50/.3
						.ar		
-151		Gray, silty, clayey,	43	AS	2-1/2	151.0- 151.5	5	80/.5
-152		gravelly. Fine to coarse grained.						
-153								

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

Susitna Hydroelectric Project PROJECT

HOLE NO. AH-D-19

SITE Borrow Site D SHEET NO. 11 OF 14

OEPTH	SOIL TYPE	DESCRIPTION: COLOR, COMMISTERCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMISTMESS,	I, PLASTICITY, COMPACTNESS,			PENETRATION TEST		
757		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	REY'D	
153	Sand	Gray, clayey, silty,	44	Α	2-1/2	153.9-	0	80/:3
	(cont)	gravelly. Fine to coarse				-1-50-0		
L-154		grained. Gravel subangular						
		to subrounded. Poorly						
-155		graded. Very dense. Moist. Many cobbles.						
}		liany cobbies.						
-156			•					
		Cobble zone.	ļ.				-	
7								
-157								
-158								
	i	No recovery; rock in sample	45	Α	2-1/2	158-0- 158-5	0	95/.5
<b> </b>		shoe.	<b> </b>		<b></b>	1.10.0		
-159								
-160	1	•						
100								
-161								
ļ			1					
300					1			
-162								
1					ļ			
-163			1					
1								: :
-164			-				<b> </b>	
1	4							
-165	1							
1			45A	ne	1-7/8	754 0	20	
			HOH.	DS	1-7/8	164.0	26	-
-166	<del> </del> -			1		to		
	Clay	Gray, silty, gravelly.				169.0		
167		Trace sand. Gravel angular	-		;			
-167		to subrounded. Clay and			}			
		silt laminated throughout.   Stiff. Slightly moist.			Ì			
-168		Jacille Strynery moist.						
, , ,								
169			1					
		American de la companya de la companya de la companya de la companya de la companya de la companya de la compa	1		<u> </u>	<u> </u>	للنسلط	

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. 75700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 1--0-19

SITE Borrow Site D

SHEET NO. 12 OF 14

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SARPL	. ¢		PENETRATION
		WATER LOSS OR GAIN, ETC.	40.	THE	SIZE	DEPTH	HEET'U	TEST
169	Clay (cont)	Gray, silty. Trace fine grained sand. Laminated.	46	AS	2-1/2	169.9- 169.4	5	80/.4
-170	(conc)	Very stiff. Moist.					M. T. College	
-171			or sales pages page					
-172			47	AS	2-1/2	171.0 to 172.5	73	30 39 69/.5
-173	American Control of the Control of t		esaber - st. (c.	<b> </b>				
		olight organic odor.						
-174								
-175 — -								
-175 -176	Sand	Gray, very clayey, silty. Trace gravel. Very fine	48	AS	2-1/2	175.0 to	ć	3 <u>9</u> 55
-177		grained. Organic odor.			- marine a marine a traphy to entire a marine a	176.2		50/.2
-178	Clay	Gray, silty. Trace very fine grained sand. Lami-nated. Some thin brown layers present. Stiff.	49	AS	2-1/2	177.0 to 178.5	70	18 27 70/.5
-179		Moist. Slight organic odor.	्ष्याच्याची ह्रा. क्षेत्रेण स्टब्स्			0.00	-	
-180								
-181			15.7.4 poer syn		ه دينو الوركس مستحد	NE JÖZ Á <del>SPO SZYST NEJ MEGYN</del> JOHNS		/ Sill, malifespering representations
-182		Same material, as above.	50	AS	2-1/2	181.0 to 182.6		15 19 29 50/.1
-183			epont ,		and a property of the second	- 1895. in <u>neuk d<del>ank spl</del>ite</u> sser, m		***************************************
-184								
-185								1

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-19

SITE

Borrow Site D

SHEET NO. 13 OF 14

DEFTH	SOIL TYPE	<u>CESCRIPTION</u> : COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PENETRATION
		WATER LDSS OR GALIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
185 186	Clay (c.at)	Gray with brown layering, silty. Trace fine grained sand. Laminated (1/4 inch). Stiff. Moist.	51	Α	2-1/2	185.0 to 186.5	0	15 21 34
-187								
-188			52	AS	2-1/2	187.0 to 188.4	17	16 26 60/.4
-189		Occasional cobble lenses.			0			
-190								
-191			53	A	2-172	191.0-	0	59
-192						191.4		507.2
-193	Silt	Brown, clayey. Trace fine	54	AS	2-1/2	193.0- 193.8	8	23 50/.3
-194 -195		to medium grained sand. Trace subrounded gravel. No laminations. Medium con- sistency. Moist.					and a shirt grant.	
–196 <sub>– –</sub> –197	Cobbles and Boulders	Very coarse material. Consists of cobbles, boulders, and coarse gravel. Matrix appears to be brown silts and sands.						
-198 -199			55	A	2-1/2	]98.0- ]98.4	0	50/.4
-200								
-201				1	<b>[</b>			

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. \$5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 44-0-19

Borrow Area D

SHEET NO. 14 OF 14

0 <b>6</b> #TH	SOIL TYPE	<u>DESCRIPTION</u> : COLOR, CONSISTENCY, STRUCTURE, HATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	SAMPLE					PENETRATION
			на	TYPE	SIZE	DEPTH	RET. 20	TEST
EU į	Cobbles	Very coarse, cobbles,						1
202	and	Doulders, and coarse grayel.	1		Ì			40 og
202	Boulders (cont)	Some brown sand and silt matrix.		Ì				
	(Conc)	mast IX.						4
203								
					İ			
204		No successful sampling due						
		to material coarseness.						•
		33.						
205			56	l a -	2-1/2	205.0-	-	· 60/.5
						205.0- 205.5	-0	
206								
	1							
207								
207					l			
208								
209		Hole advanced with tricone						
		bit. No sampling.						
210				1			1	
	1							
211								
212								
-12		Same material.					73	
							İ	
213		and the second of the second of the						
							1	
214				}				
215								
-10		Bottom of Hole 215 Ft.	57	Α	2-1/2	215.0	0	50/Ref
			٠,	''	4m 1/4m	213.0	N.	JO! VEL
216		* Pneumatic p' 20 eter tips installed 6 2.0 and						
		212.0 ft.						
217	<u></u>							

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-20

SITE

Borrow Site D

SHEET NO. 1 OF 10

CONTRACTOR: Denali Drilling Inc.

INSPECTOR E.J. Kleinkauf LOGGED BY E.J. Kleinkauf STARTED 10:00 A.M.

August 13 19 82

FINISHED 1:00 P.M.

August 19 19 82 HW, 4-1/2" G.D.

METHOD OF DRILLING:

SOIL Rotary Casing and 3-7/8" Tricone CASING DIAM.

ROCK NJ Core Barrel With Diamond Bit CORE DIAM.

4" I.D. NQ, 1-7/8"

LOCATION:

LATITUDE N 3,231,729

ELEVATIONS: DATUM

Ground Surface

DEPARTURE E 744,658 BEARING

DRILL PLATFORM GROUND SURFACE 2162.1' ROCK SURFACE

2162.11 2027.1

INITIAL DIP 90° COTHER DIPS None

BOTTOM OF HOLE WATER TABLE

DATE /2/7/82

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS.			SAMPL	E		PENETRATION
<b></b>		WATER LOSS OR GAIN, ETC.	NO.	TYPE	EIZI	DEPTH	RET'D	TEST
0	Surficial	Tundra vegetation.						
- 2	Cobbles and Boulders	2 ft zone of loose rock material.						
- 4 - 5	Sand	Gray and brown. Fine to coarse grained. Little to some clayey silt present. Little fine gravel (subrounded to subangular). Moist. Very dense.	1	AS	2-1/2	3.0 to 5.0	11	13 24 42 52
- 6			2	AS	2-1/2	5.0 to 6.4	5	11 29 50/.4
7	+							
- 8			3	AS	2-1/2	7.0	7	31 51
_ 9						9.0		54 48
1 1	SAMPLING METHOD  A - SPLIT TUBE  B - THIN WALL TUBE  C - PISTON SAMPLER  D - CORE BARREL	E - AUGER N - INS F - WASH 0 - TU P - WA	BE	NTEHT T	5	- CLOTH BA - PLIOFILM - DISCARDE	BAG	

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

F5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. 44-0-20

SITE

Borrow Site D

SHEET NO 2 OF TO

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION
		WATER LOSS OR GAIN, ETC.	DG.	TYPE	SIZE	DEPTH	M-3	TEST
9	Sand (cont)	Gray and brown with little clayey silt and trace fine	4	AS	2-1/2	9,00 9,00 9,00	•	5873
-10		gravel. Wet. Very dense. Moisture content 9%.						
-11	·		5	A	2-1/2	ij.g-		50,6
-12		Cobble or boulder.						- Cities - C
-13			- <del>pisi</del> mpega ejitti					
-14			6.	A	2-1/2	13.0 to 14.4		45 37 50/5
-15			endicata pape			Marine Nation Section		
	-		7	A	2-1/2	15.0- 15.5	``	30 25/Ref.
-16								
-17		Fine to coarse grained sand with fine gravel to cobbles.	8	AS	2-1/2	17.0 to		34 50/5
-18			) polices violen			_17.9		o -   Mary Service Miller Service Conference
-19	<b>e</b> tr						10 (A 11) (B	
-20		Brown, fine to coarse grained. Some silt and clay.	9	AS	2-1/2	19.5 to 20.8		14 42
-21		Trace fine ravel.			elista va tileta praktika ja paraktika	60.0.		50/3
22						197 2		mpo mpo a saja calapsama pagini mpo ana ana ana ana ana ana ana ana ana an
<b>–23</b>			10	AS	2- /2	22.0 to 23.3	13	30 45 50/4
-24							Carriera	
-95	Sand	Brown, fine to coarse grained. Moist. Little clayey silt.	11	AS	2-1/2	24.0 to _25.8	5	23 45

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-20 PROJECT Susitna Hydroelectric Project

SITE B

Borrow Site D

SHEET NO. 3 OF 10

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	ε		PENETRATION TEST
- X.F		water loss on Gain, etc.	NO.	TYPE	SIZE	ОЕРТИ	RET'D	1631
25 -26	Sand (cont)	Brown, fine to coarse grained. Little clayey silt and fine gravel. Very dense.	11	(con	tinued)			49 50/3
-27		Moisture content 8%.	12	AS	2-1/2	26.0 to 27.8	10	4 42 51 50/4
28 29 30			13	AS	2-1/2	28.0 to 30.0	6	2 8 39 59
-31		Trace fine gravel (sub- rounded to subangular).	14	Α	2-1/2	30.0 to 32.0	0	34 37 45 48
-33 -34	Sand	Brown, fine to medium grained. Wet. Trace to little clayey silt. Sorted.	15	AS	2-1/2	32.0 to 34.0	22	19 29 43 50
-35 -36			16	AS	2-1/2	34.0 to 36.0	14	4 14 24 33
-30 -317			17	AS	2-1/2	36.0 to 38.0	7	17 29 33 34
-39		Brown, fine to coarse grained. Little fine gravel (subrounded to rounded). Very dense.	18	AS	2-1/2	38.0 to 40.0	17	14 26 36 54
-40 -41			19	AS	2-1/2	40.0 to 42.0	15	15 28

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. 75749.55

HOLE NO 44-0-28

re Borrow Site D

SHEET NO. 4 OF 10

	DEPTI	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PERETRATION
ļ		 	MATER LOSS OR GAIN, ETC.	NC	TYPE	SIZE	DEPTH	MET 2	्राष्ट्रम
	41 -42	Sand (cont)	Brown, fine to coarse grained. Trace clayey silt.	19	(con	tinued)			34 49
			Little fine gravel. Wet. Very dense. Moisture con- tent 20%.			oder in military punching spage, darly,	•	Per Sui - Care Sear Care	
	<b>-43</b>					·			4 4
	-44							estro	
	<b>-45</b>			20	AS	2-1/2	44.0 to	**	17 35
	<b>-4</b> 6						46.0		40 58
				of and					*
	-47								
	-48			a dichidaymasını					K 4-4-1-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2-
	<b>-49</b>			21	AS	2-1/2	48.0 to		24 38 52
	-50						50.0		67
		•							
	-51								
	-52			22	75	0 7 /0	EN 2	white	Cal (Calumpation
	-53		Moisture content 22%.	22	AS	2-1/2	52.0 to	1.54	18 21 37
	54					nimalpapostas yay 1400ziaani	54.0	M.P. G.	41
	55								Part of the second
-		*		. 44					
	-56			23	AS	2-1/2	56.0 to	18	17 27
-	_57						to 57.8		~~*

CLIENT ALASKA POWER AUTHORITY

408 NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-20

SITE Borrow Site D

SHEET NO. 5 OF 10

DEPTH	SOIL TYPE	<u>DESCRIPTION:</u> COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PENETRATION TEST
<del></del>		WATER LOSS OR GAIN, ETC.	RQ.	TYPE	SIZE	DEPTH	RET'D	1631
57 58	Sand (cont)	Brown, fine to coarse grained. Very dense. Wet. Occasional zones appear to	23	(con	tinued)			42 50/3
		have higher fine content.						
-59								
-60								
-61			24	AS	2-1/2	60.0 to	19	17 28
		·Increasing fine content.				62.0		41 51
-62								
-63								
-64								
-65			25	AS	2-1/2	64.0 to 65.2	8	25 63 50/2
:						03.2		30/2
-66	Clay and	Gray, little fine to medium	26	AS	2-1/2	66.0- 66.2	Ü	50/2
-67	Silt	sand. Trace to little fine gravel (subrounded to sub- angular). Hard.						
-68								
-69								
			27	AS	2-1/2	69.0- 69.8	7	46 50/3
70								
<b>-7</b> 1			28	AS	2-1/2	71.0-	9	21
72						71.8		50/3
73								

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO: AH-D-20

SITE Borrow Site D

SHEET NO. 6 OF 10

DEPTN	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	ž.		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RECT TO	TEST
73	Clay and	Gray. Little fine to coarse grained sand. Little fine	29	Α	2-1/2	73.0- 73.8		40 50/4
-74	(cont)	gravel. Moist. Hard.						
-75			20		0.7.0			*97.
7.0			30	AS	2-1/2	75.0- 75.7		32 50/2
76								
-77								
-78								
					-			
-79 <i>—</i> —	Clay	Gray, silty, sandy (fine to	31	AS	2-1/2	79.0	* *	33
80		coarse grained). Some fine gravel. Very dense.				to 80.3		41 50/4
-81				******		<del></del>	magama artistis, aga	A CM Little general and a sign an
82			32	AS	2-1/2	81.0	23	17
		Gray and brown, silty. Trace fine sand and fine				to 83.0		18 27 37
83		gravel. Laminated.	33	AS	2-1/2	83.0	t a	
-84			JJ	Mo	2-1/2	to	الآرا	13 26 41
85						84.8		50/3
							THE COLUMN SECTION	
-86								
87								The state of the s
00	Sand	Gray, fine grained. Some silty clay present. Very	34	AS	2-1/2	87.0	7	34 21
-88		dense. Sorted.				to 89.0		34 64
89	1					55,0		U-1

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-20

SITE Borrow Site D

SHEET NO. 7 OF 10

DEPTH	SOIL TYPE	DENTERPRICE: COLOR, CONSISTENCY, STRUCTUME, WATER CONTENT, PLASTICITY, COMPACTNESS.			SAMPL	ε		PEKETRATION
89		WATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	RET'D	TEST
89	Clay	Gray and brown, silty.	35	AS	2-1/2	89.0	17	19
- 90		Trace fine sand and fine gravel (subrounded to				to		30
30		rounded). Laminated. Hard.				90.4		50/5
- 91								
- 92								
			Ì					e a las f
- 93								
<b>J</b> J								
			36	AS	2-1/2	93.0	22	19
- 94		W-2-1	İ			to		18 23
		Moisture content 28%.				95.0		44
- 95								
- 96								
30								
	1							
- 97							ļ	
	1		37	AS	2-1/2	97.0	19	14
- 98						to		17 32
						98.8		50/3
							ļ	
- 99			•				}	
		Gray and brown, silty.						
-100		Laminateo.					}	
101								
101								
			38	AS	2-1/2	707.0	24	9
102			l			to		6 23
	1.5					102.0		27
103	1							
Tot								
-104					1			
7.05						•		
105	<u> </u>		<u> </u>		<u> </u>		<u> </u>	<u></u>

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS SUFFALO NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

Borrow Site D

SITE

JOB NO. P5700.55

. . .

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-20
SHEET NO. 3 OF 10

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, MATER CONFERT, PLASTICITY, COMPRCTHESS,			SAUPL	E		PENETRATION	
105	<u> </u>	WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE.	DEPTH	RETTO	TEST	
-106	Clay (cont)	Gray and brown, silty. Trace fine sand and fine gravel (subrounded to rounded). Laminated.	39	AS	2-1/2	105.0 to 107.0	<u> 1</u> 2	9 17 24 46	
-107			*******	ļ. —		and the second second	enterio a social pare		
-108									
-109			entende er vilke, de	<b></b>		and the second s		Complements (married to the complements)	
-110			40	Ā	2-1/2	109.0 to 110.3		28 50 50/3	
-111			27	AS	2-1/2	111		e (d. c.) is the entire and	
-112	Clay and Silt	Brown, some fine to medium sand; little coarse sand. Very dense.		100	2-1/2	111:8-		58,1_	
-1.3			Ph Granderija is da			-			
-114	Sand	Brown. Fine to medium grained with little coarse grained sand. Little clayey	42	AS	2-1/2	113.0 to 114.1	1	23 45 50/3	
-115		silt. Very dense.					er es ellection villos		
-116	Gravel, Cobbles, Boulders						Committee of the Commit		
-117		Manus and I am and I am I am					inci enveri in de la mana		
-118		Many cobbles and boulders present.					and the state of t		
-119							***************************************		
							cation (material)		
-120									
-121	<u> </u>			1					

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

ноце но. AH-D-20

SITE Borrow Site D

SHEET NO. 9 OF 10

DEFTH	SOIL TYPE	DESCRIPTION: COLGR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION TEST
321		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	1651
» Z 1	Gravel,	Very coarse material.						
	Cobbles,	Difficult to sam, 3.						
122	Boulders			1				
	(cont)		43	- 00				
123			43	AS	2-1/2	122.5- 122.8	0	50/3
124		Rock fragments.	44	AS	2-1/2	124 O-	2	70
			4.1	100	2-1/2	124.0- 124.7	-	49 50/2
125								
120								
126								
	1				}			
127	# 12 N		ŀ					
167			45	AS	2-1/2	127.u- 127.4	0	50/5
				-		127_A		
128								
							1	10.0
129				[				100
143								
130								
131								
131								
132						-		
700								
133								
134								
•								
135		Gravel and cobbles with						
		fragments of decomposed bed-	46	DS	1-7/8	135.0	16	_
136		rock.			1 ''/			
	Bedrock	Moderately to highly weath-				to		
137	Diorite	ered. Jointed and fractured.				137.0		

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

**PLIENT** ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 58-0-20

TE Borrow Site D

SHEET NO. 13 OF 10

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMICTNESS,			SAMPL	. ε	<del> </del>	PENSTATION
137		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPIN	現代がなり	VEST
-138	Bedrock	Moderately to highly weathered. Jointed and fractured. Iron staining present on discontinuities.	47	DY	1-7/8	137.0	<b>5</b> 2	
-139				***************************************		to 141.5		
-140								
-141		141.5-144.5 Fresh diorite.						
-142						•	¥ H•1∜: Д	NO. NOTE SHALL AND ANALYSIS OF THE STATE OF
-143			48	DY	1-7/8	141.5	52	•
-144		Returns to being moderately				to 146.5	Same Superior Same	
-145		to highly weathered con- dition.		Ĭ			A Company of the Comp	
-146								
-147		Iron staining evident on joints and fractures throughout.					en der Grant grant in between	
-148			49	DY	1-7/8	146.5 to	50	-
-149						151.5	titistiye enage u	
-150								
-151								
-152		Bottom of Hole 151.5 Ft.  * Thermistor string in-				**************************************		
_153		stalled to 148.5 ft.					-	

CLIENT

ALASKA POWER AUTHORITY

JUB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-21

SITE

Borrow Site D

SHEET NO. 1 OF 13

CONTRACTOR: Denali Drilling Inc.

STARTED 12:00 P.M.

METHOD

August 14 19 82

August 21 19 82 4-1/2" O.D.

OF DRILLING: ROCK NQ Core Barrel With Diamond Bit CORE DIAM.

LOGGED BY R.G. Adams

R.A. Werneiwski

FINISHED 7:00 P.M. SOIL Rotary Casing and 3-7/8" Tricone CASING DIAM.

4" I.D.

LOCATION:

LATITUDE N 3,234,649

ELEVATIONS: DATUM

DATUM Ground Surface 2272.7'

1-7/8"

DEPARTURE E 747,467 BEARING -INITIAL DIP 90° OTHER DIPS None

GROUND SURFACE 2272.7

ROCK SURFACE 2098.71 BOTTOM OF HOLE 2084.01

WATER TABLE

DEPTH	SOIL TYPE	DESCRIPTION: COLUR, CONSISTERCY, STRUCTURE, WAYER CONTENT, PLASTICITY, COMPACTHESS.			SAMPL	E		PENETRATIO!
		WATER LOSS OR GAIN, ETC.	NC.	TYPE	SIZK	DEPTH	RET'D	TEST
. j	Surficial Deposits	Sand, silt, roots, and tundra vegetation.						
- 2								
- 3	Sand	Brown to tan, silty, gravelly. Some organics	1	AS	2-1/2	2.0	20	6 3
- 3 - 4		present. Mostly fine with some medium grained. Loose. Wet. Weil graded.				to 4 0		7 10
- 5		Gravel is subrounded to sub- angular.	2	AS	2-1/2	4.0 to	12	9 7
- 5						6.0		15
- 7			3	AS	2-1/2	5.0 to 7.0	6	]] ]3 30/Ref
- 8		Brown, silty, gravelly. Fine to coarse grained. Well	4	AS	2-1/2	8.0 to	13	22 24
被 A · · ·	HPLING METHOD SPLIT TUBE THIN WALL TUBE PISTON SAMPLER CGXE BARREL	E-AUSER N-IN F-WASH G-TU F-WA	38	NTENT T		- CLOTH B	BAG	

DATE 12/7/42

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO: 44-0-21

Borrow Site D

SHEET NO 2 OF 13

ОЕРТН	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WINTER CONTEXT, PLASTICITY, COMPACTNESS,			SAMPL	٤		PEMETRATION
9		WATER LOSS OR GAIN, ETC.	NQ	TYPE	SIZE	DEPTH	RE' ID	TEST
-10	Sand (cont)	Brown, silty, gravelly. Medium to coarse grained. Gravel subrounded to sub-	4	(соп	tinued)			15 15
-11		angular. Medium density. Well graded. Occasional angular rock fragments.	5	AS	2-1/2	10.0 to	?.35	14 20 26
12		Trace clay.	· · · · · · · · · · · · · · · · · · ·		THE PERSON STREET	12.0	-N-W-1	55
-13			6	AS	2-1/2	12.0 to	16	18 21
-14		Wet.				14.0		17 16
		**************************************	7	AS	2-1/2	14.0	1.4	16 24
<del>-</del> 15						to 16.0		18 19
<del> -</del> 16		No recovery of sample due to piece of diorite gravel	8	AS	2-1/2	16.0	٥	46
<del>-17</del>		lodged in sampling shoe	•			to 18.0		29 26 26
-18 -19	Sand	Cobble 18.0 to 19.0 ft. Brown, silty, gravelly.	-014/20 <sub>14-</sub>		od jerskaniski spiež 21. spieži	, <del></del>		
-20		Trace clay. Fine to medium grained. Gravel subangular to subrounded with occasional pieces to 2 inches. Medium	9	AS	Z-1/2	19.0	12	13 16
-21		pieces to 2 inches. Medium density. Well graded. Moist.				to 21.0		25 20
-22							*************************************	4 5 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4
			10	AS	2-1/2	22.0	9	27 19
-23						to 24.0		15 12
-24 -25			11	AS	2-1/2	24.0 to 26.0	12	19 11

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-21

SITE Borrow Site D

SHEET NO. 3 OF 13

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMITMENS,			SAMPL	ε		PENETRATION
AC .	<u> </u>	WATER LOSS OR GAIN, ETC.	MO	TYPE	SIZE	DEFTH	RET'D	TEST
25 -26	Sand (cont)	Brown, silty, gravelly. Trace clay. Fine to medium	11	(cor	tinued)			14 16
		grained. Gravel angular to subrounded. Occasional angular pieces or diorite.	12	AS	2-1/2	26.0 to	10	23 52
27		Well graded. Moist. Medium dencity.				27.5		75/.5
28								
29			13	AS	2-1/2	28.0	19	33 43
						to 29.9		60 65/.4
30 — —	Sand	Gray, clayey, silty,	14	AS	2-1/2	30.0 to	8	41 85/.5
31		gravelly. Occasional brown zones. Fine to medium grained. Partly to well				31.0		
32		graded. Very dense. Moist. Becomes more well graded				: : :		
		with depth.	15	AS	2-1/2	32.0- 32.8	6	41 60/.3
33								
34		No recovery of samples due	16	A	2-1/2	34.9-	3	70/.4
35		to rocky/cobbly conditions.						
36								-
			717	A	2-1/2	36.0- 36.1	0	30/.1
<b>S7</b>								
38								
39 — — 40	Sand	Brown, gravelly, silty. Little clay. Medium to coarse grained. Gravel sub-	18	TAX T	2-1/2	39.0 to 40.0	8	49 /.5
0		rounded to subangular. Moist to wet.						

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

BRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

SITE

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO AH-D-21

Borrow Site D SHEET NO. 4 OF 13

DEPT	SOIL TYPE	The contract of the contract o		PENETRATION				
11		WATER LOSS OF GAIN, ETC.	HQ.	TYPE	SIZE	DEPTH	ART'D	TEST
F 1	Sand	Brown, siity, gravelly.	19	A	2-1/2	41.0-		807.5
2	(cont)	Little clay. Medium to		<b>*</b>		anthonia.	erice see on a par	<u> </u>
2		coarse grained. Occasional						
	1	concles. Gravel subrounded to subangular. Partly to						*
3		gap graded. Moist to wet.		1				7
		Dense.						
4			20	AS	2-1/2	43.5 to 44.3	William Sange St. Tolkie	75/.3
t				1		44.3		75/.3
			erment legs/wave.com	MF/MF(SMC 1286		THE PROPERTY OF THE PARTY OF	aprilia de la compansión de la compansió	
5 — —	F		-2/4	amy work	5.75	The state of the s		
	Gravel	Gravel, cobbles, and coarse	21	A	2-1/2	45.0- 45.4	\$	85/.4
5		sand. Fines probably present						
		in small quantities but washed out during drilling.						
_		and the same same same same same same same sam						
7			22	- A	2-1/2	47.0		
				''	, -	to		16 75/.4
}			e sensorense com	• +#/. a. asa.		47.9		or the about the appropriate
9				) 1			Ī	
,		Poor to no recovery of samples due to cobbly nature	23	AS	2-1/2	49.0-	- 3	55
		of deposit.	دادين وماراتس	gerilleri zagi alandari		49.8		85/.3
)								- Strander L. K. Ling
							Š	
							Topic and a	
						į	Î	
2			24	À	2-1/2	52 0-	3	50/.3
			<del>omital si cre</del>	de revisero ne		52·9-		307.3
3					-			
					Ì			
	•					1	1	
			25	A	2-1/2	54.g-	77	507.3
J	. 3		ortoccur ( A. ) - Ar-	NETT TO MISSESSEE		54.3.		e distancement of the same
i						i	1	
					1	Į	i	
5							-	
			26	A	2-1/2	56.0- 56.3	0	80/.3
				entaknige is si		_ במכ	-	

CLIENT

ALASKA POWER AUTHORITY

ON. NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-21

SITE Borrow Site D

SHEET NO 5 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE,			SAMPL	E	PEHETRATION	
	SOIL TIPE	MATER CONTENT, PLASTICITY, COMPACTHESS, WATER LOSS OR GAIN, ETC.	NO.	TYPE	\$17.5	DEPTH	RET'D	TEST
57 -58	Gravel (cont)	Very cobbly. Coarse sand present. No sample recovery due to rocky material.						
<b>.</b>		due to rocky material.	27	Α	2-1/2	58:0- 58:2	0	70/. :
-59								
-60			28	Α	2-1/2	60.0- 60.3	0	507.3
-61						. 5		
-62	Silt and	light and dark and light	<u> </u>	}	!			
-b.	Gravel	Light and dark gray lami- nations of silt and clay. Some fine to medium grained sand. Slightly moist to d.y.	29	AS	2-1/2	62.0 to	14	17 25 31
-64		Very stiff to hard.				64.0		58
-65			30	AS	2-1/2	64.0 to	15	14 20 41
-66						65.7		59/.2
		Occasional brown laminae.	31	ĄS	2-1/2	66.0	20	10
-67						to 68.0		16 18 24
-68				-		Terrestibus MA piene		PARTY AND Address of Control
-69			32 	AS	2-1/2	68.0 to	24	16 25 47
-70						70.0		bi
<b>-71</b>								
		Hole triconed ahead in same material.						
-72								
73			1			1	1	

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. \$5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-21

SITE

rrow Site D

SHEET NO 6 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS.			SAMPL	E	<del></del>	PEWETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	ME 12	TEST
73	Silt and	Light and dark gray. Some					-	
1	Clay	fine to medium grained sand.						
<del>-74</del>	(cont)	Laminated. Slightly moist.		-				
		Stiff to very stirf.	33	AS	2-1/2	/4.0 to	**	5
<del>-</del> 75						75.5		26 43
							<u>.</u>	15
-76			Ì					J. 1 . J
1.0				Š			i.	
1								
<del>  77</del>								
	1			; 1				
-78		78.0-80.0 ft Not laminated.		<u> </u>			www.comer.	
			34	AS	2-1/2	78.0		**
<del>-7</del> 9			74	[ ·	2-1/2	to		19 33
13						79.5		53
				<del> </del>	regal distribution		William Company	. min(m. start
-80		Gray with some prownish	35	AS	2-1/2	80.0		20
		areas. Laminated. Very stiff. Moist.		1,73	- 1,2	to		33
-81		Still MOISC.				81.2		50/.2
			ncani a soum	<b></b>	-tugatar otto pia osusaka		Maria de la	- , was a substantial and a su
-62								
Lor								
			Ì		·			
£,			36	A	2-1/2	83.0	- 3	A 2
				<u> </u> ^	2-1/2	to	4,7	43 71/.5
-84	ler var		eriori, avendos		especialistica (1) benyagy tarana sagana	84.0	Manager 1	
-85								
_03			en se pace Se de	<sup>†</sup> A	2-1/2	85.0		52
				i i		85.9		1007.4
<del>-8</del> 6		Gravelly zone. Very dense.	- Commentation	سنسو	Andrews Proposed Control	· N.M. Barrier		8/48/10: <del></del>
-87			d TAN CARRONNA		derivative or the state of the	-	Motion for the con-	
		Occasional brown tan lami-	38	AS	2-1/2	87.3	13	28
00		nated clay layers present.				†o 1 88		45
-88					eritas sinteremento propriesar	00 1	entra ir mežantikumo	50/.1
-89								
	<u> </u>	<u> </u>	L					

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700,55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-21

SITE Borrow Site D

SHEET NO. 7 OF 13

ОЕРТН	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PENETRATION
89		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	MET'D	TEST
- 90	Clay	Dark gray, silty. Laminated. Little to no sand. Thin	39	AS	2-1/2	89.0	24	10
- 90		silt layers throughout. Very stiff. Moist. Occasional gravel to 1 inch				to 91.0		19 21 23
- 91		diameter.						
- 92								
- 93								
- 94			40	AS	2-1/2	93.0 to	18	15 23
- 95		Mottled annual and				95.0		42 30/.1
		Mottled appearance with gray, brown, and tan layers.	:					
- 96								
- 97								
- 98			47	100	0 7 10	**		
- 99		Silt layer 99.0 to 99.3 ft.	41	AS	2-1/2	98.0 to 99.3	19	11 16 50/.3
-100								
-101 .	Şánd	Brown, silty, clayey. Fine						
		to coarse grained. Occasional gravel to 1/2 inch.	42	AS	2-1/2	101.0- 101.3	4	75/.3
-102								
-103		Very dense. Moist.	•					
-104		Drilling easy but difficult sampling.	43	AS	2-1/2	104.0-	2	75/.2
105		Some ( Hig :				104.2		

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

DRILLING REPORT

LIEBT :: ASKA POWER AUTHORITY

Jrrow Site D

JOB NO. F5700.55

PROJECT : LIL Hydroelectric Project

HOLE NO. 44-3-21

SHEET NO. E or 13

оерти	SOIL TYPE	PE MATER CONTENT, PLASTICITY, COMPACTNESS, MATER LOSS OR GAIN, ETC.		SAMPLE					
105	: 	MATER LOSS OR CAIM, ETC.	ĦQ.	TYPE	BIZE	DEPTH	HE 1	· TEST	
-106	Sand (cont)	Brown, silty, clayey. Occasional gravel and cobbles. Very dense. Moist. Cobbles to 6 inches diameter from 105.0 to 107.5 ft.							
-107									
-108 <i>-</i> -						er kiji laji i sposala jiji ilijiki			
	Sand	Brown-uan, silty. Little or no coarse material. Moist	44	AS	2-1/2	108.0- 108.8	**	33 70/.3	
-109		to wet. Dense.							
-110			-tarret per 4 - 22				errage y to a Ma	Patricipal de la composition de la composition de la composition de la composition de la composition de la comp	
-111			45	AS	2-1/2	110.0 to 111.4		22 52 90/.4	
-112					•			A. Shidhamana, Aspensa	
-113			Ι.						
-114					Î				
-114			46	A	2-1/2	114.0	THE PERSON NAMED IN	507.1	
		Boulder at 115.0 ft.				to 114.6	Ĺ	50/.1	
<del>-</del> 115	Gravel,	Very hard drilling. Con-							
	Cobbles,	tinuously in rock. Wash							
-116	and	water contains some silt							
	Boulders	and sand.					İ		
-117				Ì					
-118						•			
1 40					- P				
***									
-119									
-120									
-121						:			

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

Susitna Hydrcalectric Project PROJECT

HOLE NO. AH-D-21

SITE

Borrow Site D

SHEET NO. 9 OF 13

<b>ОЕРТИ</b>	SOIL TYPE	DETERMITION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPRETHESS,			SAMPL	s		PENETRATION TEST
- 177		WATER LOSS ON GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	1621
-121 -122	Gravel, Cobbles, and Boulders	Very coarse material. Difficult drilling. Some silt and sand in wash water.						
-123	500 (40.)		2-4-					
			47 48	DS A	2-5/32	23.0- 123.5 123.5 123.8	2	757.3
-124						123.8		
-125		No sampling due to coarseness						
-126		of material.						
-127								
128								
1.00								
-129								
-130		Matrix is fine to course grained sand with gravel.	49	AS	2-1/2	130.0	4	60
-131		Trace silt and clay. Very dense. Moist. Gravel sub-				to 131.0		7 ó
132		rounled to subangular.						
100			. " :					
- 133								
-134			50	A	2-1/2	134.0- 134.2	0	757.2
-135								
-136			51 52	DS DS	2-5/32 2-5/32	1 136.0	2	-
=137			J.L.	U.S	2-2132	136.5		

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. 4H-D-21

SITE

Borrow Site D

SHEET NO. 10 OF 13

GEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICHY, COMPACTNESS,			SAMPL	ε		PENETRATION
137	Cobbles	WATER LOSS OR GAIN, ETC.	NG	TYPE	SIZE	Di PTH	RE-TO	TEST
700	Cobbles, etc.(cont) Sand and	Softer material.						
-138	Gravel	Tan. Fine to coarse grained.						4. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10
-139		Little silt and clay. Dense. Moist. Very cobbly.						
-146			53	AS	2-1/2	139.5- 140.0		1007.15
-147								
-142		Slow drilling. In and out of cobbles and/or boulders.						
-143		or condies and/or nounders.						
-144								
-145								
-146								
147								
-148		No recovery due to coarse-	54	A	2-1/2	148:8		100/.4
-149		ness of material.						
-150							CHI COLOR TO SAN	
-151								
-152								
-153							1	

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydrcelectric Project

HOLE NO. AH-D-21

SITE

Borrow Site D

SHEET NO. 11 OF 13

DEFIN	SOIL TYPE	OCSCRIPTION: CGLOS, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS.			SAMPL	E		PENETRATION
153		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
100	Sand and	Brown. Fine to coarse						
-154	Gravel	grained. Gravel is sub-						-
1.14	(cont)	rounded to subangular. Little clay and silt. Very	ŀ					
		dense. Damp. Occasional						
-155		cobbles.						
				1				
-156								
-157			( }					
		Few cobbles and/or boulders.	l					
-158								
-100								
			55	AS	2-1/2	158.5- 158.7	2	100/.2
-159								1.
			l			ł		-
-160								
								-
-161								
		S						
-162			1					
-105	-							
	ĺ							
-163								
-164								
			55	<del> </del> <del>A</del> -	2-1/2	164.5- 164.6	0	100/.1
-165		Increasing amounts of large	<del> </del>	<b> </b> -		164.£		
		cobbles (to 10 inches).						100
-166								
100								
-167		Cuttings indicate same material as above.						
		material as above.						
-168								
-169	<u> </u>			<u> </u>		<u> </u>		1.2

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT A

PROJECT

ALASKA POWER AUTHORITY

OR NO. 25700.55

Susitna Hydroelectric Project

HOLE NO. 4H-D-21

SITE Borrow Site D

SHEET NO 72 OF 13

	DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	. E		PENETRATION TEST
	169		WATER LOSS OR GAIN, ETC.	HG	TYPE	SIZE	DEPTH	#E-2	1521
	-170	Sand and Gravel (cont)	Brown. Fine to coarse grained. Little clay and silt. Occasional to ma cobbles and boulders. Very	57	A	2-1/2	169.5	*	50/0.0
	-171		dense. Damp.						
	-172								
	-173								
	–174 —								
	-175	Bedrock Diorite	Jointed. Slightly weathered on joint planes. Hematite/ limonite staining present.					J. T. David	
	-176		176.0-179.0 ft Drill rate 20 minutes/foot.			•			
	-177								•
	-178							100 miles	
	-179			- Anadomica para	***************************************		- A same of the graph of the Stage of		
	-180	9						7,4	
			RQD = 51%.	58	DY	1-7/8	179.0	5.1	<del>-</del>
	-181						to 183.7	The state of the s	
	-182							to the grape	
	-183							messeethicheri (ee)	
	-184		DOD - 530	59	DY	1-7/8	183.7 to	21	- Miles and Alice and Angelia
E	-185		RQD = 52%.				188.7		

CLIENT ALASKA POWER AUTHORITY

SITE

JOB NO. P5700.55

Susitna Hydroelectric Project PROJECT

Borrow Site D

HOLE NO. AH-D-21

SHEET NO. 13 OF 13

CESCHIPTION: COLOR, COMMISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC. PENETRATION TEST DEPTH SOIL TYPE HO TYPE \$IZE DEPTH REY'D 185 Bedrock Jointed, slightly weathered. 59 DY 1-7/8 (continued) Diorite Hematite/limonite staining -186 (cont) present on joint surfaces. -187 188 Bottom of Hole 188.7 Ft. -189 \* PVC pipe filled with ethylene glycol installed to 183.7 ft. -190 Pneumatic piezometer tips set at 50.0 and 120.0 ft. -191 -192 -193 -194 -195

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-22

SITE

Borrow Site D

SHEET NO. 1 DF 2

CONTRACTOR: Denali Drilling Inc.

STARTED 9:00 A.≌. FINISHED 1:30 P.M. August 30 1982

SOIL Rotary Casing and 3-7/8" Tricone Casing DIAM. SW METHOD

August 21 19 82

OF DRILLING:

ROCK HX Core Barrel

CORE DIAM. 2-5/16"

LOCATION:

LATITUDE N 3,229,532 DEPARTURE E 746,961

ELEVATIONS: DATUM

Ground Surface DRILL PLATFORM 2092.8'

BEARING

GROUND SURFACE 2092.8 ROCK SURFACE 2086.8

INITIAL DIP 90° OTHER DIPS None

BOTTOM OF HOLE 2068.8

WATER TABLE

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTIESS,			3 A M P L	E		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
0	Surficial	Tundra vegetation. Cobbles						
· 1	Deposits	and diorite boulders present. Fine material washed out during orilling.						i dis salah
2			1	DY	2-5/16	0.5	27	
_						to		
- 3						4.5		
- 4								
				<b> </b>				
- 5		Highly weathered bedrock?						
•			2`	DY	2-5/16	4.5	0	_
- 6	Bedrock	Fractured, weathered. Joints				to		
7	Diorite	and fractures are generally hematite stained. RQD 0%.				3.0		
8				<del> </del>	<b>-</b>			
9				IVO	sampli	hg -		
概 人 意 C	MPLING METHOD - SPLIT TUDE THIN WALL TUDE - PISTON SAMPLER - CORE BARREL		ERT DE	WITENT 1	3	- CLOTH & - PLIOFILM - DISCARD	BAG	*

Q - GLASS JAR

INSPECTOR E.J. Kleinkauf

LOGGED BY R.C. Powell

DATE /2/7/62

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY

JOB NO. 75700.55

Susitna Hydroelectric Project

HOLE NO. 44-5-22

SITE

Borrow Site D

SHEET NO. 2 OF 2

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, DATER COVIENT, PLASTICITY, COMPACTNESS,		:	SAMPL	Ε		PENETRATION
		WATER LOSS OR GAIN, ETC.	NQ.	TYPE	DIZE	DEPTH	RETTO	TEST
9	Diorite	Fractured, weathered.	3	AS	2-1/2	9.0 to	4	27 93/5
-10	(cont)	Hematite staining present on fractures.	Material is a			9.9		
-11				l				
			4	DY	2-5/16	10.0 to	36	- 1
-12		RQD 0%.				14.0		
-13						, , , ,		
-14					MERCHAN MANAGEMENT		- Mary No.	Na managaning to be a second
15		DOD			0 = 13 =	,,,		i i
3.0		RQD approximately 20%.	5	DY	2-5/16	1	56	-
-16						to 19.0		
-17		Fractured, weathered,				13.0		; }
		hematite stained.						
-18		•						
-19			CHARL THE CO.		- ( <i></i> )		angeron o	
							3.00	
-20		RQD 0%.	6	DY	2-5/16	19.0	60	
-21						to		
						24.		
-22								
							٦	
-23		Many parallel fractures at 45° to the core axis. Highly						
		fractured in bottom 3 inches.						
-24		Bottom of hole 24.0 ft.					c ·	
-25	1							

ALASKA POWER AUTHORITY CLIENT

P5700.55 JOB NO.

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-23

CLIENT

PROJECT

SITE

DEPTH

-10

-11

-12

-13

-14

-15

-16

-17

-18

-19

-20

-21

-22

-23

-24

25

SOIL TYPE

Sand

(cont)

SITE

Borrow Site D

SHEET NO. 1 OF 11

METHOD OF

CONTRACTOR: Denali Drilling Inc.

August 21, 19 82 September 2, 19 82 STARTED 9:30 A.M.

SOIL Rotary Casing & 3-7/8" FINISHED 11:30 A.M.

CASING DIAM. HW 4-1/2" O.D. 4" I.D.

DRILLING: ROCK None

CORE DIAM. None

LOCATION:

N 3,232,870 LATITUDE DEPARTURE E 744,336

ELEVATIONS: DATUM

Ground Surface 2163.0'

BEARING INITIAL DIP

900 None OTHER DIPS

DRILL PLATFORM GROUND SURFACE ROCK SURFACE BOTTOM OF HOLE

WATER TABLE

2163.01 2003.0

obbles nd oulders	WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR PAIN, ETC.  Vegetation and surficial deposits.	жо.	TYPE	size No Sa	moling	RET'D	TEST
nd	Vegetation and surficial deposits.			No Sa	m <b>olin</b> g		
				. 1			ł.
. 1		1	ני	4"	2.3	9"	
					to		
					5.2		
	Actual contact depth unknown.		-				
and	Tan, silty. Sand fine to						
	graded. Occasional fine, subangular gravel. Moist.						
	Medium consistency.	2	А	2-1/2	6.0- 6.2	0"	50/2"
		3	AS	2-1/2	8 <sub>0</sub> 5 <sub>5</sub>	10"	13
	and  ME MITHOD  IN TALL TUBE	Tan, silty. Sand fine to coarse grained. Well graded. Occasional fine, subangular gravel. Moist. Medium consistency.  ING RITHOR E-AUGER SAIPP	unknown.  Tan, silty. Sand fine to coarse grained. Well graded. Occasional fine, subangular gravel. Moist. Medium consistency.  2  ING PITHOD  TO TUBE  TO A LOCATION H. INSERT	unknown.  Tan, silty. Sand fine to coarse grained. Well graded. Occasional fine, subangular gravel. Moist. Medium consistency.  2 A  3 AS	unknown.  Tan, silty. Sand fine to coarse grained. Well graded. Occasional fine, subangular gravel. Moist. Medium consistency.  2 A 2-1/2  ING PIYHOD SHIPPING CONTAINER H - INSERT	unknown.  Tan, silty. Sand fine to coarse grained. Well graded. Occasional fine, subangular gravel. Moist. Medium consistency.  2 A 2-1/2 6.0-6.2  3 AS 2-1/2 805.5	unknown.  Tan, silty. Sand fine to coarse grained. Well graded. Occasional fine, subangular gravel. Moist. Medium consistency.  2 A 2-1/2 6.0- 0" 6.2  Medium consistency.  3 AS 2-1/2 80.5 10"  SHIPPING CONTAINER H - INSERT R - CLOTH BAG

#### Tan, silty. Partly graded. Little coarse gravel. Moist. Dense. 7 AS 2-1/2 17.0 Tan with some red-brown Sand to black layers. Fine to and medium grained sand. Silt

weakly laminated. Occa-

sional dark sand lenses.

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS

BUFFALO, NEW YORK

P5700.55

PERETRATION

TEST

17

24

29

21

31

20

55 55

25

16 15

22

43

50/4"

50/4"

HOLE NO. AH-D-23

SAMPLE

2-1/2

6 AS 2-1/2 14.5

5 AS

NO. TYPE SIZE DEFTH PART'S

11.0-

11.3

11.3

13.1

to

to

19.0

2-1/2 23.0- 0"

23.4

16.5

to

SHEET NO 2 OF 11

DRILLING REPORT

ALASKA POWER AUTHORITY

Borrow Site D

Susitna Hydroelectric Project

DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE,

WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.

Little fine gravel. Dense,

1' layer of red-brown sand.

Tan, silty. Sand fine to

graded. Occasional sub-

angular grave. Moist.

coarse grained. Well

Moist. Dense. 60/5" 8 A 2-1/2 21.0-Boulders and cobbles common throughout.

9 A

O - TUBE P - WATER CONTENT YIN Q - GLASS JAR

INSPECTOR

A - SELIT TUBE B - THIN WALL TUBE C - PISTON RAMPLER D - CORE SARREL

E.J. Kleinkauf

LOGGED BY

R.C. Powell

DATE

12/7/6

DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJEK ?

Susitna Hydroelectric Project

HOLE NO. AH-D-23

SITE

Borrow Site D

SHEET NO. 3 OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS.			SAMPL	. E -		PENSTRATION
<b>,</b> ,		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
25 26	Sand and Silt (cont)	Tan. Weakly laminated. Fine to medium grained sand. Moist. Dense.						
27				)				
28	Sand	Tan. Some silt. Fine to medium grained. Very poorly graded. Moist. Dense.	10	AS	2-1/2	27.0 to 29.0	16"	22 35 41 45
29						<u></u>		
-30 -31		Silty. Occasional 1/4" thick silt lenses.	11	AS	2-1/2	29.0 to 31.0	13"	27 35 40 57
		Occasional fine, sub- angular to angular gravel.	12	AS	2-1/2	31.0 to	12"	21 32
32						33.0		32 53
33		Tan, silty. Fine to medium grained. Very poorly	13	AS	2-1/2	33.0	14"	21 33
34		graded. Moist. Very dense.				to 35.0		47 51
35								
36								
37		One large piece of yravel-	14	AS	2-1/2	37.0	5"	58
38		diditte. wet.				to 38.3		61 50/4"
39	Sand	Tan, silty, Fine to coarse grained. Partly	15	A	2-1/2	39.0	0"	8/0"
40		graded. Medium consistency. Wet. Some fine gravel.						
41			[	1	1	1	1	1

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

Borrow Site D

JOB NO. P5790.55

PROJECT

Susitna Hydroelectric Project

HOLE NO 48-D-23

SITE

SHEET NO 4 OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	<b>6</b> 2		PENETRATION
		WATER LOSS OR GAIN, ETC.	HO.	TYPE	SIZE	DEPTH	PETITO	TEST
41	Sand	Tan, silty. Fine to coarse grained. Some	16	AS	2-1/2	41.0	(T)10	12
-42		coarse grained. Some fine subangular gravel.				to		36
-76		Partly graded. Medium				1		40/3"
		consistency. Wet.		** ***********************************		42.3		
-43				Of Personal C				
			17	A	2-1/2	43.0-		14
			<del> </del>			43.8	<b>-</b>	60/4"
-44	1			1				
				[			1	
-45				1				
-45			18	AS	2-1/2	45.0	1.6	27
			Ì			to		35
-46						1		72
	Silt	Tan-gray, sandy, gravelly.				46.5		
		Moist. Very Dense.		1			1	
-47	- Sand	Tan-gray, gravelly. Both	19	AS	2-1/2	47.0		
	and	sand and gravel are fine to	13	H.S	2-1/2	47.0- 48.0	\$	30
40	Silt	coarse grained. Gravel is	<del> </del>			40.0	-	65
-48		subrounded to subangular.		l			ŀ	
		Poorly graded. Moist.				Ì	1	
-49		Very decise. 49.0-50.5		1			ŀ	
· 72	<u> </u>	possibly frozen.	20	AS	2-1/2	49.0	1231	29
	]					to		45
-50						}		45/3"
				<u> </u>		50.3	THE THE PERSON	-
-51			21	AS	2-1/2	51,0		
			2.2	חש	L-1/L	(		21 40
-52			ļ			to	E .	58/5"
-52		Becomes more sandy with				52.4		00/0
		depth. Wet. Dense.					T#7778548888190 B	****
-53		<b>a</b>				<u> </u>		10.00
		Gravel to 2" diameter.	22	AS	2-1/2	53.0-	4.	50
		Multi-colored sand lenses.				53.8	The state of the s	50/3"
-54	1		1					
			1			1		
	Sand -	Multi-colored. Little		1		1		
-55		gravel to 1" (subrounded to	23	AS	2-1/2	55.0-	NUMBER OF STREET	70/6"
		angular). Poorly graded.		1	/-	55.5	"	1010
-56		Clean. Wet. Dense.		<b>†</b>			-	
-30	1							
E7						1		
57	1		L	1				

#### DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-23

SITE

Borrow Site D

SHEET NO. 5 OF 11

DEPTH	SOIL TYPE	<u>DESCRIPTION</u> : COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,	MCTNESS,					PENETRATION TEST
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEFTH	RET'D	1231
57 58	Sand (cont)	Tan, silty, gravelly. Sand is fine to coarse grained. Gravel is fine grained and	24	AS	2-1/2	57.0- 57.7	2"	40 35/2"
		subangular to angular.  Partly graded. Wet.						
59		Dense.	25	AS	2-1/2	59.0	9"	11 19
60		Well graded. Gravel to 1-1/2 subrounded to sub-				to 61.0		44 55
61		angular. Occasional cobbles.	26	AS	2-1/2	61.0 to	15"	17 31
62						63.0	-	49 74
63	Sand	Dense to very dense.	27	AS	2-1/2	63.0-	Ç N	35/5"
54	and Silt	Gray-tan, clayey. Trace gravel (fine grained). Sanu is fine to coarse grained. Very dense to				63.4		enigetuuring deutstaan aaastaans
55		hard. Moist.						
56			28	AS	2-1/2	66.0- 66.8	5"	30 50/4"
67								0071
58	-Gravel -	Tān-gray. Some sand, silt and clay matrix. Gravel to	29	AS	2-1/2	63.0- 68.7	4"	37 50/2"
59		2" subrounded to angular. Very dense to hard. Moist.	-					53,2
70								
71			30	A	2-1/2	71.0- 71.2	3"	50/2"
12		Large amounts of coarse gravel and cobbles.						

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-23

SITE

Borrow Site D

SHEET NEE 6 OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.			SAMPL	E		PENETRATION
<u> </u>	Gravel	<b>2</b>	NO.	TYPE	SITE	DEPTH	RETO	TEST
73	(cont)	Tan-gray. Some sand, silt,						
-74	(0110)	clay matrix. Very dense to						
		hard. Moist. Large amounts of coarse gravel and cobbles						
	İ	present.						
-75								
						j		
7.								
-76						i . I		
-77		Boulder 77.0-78.01.						
		busine 77.0-70.0 .					(C), 4	
-78								
-79						ļ	and the second	
-19							1	
	·							
-80			- Halm		2 1 12			
			31	I A	2-1/2	80.0-	- 10 m	40/1"
ĺ.			ample to the School and			80.1	<b> -</b>	<del></del>
-81								
-82								
-02								
		Numerous cobbles.					A COLOR	
-83		Numerous coobjes.						
							1	
							l	
-84								
				]		1 1		
-85								
				1				
-86								
07								
-87								
-88						4 11		
"							İ	
89	1			1				
บร				1	ļ		1 1	

### DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

SITE

Borrow Site D

HOLE NO. AH-D-23
SHEET NO. 7 OF 11

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPRICTNESS,			SAMPL	Ε		PERETRATION
	<u> </u>	WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	ाहडा
89	Gravel	Tan-gray, sand, silt and						
00	(cont)	clay matrix. Very dense						
90		to hard. Numerous cobbles		ŀ				
		and large amount of coarse		1				
^-	i	gravel.		1				
91								
	1							
00							-	
92 —	Sand	Tourish out Come will	}					
	Salla	Tannish gray. Some silt	32	AS	2-1/2	92.5-	911	22
00		and clay. Fine to coarse				93.8	_	52
93		grained. Some subrounded						59/3"
		to subangular gravel.		1				
		Partly graded. Medium	1	1				
94		consistency. Wet.		1				
		Temperature 12°C.		1				
^-								
95			33	AS-	2-1/2	95.0-	9"	37
			33	1,73	1-1/2	96.3	3	66
	1					30.5	-	50/4"
96								30/4
			l					
97								
				ĺ				
EE.				1				
98		Well graded.	34	AS	2-1/2	98.0-	13.	40
			34	143	2-1/2	99.4	13	48 62
						99.4		
99								50/5"
100		Little gravel to 1".	35	AS	2-1/2	100.0	13°	15
	1	Dense to very dense.	ຸ່ມນຸ	רט	2-1/2	100.0	13	15 31
			Ì			to		
101						102.0		47 63
						102.0		03
								-
102	1		<b> </b>	<del> </del>				<del></del>
	1		1					
	1							
103	1 at 2		36	AS	2-1/2	103.0	5"	26
	1	1	1 30	7.3	4-1/6	103.0		61
	1					104.3		50/4"
104		Occasional pockets of						30/4"
		overconsolidated clay,						
105		with hematite staining.						
*03	l .			1				

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO.

PE700.55

PROJECT SITE Susitna Hydroelectric Project

Borrow Site D

HOLE NO. 44-0-23

SHEET NO. E OF 11

осетн	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, INATER CONTEST, PLASTICITY, COMPACTNESS,			SAMPL	Ε		#EMETRATION
105		WATER LOSS OR GAIN, ETC.	HO	TYPE	SIZE	DEPTH	AE. L	TEST
-106	Sand (cont)	Tannish-gray, some silt and clay. Little gravel to 1-1/2" (subrounded to subangular). Clay present						
-107		in overconsolidated pockets. Moist. Dense to very dense. Temperature 14°C.	37	AS	2-1/2	107.0 to	13"	14 34
-108 -109						108.8		63 50/4"
			38	AS	2-1/2	109.0- 109.8	**************************************	38 59/4"
-110 -111		Increasing silt content. Contains red-brown lamina. Temperature 11ºC.						C. A. C. C. C. C. C. C. C. C. C. C. C. C. C.
-112		Dark gray, silty. Very	39	AS	2-1/2	111.0- 112.3		36 55 50/4"
-113		dense. Moist to wet. Temperature 10°C.	40	AS	2-1/2	113.0-		
-114			40	h3	2-1/2	114.3		27 46 50/4"
-115								
-116								
-117						•		
-118		Gray to dark gray. Some silt. Sand is fine to	41	AS	2-1/2	118.0- 119.3		29 50
-119		medium grained. Very dense. Wet.					٠	50/3"
-120								
121								

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-23

SITE

Borrow Site D

SHEET NO. 9 OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAHPL	ε		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEFTH	RET'D	TEST
121	Sand	Dark olive gray. Fine						
	(cont)	grained. Trace silt.						
-122		Very cense. Wet.	42	AS	2-1/2	122.0-	114	22
		Temperature 10°C.	• •	/	L 2/L	123.3	11	53
						ILJ.J		50/3"
123								30/3
104								
-124								
	1							e.
100								
-125								
-126								
-120			43	AS	2-1/2	126.0-	9"	24
	ļ					127.2		51
-127		1/2" thick clay layer.						50/2"
-151		Temperature 8°C.						
		remperature o.c.					i	100
-128								
120			44	AS	2-1/2	128.0-	13"	23
		Occasional gravel to 1".				129.2		56
-129								50/2"
	]							
		9						
-130	1 1							
		3" layer of silt.	45	AS	2-1/2	130.0-	14"	21
						131.3		40
-131		Time to maditum manifold						50/3"
		Fine to medium grained.						
		Moist. Temperature 11 <sup>o</sup> C.						
-132				100	0 1/0	100.0		
			46	AS	2-1/2	132.0-	12"	21
						133.3		51
-133						1	11.17	50/3"
-134								
	1							
-135								
-136		Weakly laminated.	47	AS	2_1/2	136.0-	12"	NC NC
		i newry taninated.	7/	س ا	L-1/L	137.0	14C	24 96
137				1		121.40	1	מב ו

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. PE

PH5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. 31-0-23

SITE

Borrow Site D

SHEET NO. DE OF 11

ОЕРТИ	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,		-	SAMPL	. ε	-	MENETRATION
937		WATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	MET'D	TEST
-138 -139	Sand (cont)	Olive gray, silty. Fine to coarse grained (mostly fine), occasional gravel to 1-1/2. Very dense. Moist. Weakly laminated. Temperature 12°C.						
-140			48	· AS	2-1/2	140.0- 141.0	11 <sup>u-</sup>	24 93
-141	4 ° 1			-				
-142								
-143								
-144 			49	AS	2-1/2	144.0- 145.2	13"	16
-145	Silt and Clay	Olive gray. Thinly laminated with fine sand. Occasional fine gravel.			er <del>al</del> i <u>an</u> g gandani a	145.2		42 50/2"
-146		Dense to very stiff. Temperature 10°C.	50	AS	2-1/2	146.0-	14"	16
-147					th are a second	147.2	4	31 50/2"
-148			51	AS	2-1/2	148.0-	14"	22
-149		Alternating layers of fine sand, silt, and silty clay. Thinly to weakly laminated.			***	149.2		38 50/2"
-150							and the second s	
-151	Sand	Olive gray, silty. Fine grained. Very dense.	1. 1.					
-152 153		Moist.	52	AS	2-1/2	152.0- 153.0	5"	10 94

DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

MOLE NO. AH-D-23

SITE

Borrow Site D

SHEET NO. 11 OF 11

DEFTH	SOIL TYPE	<u>DESCRIPTION</u> : COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.			SAUPL	ε		PERETRATION	
			NO.	TYPE	SIZE	DEPTH	RET'D	TEST	
153	Sand	Olive gray, silty. Fine							
-154	(cont)	grained. Very dense.		]					
-104		Moist. Occasional layers							
		of laminated silt and clay.							
-155									
				1					
			!						
-156				100	0 1 (0	155.0			
			53	AS	2-1/2	156.0-	8"	44	
						156.7	L	50/2"	
-157									
150			Ì						
-158							1		
-159									
-103									
			ĺ	1					
-160							<u> </u>		
		Bottom of Nole: 160.0'			1 10 10				
			1			1			
-161								Ì	
-162	1		}						
				1				ļ	
-163	į.								
-103									
-164									
								[	
				]					
-165									
				]			•		
-16€						1			
1 ~~									
-167								l	
			1						
-168							1		
100									
			l						
	1		1	1	ļ,		l	1	

#### DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

P5700.55 JOB NO.

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-24

SITE

Borrow Site D

SHEET NO. 1 OF 5

CONTRACTOR: Denali Drilling Inc.

STARTED 12:30 P.M.

August 23

Ground Surface

METHOD

FINISHED 5:00 P.M. AUTUST 26 19 82 SOIL Rotary Casing and 3-7/8" Tricone CASING DIAM. HW, 4-1/2" O.D.

OF DRILLING:

ROCK NQ Core Barrel With Diamond Bit core DIAM.

4" I.D. NO, 1-7/8"

LOCATIO'I:

LATITUDE N 3,231,080 DEPARTURE E 741,250 ELEVATIONS: DATUM

DRILL PLATFORM 2165.9

GROUND SURFACE 2165.9 ROCK SURFACE 2135.9

INITIAL DIP 90° OTHER SIPS None

BEARING

NOTTOM OF HOLE 2107.0 WATER TABLE

	SOIL TYPE	OESCRIPTION: COLUN, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION TEST
DEPTH	BUIL ITTE	WATER LOSS OR GAIN, ETC.	NO.	TYPER	SIZE	DEFTH	RET'D	164,
0 - 1	Surficial Deposits	Brown sandy gravel. Some silt. Trace organics. Damp.						
- 2 - 3			1	AS	2-1/2	1.5 to 3.5	ε	5 5 8 9
4	Sand	Tan to brown. Fine to coarse				******		
- <b>5</b> - 6	Salin	grained. Gravel to 1 inch. Silty with up to 25% total fines content. Well graded. Dense. Damp. Temperature 8°C.		AS	2-1/2	4.5 to 6.3	10	7 7 7
_ 7								
- 8		Gravelis subrounded to sub- angular. Temperature 10°C.	3	AS	2-1/2	7.0 to 9.0	8	7 8 8 7
**	AMPLING METHOD  1 - SPLIT TUBE  2 - THIN WALL TUBE  3 - PISTON SAMPLER  5 - CORE BARREL	E - AUGER H - H F - WAUH O - T P - W	"ZAT UBE	NTAINER CONTENT		CLOTH C PLIOFII C - DISCAS	M BAG	

INSPECTOR E.J. Kleinkauf LOGGED BY R.A. Werneiwski

BUFFALO , NEW YORK DRILLING REPORT CLIENT ALASKA POWER AUTHORITY JOB NO.

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS

PROJECT Susitna Hydroelectric Project

HOLE NO. 14-0-24

P5700, 55

Borrow Site D SITE

SHEET NO. I OF 5

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMOTNESS,			SAMPL	r		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	MET DE	TEST
9 –10	Sand (cont)	Tan, gravelly, silty. Gravel to 1-1/2 inch, subrounded to subangular. Damp.	4	AS	2-1/2	9.0 to 11.0	11/6	10 14 15 17
-11				MPSEP/REN WWW			eran (Abetare, ty	othichioni, destina
-12	Sand and Gravel	6 to 8 inch cobble at 11.5 ft. Hole sloughing. Wash is tan colored.						
-13		Sand is fine to coarse grained. Silty, gravelly.						
-14		Temperature 8°C.		ļ			n reducement is the constraint	i Fassistant
-15		Moisture content 8%.	5	AS	2-1/2	14.0 to 16.0		15 22 28 35
-16				a line Kana		ringing play part thing said p	1014.0234	
-17 -18		Gravel to 1-1/2 inch. Clayey. Tan-gray. Very dense. Moist. Temperature 5°C.	б	AS	2-1/2	16.5 to 18.5	·	7 22 43 59
-19			7	AS	2-1/2	19.0 to 19.9	É	10 50/.4
-20		Fine content increasing with		A	2-1/2	20.0	9	18/0.0/
-21		depth	12.	-^-	2-1/2	120.0		
-22			9	- <sub>A</sub> -	2-1/2	32:0-	0	507.1
-23								
-24 -25	Clay	Silty, sendy (fine to coarse grained). Gravel and rock fragments.	10	AS	2-1/2	24.0- 24.7	6	27 50/.2

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

P5700.55

PROJECT susitna Hydroelectric Project

NOLE NO. AH-D-24

Borrow Site D

SHEET NO. 3 OF 5

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, KITER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	ε		PENETRATION
		WATER LOSS OR GA!N, ETC.	NO	TYPE	SIZE	DEPTH	RET'D	TEST
25 –26	Clay? (cont)	Silty, sandy. Many cobbles and/or boulders. Rock frag- ments.						
		NCHCS.	71	A	2-1/2	26.9- 26.3	0	75/.3
-27								
-28								
<b>–</b> 29								
-30	a significant							
-31	Bedrock	Very hard, slow drilling. Spoon sampler bouncing on either boulder or bedrock.						
· :		erener bourder of bedrock.						
<del>-</del> 32		•					1,74	
-33			-					
-34						· ·		
-35								
<del>-</del> 36								
<del>-</del> 37		Started coring at 37.0 ft.	-					
	Andesite	Jointed.			·			
<del>-</del> 38		Run #1 had 100% core recovery and an RQD of 93%.	12	DY	1-7/8	37.0	54	_
-39						to 41.5		
40								
-41								

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

JOB NO. 95700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 1-2-24

SITE

Borrow Site D

SHEET HO. 4 OF 5

#### LOSS OR CAIN, ETC.  ### Diorite breccia. Weathered, fractured. Joints at 45° to core axis on a 4 to 12 inch spacing.  #### Diorite breccia. Weathered, fractured. Joints at 45° to core axis on a 4 to 12 inch spacing.  ###################################	PENETRATION		ε	SAMPL			DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPRICTNESS,	DEPTH
Bedrock   Andesite   Gractured. Joints at 45° to core axis on a 4 to 12 inch   spacing.   13   DY   1-7/8   41.5   60° to   46.5    -43	TEST	RET'D	DEPTH	SIZE	TYPE	HQ.	WATER LOSS OR GAIN, ETC.	<del></del> _
Andesite (cont) fractured. Joints at 45° to core axis on a 4 to 12 inch spacing.  13 DY 1-7/8 41.5 60° to 46.5  Run #2 had 100% recovery. 80% RQD.  48 48.8-49.4 Weathered zone.  14 DY 1-7/8 46.5 50° to 51.5  Run #3 had 98% recovery. 87% RQD.  Rock becomes much harder. Very slow drilling.				tinued)	(con	12	Diorite breccia. Weathered,	- 1
Spacing.  -43  -44  -44  -45  -45  -46  -47  -48  -48  -49  -49  -8un #3 had 98% recovery.  -87% RQD.  -80ck becomes much harder. Very slow drilling.	N. 1944	Armation, a. Co.					fractured. Joints at 45° to	
-43 -44 -44 -45 -46 -47 -48 -49 -49 -80% RQD.  Run #2 had 100% recovery.  80% RQD.  13  DY 1-7/8 41.5 60 46.5  46.5  59 to 51.5  Run #3 had 98% recovery. 87% RQD.  Rock becomes much harder. Very slow drilling.							core axis on a 4 to 12 inch	42
To 44 Run #2 had 100% recovery. 80% RQD. 46.5  -45  -46  -47  -48							spacing.	
Run #2 had 100% recovery.  46.5  47  48  48.8-49.4 Weathered zone.  14 DY 1-7/8 46.5 59  to 51.5  Run #3 had 98% recovery.  87% RQD.  Rock becomes much harder. Very slow drilling.		60	41.5	1-7/8	DY	13		43
Run #2 had 100% recovery.  46.5  47  48  48.8-49.4 Weathered zone.  14 DY 1-7/8 46.5 59  to 51.5  Run #3 had 98% recovery.  87% RQD.  Rock becomes much harder. Very slow drilling.			to					
-45 -46 -47 -48 -49 -49 -49 -80% RQD.  Run #3 had 98% recovery. 87% RQD.  Rock becomes much harder. Very slow drilling.								44
-45 -46 -47 -48 -48 -49 -49 -49 -50 -50 -51 -52			40.5				Run #2 had 100% recovery.	44
-46 -47 -48 -48 -49 -49 -49 -50 -51 -52 -52 -58 -58 -69 -60 -60 -60 -60 -60 -60 -60 -60 -60 -60	*						80% KUD.	
-46 -47 -48 -48 -49 -49 -49 -50 -51 -52 -52 -58 -58 -69 -60 -60 -60 -60 -60 -60 -60 -60 -60 -60	į.							45
-47 -48 -49 -49 -50 -51 -52 -48 -48.8-49.4 Weathered zone.  48.8-49.4 Weathered zone.  14 -7/8 46.5 59 to 51.5  Rock becomes much harder. Very slow drilling.	!							
-47 -48 -49 -49 -50 -51 -52 -48 -48.8-49.4 Weathered zone.  48.8-49.4 Weathered zone.  14 -7/8 46.5 59 to 51.5  Rock becomes much harder. Very slow drilling.								
-48 48.8-49.4 Weathered zone. 14 DY 1-7/8 46.5 59 to 51.5 87% RQD. Solution Run #3 had 98% recovery. 87% RQD. Rock becomes much harder. Very slow drilling.								46
-48 48.8-49.4 Weathered zone. 14 DY 1-7/8 46.5 59 to 51.5 87% RQD. Solution Run #3 had 98% recovery. 87% RQD. Rock becomes much harder. Very slow drilling.				***************************************				
-48 48.8-49.4 Weathered zone. 14 DY 1-7/8 46.5 59 to 51.5 87% RQD. Solution Run #3 had 98% recovery. 87% RQD. Rock becomes much harder. Very slow drilling.	1							47
to Run #3 had 98% recovery. 87% RQD.  Rock becomes much harder. Very slow drilling.								
to Run #3 had 98% recovery. 87% RQD.  Rock becomes much harder. Very slow drilling.								1
Run #3 had 98% recovery.  87% RQD.  Rock becomes much harder. Very slow drilling.	_	59	46.5	1-7/8	DY	14	48.8-49.4 Weathered zone.	48
Run #3 had 98% recovery.  87% RQD.  Slow drilling.								
87% RQD.  Rock becomes much harder. Very slow drilling.							Dun #2 had 000	10 l
-50			51.5				Run #3 nad 98% recovery.	73
Rock becomes much harder. Very slow drilling.							or a hop.	
-51 Very slow drilling.							بسر بسير منيد بنيد بشيد بشيد بثيبه عدير وست بسيد بسيد وسيد وست	50 — — —
-51 -52							Rock becomes much harder.	
-52							Very slow drilling.	51
-52   15 DY 1-7/8 51.5 29								31
-52   15 DY 1-7/8 51.5 29	F 270 <del>Variation della conte</del>							1
15 DY 1-7/8   51.5   29								52
	-	29	51.5	1-//8	זע	15		
to to			to				5. 114 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Run #4 had 100% recovery. 53.9			53.9				Run #4 had 100% recovery.	23
100% KQU-							100s KQD.	
L-54   L	W							54
	n e e		74.0	. 7.0	~~	3.0		
16 DY 1-7/8 54.0 24	-	24		1-1/8	זע	10		
Run #5 had 100% recovery.			to				Run #5 had 100% recovery.	55
0% RQD.			56.0				<b>∪</b> % KŲŪ.	
_56								56
	-	35	56.0	1-7/8	ŊΥ	17	The Roll to the total	
Run #6 had 100% recovery. to 58.9			to		} .		Kun #6 had 100% recovery.	57

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-24

SITE Borrow Site D

SHEET NO. 5 OF 5

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, BATER CONTEXT, FLASTIGITY, COMPACTNESS,			SAMPL	E		PENZTRATION
<del></del>		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEFTH	ואבד'ם	TEST
57	Bedrock		17	(con	tinued)			
~~				[				
58	(cont)							
59				<u> </u>				
		Bottom of Hole 58.9 Ft.						
							}	
60	·							
		* Installed pneumatic piezo- meter with tip at 25.8 ft.						
	1	meter with tip at 25.6 it.						
		* 2-inch PVC pipe installed to 30.8 ft.	1					
		to 30.8 ft.						
				1				
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O DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-25

SITE

Watana Relict Channel

SHEET NO. 1 OF 7

CONTRACTOR: Denali Drilling Inc.

STARTED 11:00 AM. FINISHED 11:30 AM. August 27 1982

ME HOD

September 5 19 82 HW, 4-1/2" O.D. 4" I.D.

SOIL Rotary Casing With 3-7/8" Tricone Casing DIAM.

DRILLING:

LOCATION:

ROCK NQ Core Barrel With Diamond Bit CORE DIAM. H Size Denison Core Barrel

NQ, 1-7/8"

LATITUDE N 3,232,611

ELEVATIONS: DATUM

Ground Surface

DEPARTURE E 742,262 BEARING

DRILL PLATFORM 1986.7 GROUND SURFACE 1986.7 ROCK SURFACE

INITIAL DIP 90° OTHER DIPS None

BOTTOM OF HOLE 1896.7 WATER TABLE

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS.			SAMPL	ε		PENETRATIO
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
0	Surficial Deposits	Roots, peat, and other organic material.						
1	, · · · ·							
2								
3					0.170			
4				A	2-1/2	3.0 to 5.0	0	5 1 1 1
5			2	A	2-1/2	5.0 to 7.0	0	I H/R I
7 8 9	Sand	Gray, clayey, with sub- angular and angular gravel, wet. Cobbles throughout.	3	A	2-1/2	7.0 to 9.0	0	12 7 6 6
斯 A a B -	MPLING METHOD  SPLIT TUBE  THIN WALL TUBE  PISTON SAMPLER  CORE BARREL	E - AUGER M - IN: F - WASH O - TU P - WA	86	NTENT T	8	- CLOTH BA - PLIOFILM - DISCARDI	246	•

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY JOB NO. 257NJ.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 4-2-25

SITE Watana Relict Channel

SHEET NO. 2 OF 7

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, RATER CONTENT, PLASTICITY, COMPACTNESS,	SAMPLE					PENUTNATION
9		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'O	1231
-10	Sand (cont)	Gray, clayey, with angular and subangular gravel throughout. Well graded.	4	AS	2-1/2	9.0	ş	8 4
-11		Coarse fragments and cobbles, mostly diorite.				to 11.0		3 2
			5	Α	2-1/2	11.9-	Ċ.	30/.2
L <sub>12</sub>			:					
-13								
-14					-		managar 1	an a the state of
-15			6	AS	2-1/2	14.0 to	11	52 45 34
-16						16.0		43
_17		Cobbles encountered throughout.						
-18			6A	DS	1- 7/8	17.0 to 18.0	11	_
						10.0		
-19		Sampling mode changed often from split spoon to rock					Į.	
-20		coring when boulders were encountered.	\7-	A	2-1/2	20.0	-0.	30/Ref.
-21								
22			\8	Á	2-1/2	22.0	n	30/Ref/
-23			8A	DS	1.7/8	22.4	15	30/ Kel/
						to		
-24		Very cobbly.				25.4		
-25								

DRILLING REPORT

CLIENT ALASKA FOWER AUTHORITY P5700.55

PROJECT Susitna Hydroelectric

HOLE NO. AH-D-25

- 1		DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE,		SHEET NO.				Tarvers	
DEPTH	SOIL TYPE	WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	710	T				PENETRATION TEST	
25	Sand			TYPE	SIZE	DEPTH	RET'D		
	(cont)	Gray, mostly medium grained with some coarser material	<u>8A</u>	100	ntinued				
-26		present. Trace silt. Wet. Moisture content 14%.	9	AS	2-1/2	2" 5	12	10 10	
-27						to 27.5		15 16	
-28									
-29	Sand	Rusty brown, clayey,		<del>                                     </del>					
· .	Junio	gravelly, very dense, moist	70	AS	2-1/2	29.0	16	17 31	
-30		to wet. Coarse fraction subrounded. Moisture content 13%.				to 30.8		48 60/.3	
-31				<del> </del>	2				
-32									
-J.L			11	AS	2-1/2	32.0- 32.7	6	59 60/.2	
-33		Sand moderately to highly							
-34		oxidized. Fractured rock to 2 inches present.							
25									
-35									
-36		Becomes more rocky, numerous cobbles throughout.	12	A	2-1/2	36.9- 36.4	0	70/.4	
-37									
-38						-			
-30			13	AS	2-1/2	38.0 to 38.9	5	41 80/.4	
-40			14	A	2-1/2	40.0- 40.5	0	90	
41			<b> </b>	<b> </b> -		40.5			

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY

JOB NO. PETUD.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-13-25

SITE Watana Relict Channel

SHEET NO. 4 OF 7

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,				C		PREMETRATION
41		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEFTH	C'TER	TEST
-42	Sand (cont)	Red-brown, gravelly, with numerous cobbles throughout.						
72		Very dense.	15	А	2-1/2	42.0-	0	60/.3
-43								
-44			16	A	2-1/2	44.0- 44.2	C	50/.2
-45			[		and service and se	.37.6		
							·	
<del>-</del> 46			17	Α	2-1/2	46.9-	0	307.1
<b>-4</b> 7		Sampling difficult due to				40.1		
		numerous cobbles and boulders.						
<b>-48</b>								
<b>-49</b>								
			. :					4
-50	1.4.							
-51								
,			18	Α	2-1/2	51.0- 51.2	U	407.2
-52								
-53								
-J3 — —	Silt	Silt layer 53.0-54.0, lami-	19	AS	2-1/2	53.0 to	4	25 85
-54		nated. Some gravel and coarse sand throughout.			- The Control of Contr	54.0	The last three con-	
<del>-</del> 55		\ Very stiff, moist, oxidated.						
00		Trans year own was also have your time was own wind you have						
-56								
_57		Very rocky.						

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

JOB NO. \$5780.55

HOLE NO. A 1-25

PROJECT Susitna Hydroelectric Project

ALASKA POWER AUTHORITY

Watana Relict Channel

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS

BUFFALO , NEW YORK

DRILLING REPORT

HOLE NO. 4-1-25

Watana Relict Channel

SHEET NO. 5 OF 7

SHEET NO. & OF 7

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMCTNESS,			SAMPL	ε		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	RET'D	TEST
57	Sand	Brown, fine-coarse grained.	80	A	2-1/2	57.0	0	30/Ref/
-58	(cont)	Gap graded. Gravelly, silty. Very dense. Moist. Very						
30		rocky.						
			ŀ					
-59				<del> </del>				
-60		Э						
			20A	DS	2-5/16	59.0	17	
-61			KUA	US	2-3/10		17	_
				-		to		
-62			ł			63.5		
02								
62	}							1, 1,
-63								
			<del></del>	<del> </del>	-			
F:								
-65		elia de la secono de la compania de la compania de la compania de la compania de la compania de la compania de						
-66				<u> </u>				
			21	A	2-1/2	ee 0-	0	40/.1
-67			21	<b>\</b> ^	2-1/2	66.0- 66.1	U	40/ - 1
Lo,								
-68		Predominately medium grained with some fine and trace	22	AS	2-1/2	68.0	9	42
		coarse. Trace silt. Very	1			to		68
-69		dense. Moisture content	<u> </u>	┼		69.1		40/.1
		17%.		1				in the
-7C								
1								
<del>-71</del>	1							
'		Coarse, subangular. Many			·			
70		Cobbles.						
-72			23	DS	2-5/16	72.0	21	-
<b>-73</b>	Gravel					to 77.0		

	T .	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE,	<del></del>	-	SANPL		·	
DEPTH	SOIL TYPE	WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	NQ.	TYPE	SIZE	DEPTH	RET'D	PENETRATION TEST
73	Gravel (cont)	Coarse, subangular. Many cobbles.	23	<del> </del>	tinued)	VEFIR	NE.3 02	
-74	(Conc)	constes.						
-75		Denison sampler used because						
		of coarseness and hardness.						i a A
<del>-</del> 76								
<b>77</b>							<del></del>	
<del>-</del> 78								
, 3							**************************************	
<del>-</del> 79			24	DS	2-5/16	78.0 to	7	
-80						81.5		•
								į.
-81								
-82								
-83		Gravel and cored rock.						
<b></b>		Gravel and tored fock.  Gravel averages 1/2 inch, subrounded to subangular.	25	DS	1-7/8	83.0	18	
-84		and condee to Subdinguisti.				to		
-85			**********		No. 2 March 19 March	85.0	AND WEST STREET	
<b>^</b>								
-86		No sampling. Triconed.						
-87								
-88								
_89	<u> </u>						L	

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-25

SITE Watana Relict Channel

SHEET NO. 7 OF 7

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CORRISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.			SAHPI	. E		PENETRATIO
	<u> </u>		NO.	TYPE	SIZE	DEPTH	RET'D	TEST
89	Gravel	Gravel and cored rock. No						
	(cont)	sampling. Hole triconed to 90.0 ft.						**
90		Bottom of Hole 90 Ft.				<del>                                     </del>		
		bottom of hore 90 Ft.				Ì		
91		* Pneumatic piezometer tip						
		* Pneumatic piezometer tip installed at 84.5 ft.						
na.								
92				)				:
93				}		]		
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CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-26

SITE

Watana Relict Channel

SHEET NO. 1 OF 8

CONTRACTOR: Denali Drilling Inc.

9:30 A.M.

Denali Drilling Inc. STARTED 9:30 A.M. September 3 19 82
FINISHED 6:00 P.M. September 9 19 82
SOIL Rotary Casing and 5-5/8" Tricone CASING DIAM. SW, 6-3/4"O.D.

METHOD OF DRILLING:

CORE DIAM.

6" I.D. HX, 2-5/16"

LOCATION:

ROCK HX Core Barrel

ELEVATIONS: DATUM

LATITUDE N 3,230,658
DEPARTURE E 746,598 BEARING

DATUM Ground Surface DRILL PLATFORM 2214.7' GROUND SURFACE 2214.7'

INITIAL DIP 90° OTHER DIPS None

ROCK SURFACE 2118.7' BOTTOM OF HOLE 2104.8

WATER TABLE

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE WATER CONTENT, PLASTICITY, COMMICTNESS,	1	SAMPLE				PERETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	GEPTH	RET'D	TEST
0	Surficial	Boulder at edge of hole.				•		
	Deposits	Numerous cobbles to 4 ft.	1.					
. 1								
- 2			1					
- 3								1
- 3								
				}				
- 4	Sand	Tan, fine to coarse grained,						
	03,11-	silty, gravelly. Gravel to						
- 5		2 inches, subangular to angular. Moist. Very demse	. 1	80	2 7 70	4.0	30	
		Scattered larger material.	1 '	AS	2-1/2	4.2	13	37 55
Ü						to		25
- 6			1			6.2		34
						<del></del>	<b> </b>	<del> </del>
- 7							1	
							1	
- 8						1	ł	
- 0								
- 9								
	MPLIKS METHOD		HING CON	TAINER	<del></del>	<del></del>		1
e C	- SPLIT TUBE - THIN WALL TUBE - PISTON SAMPLER - CORE BARREL	F- WASH 0+1	ube Vater co Labb Ja	MTENT T	3	- CLOTH 8 - PLIOFILM - DISCARD	BAG	

LOGGED BY R.C. Powell

DATE 12/8/ER

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

₱5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. 44-0-26

Watana Relict Channel

SHEET NO: 2 OF 8

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPRCTNESS.			SAMPL	. €		PENETRATION
9	<u> </u>	WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET D	TEST
	Sand (cont)	Tan, fine to coarse grained,	2	AS	2-1/2	9.0	77	20
-10	(Conc)	silty, gravelly. Dense. Moist.	7	"	- '/-	to	''	15
				1		11.0		14 20
-11						1110		20
-12								
i i								
-13		T		ł				
		Tan, very silty, well graded. Gravel subrounded to sub-						
-14		angular to 1-1/2 inches.						2.434
		Temperature 9°C.	3	AS	2-1/2	14.0 to	17	32 58
-15				<u> </u>		15.2		40/2
N THE	Silt	Tan, sandy, gravelly. Sand						
-16		is fine to coarse grained. Gravel is angular to sub-						
-		angular (to 2 inches). Well						
-17		graded. Very dense. Moist.						
-18		Temperature 8°C.						
٠.								
-19			4	A	2-1/2	19.0-	Q.	50/1
			- Annual (MTM			19.0- 19.1		40/1
-20								
		Scattered coarse gravel and						
-21		cobbles.						
-22								
-23			5	AS	2-1/2	22.5 to	11	41
						23.6		72 _50/1
-24								
25	<u> </u>		L		i			

CLIENT ALASKA POWER AUTHORITY

P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-26

Watana Relict Channel

SHEET NO. 3 OF 8

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	£		PENETRATION
- 32-		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZVE	DEPTH	RET'D	TEST
25 -26	Silt (cont)	Tan, sandy, gravelly. Well graded. Very dense. Moist.						
					a.			
–27 <i>– –</i> –28	Clay	Olive gray. A mixture of clay, silt, and sand. Well graded. Gravelly, subangular to angular, to 2-1/2	6	AS	2-1/2	27.0 to 28.4	16	19 26 50,′5
<del>-2</del> 9		inches. Very dense to hard. Moist.						
30		Temperature 10°C.						
-31								
-32		6 inch cobble at 32.0 ft.	7	А	2-1/2	32.0- 32.3	0	20/3
-33			8	A	2-1/2	33.0	0	33
-34						34.3		48 50/4
-35								
-36								
-37								
-38 <i>– –</i> -39	Silt	O'ive gray, clayey, sandy. Some gravel to 1 inch (sub-	9	AS	2-1/2	38.0- 38.8	7	38 50/3
-39 -40		angular to angular). Sand is fine to coarse grained. Partly graded. Moist. Hard.						
		Temperature 12°C.						

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. 75737.55

PROJECT Susitna Hydroelectric Project Watana Relict Channel

HOLE NO. 4-5-26 SHEET NO. 4. OF &

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPRISTNESS,	ļ		SAMPL	ε.	į	PERTAIN
77		WATER LOSS OR GAIN, ETC.	ЖQ	TYPE	SIZE	DEPTH	RET'D	7 <b>65</b> T
41	Silt	Olive gray, clayey, sandy,						
	(cont)	gravelly. Sand fine to	ľ			1	1	
42		coarse grained. Gravel to		1				
		2 inches, subangular to			].			Y Ar
		angular. Partly graded.					<b>.</b>	ä
43		Hard. Moist. Temperature	10	AS	2-1/2	43.0	- 5	26
		13°C.	''	, AS	2-1/6	l to		26 50/4
14				- maintagner		43.8	THE PERSONAL PROPERTY.	
<del>!"</del>								,
	1		1	1				
15								
			ł			l	}	
				1	İ	ļ	]	*
16	L		2.0			1 2 2 2	1	
	Silt	Mottled olive gray to light						ž.
		olive brown, clayey, sandy.		1				
17		Partly graded. Sand fine to		1			<b>1</b> '	
		coarse grained. Trace						
		gravel to I inch (rounded to		1				) }
8		angular). Very stiff to	11	AS	2-1/2	48.0	-8	
		hard. Moist. Temperature	111	H2	2-1/2	to	2	48
		11°C. Numerous cobbles.				48.8		50/4
19				<del> </del>	<u> </u>	70.0		
				1			1 .	
50								
,U				1				
			}					Į
51								
<del>.</del> .					1			j L
	1				1			1
52				1	]			•
	1					1		
	La Santa Carlo							İ
53		Olive gray, clayey, sandy.	12	AS	0.770	62.0	7	<u> </u>
		Some gravel to 1 inch.	12	H2	2-1/2	53.2		53
		Partly graded. Hard.				53,9		50/3
54				<del> </del>	<del> </del>	-33.3	erelected bet Self.	
r e						1	1	
55					]	]		
56			1	1	1			
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57	1		ļ :	1	1	1		

CLIENT ALASKA POWER AUTHORITY

JOB NO. J700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-26

SITE Watana Relict Channel

SHEET NO. 5 OF 8

		T and the second	i		· · · · · · · · · · · · · · · · · · ·		<del>-,</del>	<u> </u>
ОЕРТИ	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	HO.	T	SAMPL			PENETRATION TEST
57	Silt	Olive gray, clayey, sandy.	H 12	TYPE	SIZE	DEPTH	RET'D	
	(cont)	Trace gravel to 3/4 inch.					-	
-58		Sand fine to coarse grained.	13	AS	2-1/2	58.0	5	19
		Well graded. Hard. Moist.		'	- ','-	to		50/5
-59		Temperature 9°C.				58.9		
-60								
-61		Scattered coarse gravel and						
		cobbles present throughout.						
-62								
-63								
	Clay	Olive black, silty. Some	14	AS	2-1/2	63.0	10	20
-64		fine to coarse grained sand.		1		to		44
134		Trace subanguiar gravel to linch. Poorly graded. Very				64.3		50/3
C.F.		stiff to hard. Moist.						
-65						r.		
-66		Temperature 7'C.						
-67								
-68			15	AS	2-1/2	68.0	12	44
			``	,,,	- 1/2	to 68.3	,,,	50/4
-69		Scattered cobbles.	ļ					
-70								
-71								
-72								
c73	<u> </u>	•		}				

## ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA PO

ALASKA POWER AUTHORITY

JOB NO. ₱5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. 34-2-25

SITE

Watana Relict Channel

SHEET NO. & OF 8

DEFTH	SOIL TYPE	PESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			3 A M P L	E		PERETRATION
77	<u> </u>	WATER LOSS OR GAIN, ETC.	NG	TYPE	SIZE	DEPTH	REE D	1631
73	Clay	Olive gray, silty. Some sand, trace grayel. Poorly	16	Α	2-1/2	73.0- 73.7	C	31 50/2
-74	(cont)	graded. Very stiff to hard. Moist.						and the state of t
<del>-</del> 75	Clay	Curry to doub array and alice						
<del>-</del> 76	Clay	Gray to dark gray and olive brown, silty. Trace sub-rounded to subangular gravel.					rygene	THE PROPERTY OF THE PROPERTY O
<del>-</del> 77		Laminated at an angle to horizontal. Very stiff to hard.						and the property of the state o
<del>-</del> 78	1,742				7-0	.ر		
<del>-</del> 79		Temperature 9°C.	17	AS	2-1/2	78.0 to 79.5	19	12 21 62
				ļ		-,		
-80								
-81								
-82								
<del>-</del> 83								
Ü.	Silt	Light olive gray, sandy,						
-84		gravelly. Gravel rounded to angular (to 2 inches). Sand	18	AS	2-1/2	83.3- 83.7	2	70/5
		fine to coarse grained.						
-85		Some clay. Motiled. Hematite staining present. Very dense. Moist.						
-86			19	AS	2-1/2	85.5 86.1	5	50/1
87								
		Clayey. Green-gray staining around some gravel.						
-38		Temperature 11°C.	20	Α	2-1/2	88.0	0	20/0/
89	1							

#### DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

Susitna Hydroelectric Project PROJECT

HOLE NO. AH-D-26

SITE Watana Relict Channel

SHEET NO. 7 OF 8

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
- 90 - 91	Silt (cont)	Mottled olive gray, sandy, gravelly, clayey. Sand fine to coarse grained. Gravel rounded to angular (to 2-1/2 inches). Hematite staining.						
- 31		Dense. Moist.	21	Α	2-1/2	8].9-	0	50/2
- 92 - 93						-71-6		
		Triconed through rock (boulder?) from 93 to 96 ft.	22	Α	2-1/2	93.0	0	20/0/
<b>- 94</b>		(						
<b>–</b> 95								
- 96								
<b>–</b> 97	Bedrock Diorite	Fractured. 50% of fractures at 20° to horizontal. Slightly to moderately weathered. More weathered	23	DY	2-5/16		47	- REC=100%
<b>– 9</b> 8		at 97.5 to 99.0 ft with sand infilling joints.				to 99.9		RQD=1207
<b>– 9</b> 9		98.5 2 to 3 inches andesite gravel layer.						
-100		Fractured. Slightly weathered. 4 to 5 inches of						
-101		argillite and diorite gravel to 2 inches.	24	DY	2-5/16		30	REC= 509 RQD=*159
-102						to 104.9		
103		Highly weathered. Becomes less weathered with depth.						
-104								
_105			<u> </u>	<u> </u>				

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

SITE

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project Watana Relict Channel

HOLE NO. 11-0-26 SHEET NO. 5 OF 8

DETH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTUME, MATER COSTENT, PLASTICITY, COMPRCTNESS,			SAMPL	ε		PENETRATION
105		EZTER LOSS OR GAIK, ETC.	NO.	TYPE	SIZE	DEFTH	HET'C	TEST
105	Bedrock Dio.ite	Jointed and fractured. Slight weathering present on joint surfaces.						
-106	(cont)	joint surfaces.						
			25	ינט	2-5/16	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	60	REC=1002
-! 07						to	1	400 A
						109.9		
-108								
-109								
-110		Bottom Of Hole 109.9 Ft.		<del> </del>	<b>-</b>		restor <sub>itor</sub> a	
		2000011 01 11512 103.3 1 2.						
111								
				1				
:								
							4	
: -							114470	
alterial Tables							1	
							S CORR	
							1000	
							9	

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-27

SITE

Borrow Site D

SHEET NO. 1 OF 13

CONTRACTOR: Denali Drilling Inc.

STARTED 5:30 P.M. September 5 19 82.
FINISHED 3:00 P.M. September 17 19 82
and CASING DIAM. HW, 4-1/2" 0.D.
4" I.D.

METHOD

LOCATION:

Rotary Casing; 3-7/8 and 2-15/16" Tricone

ROCK NQ Core Barrel with Diamond Bit CORE DIAM. NQ, 1-7/8"

DRILLING:

LATITUDE N 3,231,126 DEPARTURE E 749,709

ELEVATIONS: DATUM DRILL PLATFORM

BEARING INITIAL DIP 90° OTHER DIPS None

GROUND SURFACE 2148.8' ROCK SURFACE BOTTOM OF HOLE

1953.81

WATER TABLE

12/8/82

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			<b>3 A M P L</b>	E		PENETRATION
0		WATER LOSS OR GAIN, ETC.	HO.	TYPE	SIZE	DEPTH	RET'D	,
-T	Surficial Deposits	Tundra vegetation and surficial soils						
•								
-2								
-3								
-4								
ir.								
-3	Sand	Brown, gravelly. Little silt. Mostly fine grained	1	AS	2-1/2	5.0	5	16 13
<del>-</del> 6		with some coarser sand. Coarse, subangular grayel.				to 7.0		7 7
-7		Medium density. Moist. Temperature 4°C.						
-8								
-9			1					
# A-	HPLING HETHOD  SPLIT TUBE THIN WALL TUBE PISTON SAMPLER CORE BARREL	E - AUGER H - IN: F - Wash O - TU P - Wa	6E	NTENT TI	3	- CLOTH BI - PLIOFILM - DISCARDI	BAG	

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. PETDD. 55

PROJECT

Susitna Hydroelectric Project

HOLE NO. 35-2-27

Borrow Site D

SHEET NO. 2 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTIVESS.		•	SAMPL	ε		PENETRATION
		WATER LOSS OR GAIK, ETC.	NO.	TYPE	SIZE	DEPTH	RET'E	TEST
9	Sand	Brown, gravelly. Little						
	(cont)	silt. Mostly fine grained		1				
-10		with some coarser sand.			***************************************	<b></b>		<del></del>
		Coarse, subangular gravel.	2	A	2-1/2	10.0	0	
-11		Medium density. Moist.				to		15
-11								16
						12.0		21
-12								
-13								
							1	
7.4								
-14								
-15		Brown, gravelly. Some silt						
		and clay. Dense. Moist.	3	AS	2-1/2	15.0-	7	38
		Temperature 7°C.			ļ	15.7	<u> </u>	70/.2
-16							1	
						-	1	
1-7						111		
-17								
-18						-	i	
,,,								
							]	
-19							Î	
200								
-20	Cobbles	Very rocky. Cobbles and	4	Α	2-1/2	20.Q- 20:	T	70/.2
	and	coarse gravel. Poor				<u> </u>		Yakiri da asala asala ayai basa
-21	Gravel	sampling results. Very						
		slow drilling.						
								1,
-22								
-23								
20								
-24				Ì				
-25	ļ · · ·			1		!		

#### DRILLING REPORT

CLIENT

YTINCHTUA NAWOR ANZAJA

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-27

SITE

Borrow Site D

SHEET NO. 3 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PENETRATION
		WATER LOSS OR GAIN, ETC.	NQ.	TYPE	SIZE	DEPTH	RET'D	TEST
25	Cobbles	Very coarse gravel and						
	and	cobbles.						
-26	Gravel							
	(cont)							
97								
-27								
-28			L					
	Sand	Charle Gharlallie alares	5	AS	2-1/2	28.0	9	51
	Salia	Gray, gravelly, clayey. Some silt. Sand is				to		46
-29		predominately fine grained		Ì		29.3		70/.3
		with occasional layers of		<del>                                     </del>				
-30		coarser material. Gravel is						
		subangular. Very dense.	6	A	2-1/2	30.6- 30.2	0	75/.2
		Partly graded. Temperature 7°C. Occasional to some		-		30.4	-	
-31		cobbles.						ξ.
		2000103.		}				
-32								
JL								
-33	1							
			Ì					
-34								
-34								
-35				<u> </u>	-		-	
			7	A	2-1/2	35.0- 35.3	0	90/.3
						2.2.5		
-36		Very cobbly. Poor			j			
		sampling results due to						
-37		coarseness of material.						
-38								
			}					
-39							. :	
JJ								
								(
-40				<del> </del> _	0 3 10	100		
			8	A	2-1/2	40.0- 40.2	0	65/.2
41				<del>                                     </del>			<b> </b>	<del></del>

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. ₹5700.55

Susitna Hydroelectric Project PROJECT

HOLE NO. LH-D-27

Borrow Site D SITE

SHEET NO. 4 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			3 A M P L	É		PERETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	нтязс	HETT	TEST
41	Sand (cont)	Gray, gravelly, clayey. Some silt. Sand is mostly	9	AS	2-1/2	41.0- 41.8	Ç.	42 80/.3
<del>-4</del> 2	•	fine grained with some coarser layers. Gravel is subangular to angular.						1
-43		Very dense to medium dense. Moist. Partly graded.						
-44		Temperature 10°C.	10	AS	2-1/2	44.0-		33
				1.5	2-1/2	44.8		85/.3
<del>-4</del> 5								
46		(Hole sampled on 5 ft interval)						
-47							er entremental	
-48							And the second s	
<b>–</b> 49								
-50			11	AS	2-1/2	49.0- 50.0	1:	19 70 30/Ref.
					-	ب وجود المحدد المحدد المحدد المحدد المحدد المحدد المحدد المحدد المحدد المحدد المحدد المحدد المحدد المحدد المحدد	enti Mitau empi	GO/ NCT.
51								
-52								
-53				1				
-54		Same material.	12	AS	2-1/2	<u>54:8</u> -		80/.4
-55								
-56		Some rocky zones.						
<b>57</b>		Come roomy Lones.			1. 1. A			

. DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

SITE .

JOB NO. P5700.55

SHEET NO. 5 OF 13

PROJECT Susitna Hydroelectric Project Borrow Site D

HOLE NO. AH-D-27

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

CLIENT

Susitna Hydroelectric Project

HOLE NO. 4H-D-27

Borrow Site D

SHEET NG 6 OF 13

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SARPL	Ε	:	PENETRATION
		WATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	RET'D	TEST
57 -58	Sand (cont)	Gray gravelly, clayey. Some silt. Mostly fine grained sand. Very dense to medium dense. Moist. Partly graded.						
-59								
-60 -61	Sand	Gray, silty, clayey. Little gravel (subrounded to sub- angular). Mostly medium	13	AS	2-1/2	60.0 to 61.2	14	52 59 50/.2
-62		and fine grained sand. Partly graded. Moist. Very dense.						
-63	Sand	Brown, gravelly, silty,						
-64	Sand	clayey. Gravel subrounded to subangular. Sand mostly medium and fine grained.						
-65		Poorly to partly graded. Damp. Very dense.	14	AS	2-1/2	65.0-	4	48/ <sup>4</sup> .1
-66								
67 68								
-69								
-70		Brown, gravelly, silty.	15	AS	2-1/2	70.0	8	15
<b>-</b> 71		Trace clay. Slightly moist. Partly graded.	10	,,,,	e~1/6	to 71.2	J	52 70/ <sub>+</sub> 2
<del>-</del> 72								
<u>-73</u>								

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	τ .		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	RET TO	TEST
73 -74	Sand (cont)	Brown, silty, gravelly. Trace clay. Mostly medium		٠				
75		grained sand with some fine and coarse grained. Very dense. Partly graded.					- Project - Description - Personal - American	
75		Moist.	16	AS	2-1/2	75:8-	•	75/.3
76			*.					The state of the s
77							S TANK BE A LANGE BERNELLE BER	
78								
79								
80		No recovery - rock.	77	A	2-1/2	80.0- 80.3	·	75/.3
<del>8</del> 1		81.0 - 84.0 Wash water showing gray color.						*,
82								
83								
84		Very slow drilling due to cobbles in hole.						
85			any quantizanite				-dr. At success	
o.c			18	Α	2-1/2	85.0- 85.8	Ø	56 80/.3
86								
87								
88								
89							1	

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS

BUFFALO , NEW YORK

DRILLING REPORT

### DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-27

SITE

Borrow Site D

SHEET NO. 7 OF 13

нтчэо	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE. WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.			PEHETRATION			
			NO.	TYPE	SIZE	DEPTH	RET'D	TEST
89	Sand (cont)	Brown, silty, gravelly, trace clay. Very dense. Cobbly. Poorly to partly						
90		graded. Moist.	19	Α	2-1/2	98:9-	0	75
-91								
92								
<del>-9</del> 3		93.0 ft Sand or gravel zone - lost drill water, nudded hole.						
94	•							
95			20	А	2-1/2	95.0- 95.8	0	33 75, .3
95								
<del>-9</del> 7								
<del>-9</del> 8			·					
<del>-9</del> 9	Gravel	Coarse gravel and cobbles.						
-100		Refusal on Rock.	21	Ā	2-1/2	100.0- 100.4	0	50/.4
-101								
-102		Rocky. Very slow drilling.						
-703								
-104								•
-105								

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. 35700.55

Susitna Hydroelectric Project

HOLE NO. 44-D-27

Borrow Site D

SHEET NO. 8 OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.		PENETRATION				
			МС	TYPE	SIZE	DEPTH	RE"D	TEST
105	Gravel (cont)	Coarse gravel and cobbles. No successful sampling due	22	Α	2-1/2	105.0- 105.7	হৈ	85 60/.2
-106		to density and coarseness of material.						
-107	•							
-108								
09			1			•		
-110			23	A	2-1/2	]]0.0- ]]0.2	7	70/.2
-111		Very slow drilling due to rocky material.				110.2		
-112				سلامة مساوحة والمساولة وال				
-113		Very hard. Hole triconed ahead.				-		
-114		criconed anead.						
-115								
-116								
<b>–117</b>								
-118	-							
<del>-</del> 119 -	Gravel and	Very coarse, dense material. Very difficult						
<b>–120</b>	Cobbles	drilling.						
-121								

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-27 PROJECT Susitna Hydros

SITE

SITE

Borrow Site D

SHEET NO. 9 OF 13

	SHEET NO. 9 (							OF 13	
DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTULE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.							
121	Gravel and	Cobbles and coarse gravel.	NO	TYPE	SIZE	DEPTH	RET'D	TEST	
-122	Cobbles (cont)	Very dense. Difficult drilling.							
<b>–</b> 123						•			
-124									
124								· · · · · · · · · · · · · · · · · · ·	
-125			24	Α	2-1/2	125.0- 125.3	0	50/3	
-12 <sub>2</sub>									
-127			25	DS	1-7/8	125.3	18	-	
-128						to 130.0			
-129									
<b>–130</b>									
-131			26	DS	1-7/8	130.0	18	•	
-132						to 133.5			
-133									
-134									
-135									
		Very hard.	27	DS	1-7/8		23	-	
-136		anyong han av				to 140.0			
-137									

# ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. 75700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 44-0-27

Borrow Site D

SHEET NO. 10 OF 13

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.		PENETRATION				
707			NO.	TYPE	SIZE	CEPTH	ጸ६ <sup>™</sup> ን	TEST
137	Gravel	Very dense, coarse material.	27	(cor	`inued)	1		1
-138	and	Very difficult, slow						4
-130	Cobbles (cont)	drilling. Repeated drill water loss in highly						9 1
p - 1	(00110)	permeable zones.				ł		
-139								1
							ĺ	
-140								
	) 					<b>1</b>		
7 8 7						ŀ		
-141				4				
:			28	DS	1-7/8	140.0	22	_
-142				a constant		to	1	
,						145.0		
-143				1		,,,,,,	į	
-143								
-144					·		Ì	
	•				-			
-145			heit drittent					
			23	DS	1-7/8	145.0	23	_
1.66		Gravel jammed coring bit.				to		
146						146.5		
			Apparament to you					a a general constant
-147								
-148		Hole advanced with tricone			,		t private i	
-140		bit.					d. de la Carlo	
-149								
-150								
3.63								
-151	Parameter.				•			
				]				
-152								
Page 4								
-153						[		
100			<u> </u>	<u> </u>				

DRILLING REPORT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-27

Borrow Site D

SHEET NO. 11 OF 13

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.		-	PENETRATION			
			NOL	TYPE	SIZE	DEPTH	RET'D	TEST
153 154	Gravel and Cobbles (cont)	Very coarse gravel and cobbles. Very slow, difficult drilling.					-	
–155 –156		155 - 157 ft. Some brown plastic clay returned on drill tools.	30	DS	1-7/8	155.0 to 157.0	18	
-157 .	Clay	Gray. Trace fine grained						
−158 −159		sand. Stiff Moist. No laminations.						
-160 -161			31	AS	1-1/2	160.0 to 162.0	14	53 58 64 73
-162 -163								
-164 -165		Gray. Laminated throughout with silt on interfaces. No sand visible. Hard. Dry to slightly moist.	32	AS	1-1/2	164.0 to 166.0	24	22 42 39 68
-166			<b>-</b>					
-167 -168								
-168 - <u>169</u>				in the second se				

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

F5700\_55 JOB NO.

Susitna Hydroelectric Project PROJECT

HOLE MA 54-2-27

SITE Borrow Site D

SHEET NO. TO OF 13

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.		PENETRATION				
1.50			NO.	TYPE	SIZE	DEPTH	RETT	TEST
169 -170	Clay (cont)	Gray. Laminated throughout with slight amounts of						
1.00	u didi	silt. Stiff to very stiff. Moist.	33	AS	1-1/2	170.0	24	19 24
<del>-</del> 171	Account of the Control of the Contro					to 172.0		32 36
-172							<del>- To the thinks</del>	
-173								
-174								
-175	Service de la constante de la	Gray. Lamirated with thin	34	AS	1-1/2	175.0	22	20
-176		layers of light gray silt. Trace sub-rounded grawel. Hard. Moist				to 177.0		31 29 40
-177			******				च्याचा द्राप्त्य अ	<u> </u>
-178	Gravel and	Coarse, rocky material.						
-179	Cobbles						# #	
-180			35	DS	1-7/8	180.0	2*	
-181		Diamond cored.				to 185.0		
-182					•			
-183								
-184							1 1 1 1 1 1	
_185								

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-27

SITE Borrow Site D

SHEET NO. 13 OF 13

	I	DESCRIPTION: COLOR CONSISTEMOS STRUCTURE	<u> </u>		T -			
DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS, WATER DES OR GAIN, ETC.			SAMPL		<del>,</del>	PENETRATION TEST
185			NQ	TYPE	SIZE	DEPTH	RET'D	
100	Gravel and	Cobbles and very cearse gravel. Hole advanced with				ŀ		
-186	Cobbles	tricone bit from 185.0 -						
:	1	195.0 ft, no sampling.						
-187	(Cont)							
101								
-188							1	
-189								
			1.1					٠,
-190						}		
			Ì					
707				1				
-19 <del>1</del>		Very rock drilling.				ر	1	
192								*
-193							1	
704								
-194								
	1							
-195				<del> </del>		<u> </u>	<del> </del>	
		Better of Hole: 195.0 ft						
-196								
		* Installed thermistor string to 175.0 ft						
-197		seeing to 175.0 it						
-19/								
				1	es a			
-198								
-199								
-200								
£00								
			•			1		
				1		1	1	

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#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-28

SITE

Watana Relict Channel

SHEET NO. 1 OF 16

CONTRACTOR: Denali Drilling Inc.

STARTED 10:00 A.M. September 11 1982

METHOD

FINISHED 1:30 P.M. September 21 1982

SOIL Rotary Casing and 3-7/8" Tricone CASING DIAM. HV, 0.D. 4-1/2"

I.D. 4"

OF DRILLING:

ROCK NQ Core Barrel With Diamond Bit CORE DIAM. NO, 1-7/8"

LOCATION:

LATITUDE N 3,232,782 DEPARTURE E 751,610

ELEVATIONS: DATUM

Ground Surface

BEARING INITIAL DIP 90°

OTHER DIPS None

DRILL PLATFORM 2226.3 GROUND SURFACE 2226.31

ROCK SURFACE BOTTOM OF HOLE 1992.31

WATER TABLE

1	DEPTH	BOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS.	) I I I I I I I I I I I I I I I I I I I				PENETRATION	
L	·		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RETII	TEST
1	0 1 2	Surticial Deposits	Tundra vegetation and sur- ficial soil deposits.						
-	3 —	and the state of t		1	AS	2-1/2	2.0 to	12	2 3
-	4	Silt and Sand	Light olive gray, fine to coarse grained, trace fine gravel to 3/4 inches diameter.				4.0		3
-	5	•	Moist. Loose to medium den- sity. Partly graded.	2	A	2-1/2	4.0 to	- 0	6 7 6 8
1	6						6.0		8
-	7			3	А	2-1/2	6.0 to	0	8 7 8
1	8		Scattered cobbles.				8.0		10
	9		Saucerea Copples.	4	А	2-1/2	8.0- 10.0	0	13 10

A - SPLIT TUBE 8 - THIN WALL TUBE C - PISTON SAMPLER E - AUGER

N - INSERT O - TUBE P - WATER CONTENT TIN Q - GLASS JAR

R - CLOTH BAS S - PLIOFILM BAS Z - DISCARDED

INSPECTOR E.J. Kleinkauf

LOGGED BY R.C. Powell

APPROVED

DATE 12/62/82

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. #5700.55

PROJECT Susitna Hydroelectric Project

HOLE NY 44-0-28

SITE

Watana Relict Channel

SHEET NO. 2 OF 16

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMCTNESS,			5 A M P L	É		PENETRATION
9	ļ	WATER LOSS OR GAIN, ETC.	HQ.	TYPE	SIZE	DEPTH	WE TO	TEST
+10	Silt	Light olive gray, sandy, some gravel (rounded to angular) to 1-1/2 inches. Partly	4	(co	tinued			13 13
  -  -		graded. Very dense. Moist.	5	AS	2-1/2	10.0 to	The second second	10 13
12						12.0		17 16
13		Poorly graded. Slightly plastic.	6	AS	2-1/2	12.0 to 14.0	14	9 13 13 20
+14 +15		Stratified with occasional layers of silty sand.	7	AS	2-1/2	14.0 to 16.0	16	6 21 15 18
16		Light olive gray, some fine	- <del>7-1</del>		0.740			2012 Addition 1
17		to coarse grained sand. Poorly graded. Some gravel (subrounded to subangular). Very dense.	8	AS	2-1/2	16.0 to 18.0	•	20 20 26 30
<del>-</del> 18		Tory serious	<u>0</u>	AS	2-1/2	18.0	17	18
-19	Clay	Light olive gray, silty, some fine to crarse grained sand, trace gravel to				to 20.0		18 26 28
+20		3/4 inch (subangular to angular). Decomposed diorite cobbles. Moist. Very dense,	10	AS	2-1/2	20.0	16	9
<del>-</del> 21		some iron staining present on gravel. Striations appear on some gravel. Clay content				to 22.0		15 20 24
+22		increases with depth. Moisture content %.	11	AS	2-1/2	22.0	18	15
-23						to 24.0		13 15 15
-24 -25		Light olive gray, silty, trace sand. Striated gravel.	12	A.S	2-1/2	24.0 to 26.0	21	9 14

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK

### DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PR JECT Susitna Hydroelectric Project

Watana Pelict Channel

HOLE NO. AH-D-28

SITE	Watana F	Relict Channel				SHEET	NO. 3	<b>OF</b> 16
DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,				PENETRATION TEST		
25		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	,,,,,
-26	Clay (cont)	Hematite staining on gravel. Very stiff to hard. Changing to a medium gray color with	12	(co	ntinued	)		21 30
		increasing depth.	13	AS	2-1/2	26.0	16	12 20
-27						to 27.8		40 50/4
-28		Gravel subrounded to sub- angular. Hard. Mosit. Cobbly.	14	AS	2-1/2	28:9-	3	50/3
-29		County.						
-30		Scattered coarse gravel and cobbles.						
-31								
-32			15	А	2-1/2	<u> 32.Q</u> -	0	25/3
-33						36.3		
<b>-34</b>		Olive gray. Contains						
-35		striated gravel. Mosit. Decomposed diorite fragments present.	16	AS	2-1/2	34.0 to 35.8	19	21 48 63 50/3
-36						2216		50/3
-37			. 17	AS	2-1/2	36.0 to	21	27 41 75
-38		Temperature 7°C.				38.0	-	80
<del>-</del> 39								
<del>-4</del> 0		Olive gray, trace striated gravel to 1-1/2 inches	18	AS	2-1/2	40.0	12	29 59
41		(8-10%). Hard. Moist.		]		to 41.3		צכ

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. 95700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 48-0-28

Watana Relict Channel

SHEET NO. 4 OF 16

	ЕРТИ	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, MATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	£	<del>*</del>	PENETRATION
4			MATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	PET'30	TEST
1	٠	Clay	Olive gray, silty, trace	18	(con	tinued)			50/3
-42	2	(cont)	gravel (subrounded to sub- angular). Trace fine to medium grained sand. Gravel is striated. Moist. Tem-						# # # # # # # # # # # # # # # # # # #
43	}		perature 9°C.						
-44	1			19	D	2- 5/16	44 0-	0	
						- 5/10	44:2-		* = +
45	5		Striated gravel to 2 inches.					-market total	<b>∮</b> 100 paramantu,
-46	5		Trace fine to coarse grained sand. Temperature 8°C.	20	AS	2-1/2	45.0 to	19	17 47 60
-47	,			a, aparaini rengia.			47.0	<del></del>	66
-48	3								
-49	)								City the secretary was in
-50	)		Silty, trace gravel to l inch. Gravel is subrounded to subangular. Some gravel striated and/or polished.	21	AS	2-1/2	49.0 to	17	13 30 49
-51				and many			51.0		68
-52	<b>)</b>								
-53	}	Gravel	Olive gray, clayey. Gravel	22	AS	2-1/2	<u> 53.9-</u>		30/2
-54			size to 1 1/2 inch; sub- rounded and striated. Trace silt. Hard, moist.						
-55	5								
-56	i								
57									

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-28

SITE Watana Relict Channel

SHEET NO. 5 OF 16

Scattered cobbles.	JITE	nacana ne	erice channer				SHEET	NO.	OF 10
Scattered cobbles.   High plasticity, silty clay.   Several vertical gray fine sand seams present, decreasing in prominence with depth.   Scattered content 2.   As   2-1/2   61.0   11   15   16   17   16   17   18   18   18   18   18   18   18	DEFTH	SOIL TYPE	WATER CONTENT, PLASTICITY, COMPACTNESS,		•	SAMPL	Ε		PENETRATION
Clay	57			HC.	TYPE	SIZE	DEPTH	RET'S	
Scattered cobbles   Figure   Scattered cobbles   Scattered cobbles   Figure   Scattered cobbles   Figure   Scattered cobbles   Figure   Scattered cobbles   Figure	-	Clay	Olive gray, silty. Some	23	AS	2-1/2	57.0	22	
Sand, mostly coarse grained   Sp.0   52    -59	<del>-</del> 58		rounded to subangular.				to		
Hard. Moist. Temperature					,		59.0		52
-60 -61 -62 -62 -63 -63 -64 -65 -66 -67 -68 -69 -69 -69 -69 -69 -69 -70 -71 -72 -72 -72 -72 -72 -72 -75 -60 -61 -61 -61 -61 -61 -62 -63 -64 -65 -67 -68 -69 -69 -69 -70 -71 -72 -72 -72 -73 -74 -75 -75 -76 -77 -77 -77 -77 -77 -77 -77 -77 -77	-59		Hard. Moist. Temperature				•		
Scattered cobbles. High plasticity, silty clay. Several vertical gray fine sand seams present, decreasing in prominence with depth.  24 AS 2-1/2 61.0 11 to 24 30/1  25 AS 2-1/2 64.0 21 12 28 to 38 66.0 39  Moisture content 2.  26 AS 2-1/2 68.0 14 16 to 24 550/4  Temperature 5.5°C	<b>60</b>								
High plasticity, silty clay. Several vertical gray fine sand seams present, decreasing in prominence with depth.  24 AS 2-1/2 61.0 11 15 to 24 62.1 30/1 24 62.1	-60								
High plasticity, silty clay. Several vertical gray fine sand seams present, decreasing in prominence with depth.  24 AS 2-1/2 61.0 11 15 to 24 62.1 30/1 24 62.1	C1								
Several vertical gray fine sand seams present, decreasing in prominence with depth.    63	-01			24	AS	2-1/2		11	
Sand seams present, decreasing in prominence with depth.  -64  -65  -66  -67  -68  -69  Moisture content 2.  Zea AS 2-1/2 64.0 21 12 28 38 66.0 39  -70  -71  -72  Temperature 5.5%	-62		High plasticity, silty clay.   Several vertical gray fine						
-63 with depth.  -64 -65 -65 -66 -67 -68 -69 -70 -71 -72    Temperature 5 5°C	Ü.		sand seams present,						
-65 -66 -67 -68 -69 -70 -71 -72 -65 -65 -65 -67 -68 -69 -70 -71 -72 -72 -75 -76 -76 -77 -77 -78 -78 -79 -70 -70 -71 -70 -71 -72 -70 -71 -72 -70 -71 -72 -72 -73 -74 -75 -75 -76 -77 -77 -78 -78 -79 -70 -70 -70 -70 -70 -71 -72 -72 -73 -74 -75 -75 -76 -77 -77 -78 -78 -79 -70 -70 -70 -70 -70 -70 -70 -70 -70 -70	-63		with depth.						
-65 -66 -67 -68 -69 -70 -71 -72 -65 -65 -65 -67 -68 -69 -70 -71 -72 -72 -75 -76 -76 -77 -77 -78 -78 -79 -70 -70 -71 -70 -71 -72 -70 -71 -72 -70 -71 -72 -72 -73 -74 -75 -75 -76 -77 -77 -78 -78 -79 -70 -70 -70 -70 -70 -71 -72 -72 -73 -74 -75 -75 -76 -77 -77 -78 -78 -79 -70 -70 -70 -70 -70 -70 -70 -70 -70 -70				,					
-65 -66 -67 -68 -69 Moisture content 2.  70 -71 -72 Temperature 5.5°C	-64								
-66 -67 -68 -69				25	AS	2-1/2	64.0	21	12
-66 -67 -68 -69	-65						to		28
-67 -68 -69							66.0		
-68 -69 Moisture content 2. 26 AS 2-1/2 68.0 14 16 20 45 69.8 59/4 -70 -71 Temperature 5.5°C	-66								
-68 -69 Moisture content 2. 26 AS 2-1/2 68.0 14 16 20 to 45 69.8 59/4 -70 -71 Temperature 5.5°C	•								
-69 Moisture content 2. 26 AS 2-1/2 68.0 14 16 20 45 69.8 59/4  -70 -71 Temperature 5.5°C	-67								
-69 Moisture content 2. 26 AS 2-1/2 68.0 14 16 20 45 69.8 59/4  -70 -71 Temperature 5.5°C	co							100	
-69 Moisture content 2. to 45 59.8 59.4 -70 -71 Temperature 5.5°C	-08			26	AS	2-1/2	68 N	14	76
-70 -71 Temperature 5.5°C	_60		Mojetuva santast (			, -			20
-70 -71 -72 Temperature 5.5°C	0.5		rioisture content 72.						45 50/4
-71 -72 Temperature 5.5°C	<del>-</del> 70							,	
72 Temperature 5.5°C									
Temperature 5.5°C.	-71								
Temperature 5.5°C.									
1 4 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7	-72		Temperature 5.5°C.	27	AS	2-1/2	72.0	20	10
27 AS 2-1/2 72.0 20 18 to 74.0 22	73			41	HO	4-1/2	to	20	22

## ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. 75700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 1-2-28

SITE Watana Relict Channel

SHEET NO. 5 OF 16

DEFTH	SOIL TYPE	CESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMICTNESS,		PEDETRATION				
		WATER LOSS OR GAIN, ETC.	HQ.	TYPE	SIZE	DEPTH	NE TO	7837
73 -74	Clay (cont)	Olive gray, silty, some gravel to 2 inches (sub-rounded to subangular),	27	(con	tinued)			30 42
-75		striated. Trace fine to mostly coarse grained sand. Hard. Moist.						
		naru. 11015t.						
-76		Occasional cobbles.						
<del>-</del> 77		Sand content <5%.				· · · · · · · · · · · · · · · · · · ·	<u> </u>	
-78		Temperature 4.5°C.	28	AS	2-1/2	77.0 to	24	17 30
-79						79.0		37 53
73			 		د مانونزو(هوردولمده استاه استا :			C. L. as. By C.
-80 .								
-81		Moderate plasticity. Gravel striated. Temperature 5.0°C.	79	AS	2-1/2	81.0	24	22
-32				7.5	L-1/L	to 83.0		43 56 69
-83		Gravel and/or cobbles		Ì	·		- Transition	50-387 BB
-84		encountered.						
-85					military vije osobenjek	and a large name of the large large large large large large large large large large large large large large la		
-86		Temperature 4°C.	30	.AS	2-1/2	35.0 to	16	26 55
-00				<u> </u>		86.3		50/4
-87		Trace fine to coarse grained						
-88		sand.						
-89		Temperature 5°C.						

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

#### DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-28

SITE Watana Relict Channel

SHEET NO. 7 OF 16

אויפס	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTEXT, PLASTICITY, COMMCTNESS,	SAMPLE					PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
89	Clay (cont)	Olive gray, silty, some round to subangular gravel to 2		AS	2-1/2	89.0 to	11	28 67
- 90		inches. Trace fine to coarse grained sand. Gravel is				90.0		
- 91		striated. Moist. Moderate plasticity. Temperature 5°C.						
- 92								
- 93								
- 94		700	32	AS	2-1/2	93.0	24	17 29
- 54		Temperature 7°C.				to 95.0		36 60
- 95		3						
- 96								
- 97			33		2 172	07.0		30
Ovs			33	AS	2-1/2	97.0- 97.6	7	24 20/1
- 98	Gravel	Material type changed. Numerous cobbles and much						
- 99		coarse material causing poor sample returns.						
-100								
-101								
			34	A	2-172	101.0- 101.2	0	50/2
-102								
-103		Diorite cobbles ranging from 4-9-1/2 inches. Striations	\35	A	2-1/2	103.0	0	25/0/
-104		appear occasionally. Trace argillite gravel. Some	36	DY	1-7/8	103.0	6	
-105		silty sand adhered to cobbles.				to 105.0		

## ASRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. PS730.55

PROJECT Susitna Hydroelectric Project
SITE Watana Relict Channel

HOLE NO. AH-Q-28
SHEET NO. 8 OF 76

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, COMMISTENCY, STRUCTUME, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMP	. ε		PENETRICION
105		WATER LOSS OR GAIN, ETC.	NQ.	TYPE	SIZE	DEPTH	RET'S	7EST
105	Gravel (cont)	Diorite cobbles and gravel. Gragmented cobbles to 9-1/2						
10€		inches. Partly graded.		<b>.</b>				
107		Olive brown silty sand adhered to rocks. Argillite	37	DY	1-7/8	105.9	30	-
-10/		gravel to 2-1/2 inches (sub- rounded to subangular);		&		to		
108		striated.		DS		109.5		
-109								
-110		Diorite and argillite gravel; striated. Trace silty sand	38	DS	1-7/8	109.5	10	
-111		adhering to gravel.				to		
112						112.6		
-113		9 inches diorite cobble. Striated.	39	DY	1-7/8	112.6 to 113.5	8	and the second s
-114			40	DY	1-7/8	113.5	4	•
-115		2.1/2.5				to 115.2		
113		3-1/2 inches diorite cobble, fractured.	41	DY	1-7/8	115.2	5	A. Production
-116		C illing rate slow due to circulation being blocked by				to		
-117		what silty sand is present.				117.5		
-118								
-119								
-120								
121								

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-28

E Watana Relict Channel

SHEET NO. 9 OF 16

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION TEST
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	1631
-122 -122	Gravel (cont)	Diorite and argillite cobbles and gravel in a silty sand matrix.						
-123 -124 -125	Clay	Olive gray, silty, sandy (fine to medium grained) with weak laminations of clay and silt. Very stiff to very dense. Slightly plastic. Moist. Wood embedded in sand						
-126		layer.	42	AS	2-1/2	125.0 to 126.3	16	17 34 50/4
-127 -128			43	A	2-1/2	127.0 to 128.2	0	28 29 50/2
-129 — - -130	Sand	Olive gray, fine to medium grained, trace silt. Very dense.	44	AS	2-1/2	129.0- 129.8	9	47 50/4
-131		Temperature 5°C.	45	AS	2-1/2	131.0 to	12	20 74
-132 -133		Silty, very dense, moist. Occasional very thin layers of clay.				132.0		
134								
135 136	and state sease since with some							
-137	Clay	Olive gray, silty, thinly laminated, very stiff to hard. Some gravel.	46	DS	1-7/8	136.0 to 141.0	28	

## ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. 35788.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 4-12-28

SITE Watana Relict Channel

SHEET NO. TOF 16

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTERT, PLASTICITY, COMPACTWESS.	<u> </u>		SAMPL	E		ENETRATION
		WATER LOSS OR GLIM, ETC.	NO	TYPE	SIZE	DEPTH	RET'D	TEST
137 -138	Clay (cont)	Olive gray, silty. Thinly laminated, slightly plastic. Occasional gravel present. Very stiff to hard. Moist.	46	(con	tinued)			
-139		Temperature 6°C.						
-140								
-141						· Melus e supporturior		Secondaria de la companya della companya della companya de la companya della comp
-142								
-143		Laminated, very stiff.						
-144		Occasional modules of very hard overconsolidated clay. Highly plastic. Temperature	47	AS	2-1/2	143.5 to	24	11 16
-145		5°Č.				145.5		20 27
-146	The state of the s							
-147								
-148							Constitution of the consti	
-149		Olive gray to olive black. Occasional very thin lami-	48	AS	2-1/2	148.5 to	24	13 16
-150		nations of very light gray silt. Temperature 3°C.				150.5	P. P. Strategy and the strategy and the	17 25
-151								
-152								**************************************
-153								

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

### DRILLING REPORT

CLIENT ALASI

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-28

SITE Watana Relict Channel

SHEET NO. 11 OF 16

DEPTN	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, RAYER CONTENT, PLASTICITY, COMPACTNESS,		SAMPLE				
		WATER LOSS OR GATH, ETC.	ЖО	TYPE	SIZE	DEPTH	RETD	TEST
153	Clay (cont)	Olive gray to grayish black, silty. Laminated. Very						
<del>-</del> 154		stiff. Highly to moderately plastic. Thin laminations of light gray silt present.	49	AS	2-1/2	to	24	8 15 20
<b>–155</b>		or right gray sire present.				155.5		28
-156								
157					ē .			
-158								
<b>-159</b>		Olive gray to olive black. Very stiff. Laminated. Temperature 6°C.	50	AS	2-1/2	158.5 to	24	13 16
-160			·			160.5		20 25
<b>-</b> 161								
-162								
-163								
-164		Rare nodules of very hard	51	AS	2-1/2	163.5 to	18	14 16
<del>-</del> 165		overconsolidated clay present.				165.0		20
-166								
-167								
-168 -169			52	AS	2-1/2	168-5-	18	11

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. ₱5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 44-D-28

TE Watana Relict Channel

SHEET NO. 32 OF 16

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, MATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		KOITANTSHIP
7.60		WATER LOSS OR GAIN, ETC.	NQ.	TYPE	SIZE	DEFTH	DE T	TEST
169 -170	Clay (cont)	Olive gray to dark gray, silty, laminated. Very stiff. Slightly to highly	52	(con	tinued)			19 21
-171		plastic. Rare nodules of overconsolidated clay present. Thin laminations of very light gray silt common. Temperature 7°C.			\$			
-172								
-173								
-174			53	A	2-1/2	173.5 to 175.0	\$	11 17 23
-175								
-176								· .
-177								
-178			***************************************		and the second s	48/18/14		
-179		Olive gray to medium gray, silty, laminated. Modera ely to highly plastic. Thin	54	AS	2-1/2	178.5 to 180.0	18	16 19 26
-180		layers of light gray silt. Temperature 5°C. Moist.				112		. Valence
-181			-**		.*			
-182								
-183								
-184								
-185								

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-28

SITE Watara Relict Channel

SHEET NO. 13 OF 16

-					····	<del></del>		
DEFTH	SOIL TYPE	<u>DESCRIPTION:</u> COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMICTHESS, WATER LOSS OR GAIN, ETC.	NO	TYPE	S A M P L	E DEPTH	RET'D	PENETRATION TEST
185	Clay	Olive gray to medium gray,			<u> </u>	DEFIN	KEID	
1	(cont)	silty, laminated. Moderately						
-186		to highly plastic. Very						
		stiff. Moist. Thin layers of very light gray silt						
-187		present. Temperature 5°C.						·
-188								
-189		Drilled without sampling						
		until next material change						
-190		was noted.		! !				
191								
-192								
132								
3.00								
-193								
1								
<del>-</del> 194								
-195								
1	l							
196	}							
-197	Silt	Olive gray, sandy (fine to coarse grained). Poorly						
		graded. Trace round to sub-						
-198		angular gravel. Scattered	55	A	2-1/2	197.5	0	20/0
		cobbles. Layers of brown silt to 1-1/2 inch thick					1,	
-199		present. Slightly moist.						
		Dense. May contain organics.						
-200								
1 -				-				
L201				<u> </u>				

## ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO AH-D-28

Watana Relict Channel SHEET NWD 14 of 16

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			5 A M P 1	£	<del></del>	PERCTRATION
201		WATER LOSS OR GAIN, ETC.	₩Q	TYPE	SIZE	DEPTN	PETO	1257
-202	Silt (cont)	Olive gray, sandy. Poorly graded. Trace gravel (round to Subangular). Scattered cobbles. Layers of brown					Co. Corto, Company Control Con	
-203		silt to 1-1/2 inch thick. Slightly moist. Dense. May contain organics.	56	AS	2-1/2	202.5 to 203.3		37 50/4
-204								
-205								
-206		Several layers of medium to	57	AS	2-172	206.0- 206.7	5	24 40/2
-207		dark brown silt to 1/4 inch thick. Organics.		M Jake Charly Shilling		200.7	Total of delicer	90/2
-208								
-209			58	AS	2-1/2	<u> 288:</u> <u>2</u> -	8	5872
-210		Olive gray to grayish brown.			1			
-211 212	Silt	Light olive gray to tan, clayey. Trace fine to medium grained sand. Very stiff. Slightly moist. Occasional	59	AS	2-1/2	210.5 to 212.3		19 31 48
	٠	zones of very thinly lamina- ted dark brown and red brown	60	AS	2-1/2	212.5	with a gamening	50/4
-213		silt. Organics (wood) pre- sent throughout. Trace striated gravel (subrounded to subangular).	UU	no.	2-1/2	to 214.2		23 30 52 50/2
-214		eo sanonga tar II	- Lylling Miller pagagana i Alia				# FL	
-215		Temperature 6°C.						
-216		Poorly graded.						
-217								

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-28

SITE

CLIENT

Watana Relict Channel

ALASKA POWER AUTHORITY

SHEET NO. 15 OF 16

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATIO
217		WATER LOSS OR GAIN, ETC.	7.5	TYPE	SIZE	DEPTH	RET'D	TEST
217	Silt (cont)	Light olive gray, clayey. Trace sand. Very stiff. Organics. Poorly graded.						
 219	Sand	Gray-brown, gravelly (to	61	AS	2-1/2	218.5- 218.8	4	500/4
220		1-1/4 inch). Gravel is sub- rounded to subangular and fragmented. Moist. Very Dense Partly graded.						
221								
222								
223	Sand and Silt	Grayish tan. Fine to medium - grained (mostly fine). La- yered with weakly lamınated	62	AS	2-1/2	222.5- 223.0	5	135
224		silt. Moist. Very Dense.			٠.			
	Sand							
225			63	A	2-1/2	225.0- 225.4	0	160/5
226								
227								
228								
229								
-63								
230								
231		Grayish tan, gravelly. Sand						
232		is fine to coarse grained. Gravel is subrounded to sub-	64	AS	2-1/2	23].5- 23].8	3	200/4
233		angular to 1-1/4 inch. Trace silt. Well graded. Moist						

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CLIENT

SITE

ALASKA POWER AUTHORITY

JOB NO. ⇒5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 4H-D-28

Watana Relict Channel SHEET NO 16 OF 16

1		DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, DATER CONTENT, PLASTICITY, COMPACTNESS,	348715							PENETRATIO	
233	<u></u>	WAIER LD53 OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	ATT'S	TEST			
233	Sanc	Grayish tan, gravelly. Very dense. Thin layers of silt.									
004	(cont)	Moist.	65	A	2-1/2	233.5- 234.0		160			
-234	<del> </del>		<del> </del>	<del> </del>		234_0	and the second				
		Bottom of Hole 234.0 ft.									
-235											
.		* Pneumatic piezometer in-									
	-100 -100 -100 -100 -100 -100 -100 -100	* Pneumatic piezometer in- stalled in hole with depth			٠						
-236		to tip 226.0 ft.	1								
1			ĺ								
-237			1								
				1							
								· f			
. ]											
- 1											
	·										
							į.				
17.5											
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#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

P5700.55 JOB NO.

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-29

SITE

Borrow Site D

SHEET NO. 1 OF 11

CONTRACTOR: Denali Drilling Inc.

STARTED

SOIL Rotary Casing & 3-7/8" Tricone

7:00 A.M. September 19, 19 82 4:30 P.M. September 24, 19 82 CASING DIAM. HW, 4-1/2" O.D. 4" I.D.

METHOD OF DRILLING:

ROCK None

CORE DIAM. None

LOCATION:

ELEVATIONS: DATUM

Ground Surface

LATITUDE N 3,238,258 DEPARTURE E 757,174 BEARING

2411.0 DRILL PLATFORM

GROUND SURFACE 2411.0

INITIAL DIP 90° OTHER DIPS None

ROCK SURFACE BOTTOM OF HOLE 2253.0

WATER TABLE

DEF7H	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	ε		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
0	Surficial	Tundra material, organics.		,				
1	Deposits	Spongy with root and other						
•		vegetation.						
2		•						
3								
**	·							
4	Sand	Tan to light brown. Mostly	<del>                                     </del>	<b>-</b>				<del>                                     </del>
		fine grained with some	1:	AS	2-1/2	4.0	18	11 20
5		medium grained. Little silt				to		22
		and gravel. Gravel is fine				6.0		37
_		grained and angular to sub- angular. Poorly graded.						
6		Medium density. Moist.	2	1	2 7 / 2		70	<del>                                     </del>
			2	AS	2-1/2	6.0	12	13 20
7						to		23
						8.0		20
0							1	
8			3	AC.	2-1/2	8.0-	13	12
g			3	i Ma	2-1/2	10.0	13	13
# A.	MPLING METHOD SPLIT TUBE THIN WALL TUBE PISTON SAMPLER CORE BARNEL	E - AUGER H - IN F - WASH O - TU F - W/	36	NTENT T	3	- CLOTH B. - PLIGFILM - DISCARD	BAG	

INSPECTOR LOGGED BY E.J. Kleinkauf

R.G. Adams

DATE

12/8/82

#### ACRES AMERICAN .NCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO.

4H-D-29

SITE

Borrow Site D

SHEET NO. 2 OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTERCY, STRUCTURE, WATER CONTENT, PLASTICITY, CONTENTS,			SAMPL	C		PERETRATION
		WATER LOSS OR GAIN, ETC.	NQ	TYPE	SIZE	DEPTH	RE: to	TEST
- 9 -10	Sand (cont)	Light brown, silty, gravelly. Mostly fine with some medium	3	(co	tinued			18 21
71		to coarse grained. Fine gravel (subrounded to sub-angular). Dense. Moist. Poorly to partly graded. Trace clay.	4	AS	2-1/2	10.0 to 12.0	4	11 15 16 19
-12  -13			5	AS	2-1/2	12.0 to 14.0	14	9 16 21 32
-14 —  -15  -16	Sand	Brown, gravelly, silty, clayey. Predominately fine grained. Clay content decreases with depth. Very dens. Poorly to partly graded. Noist.	6	AS	2-1/2	14.0 to 16.0	16	22 38 42 47
-17  -18			7	A5	2-1/2	16.0 to 18.0	16	23 47 48 45
-19  -20	Sand	Brown to rusty brown. Gra- velly, silty, trace clay. Mostly fine with some coarse and little medium grained. Fine gravel (subrounded to subangular). Verv dense.	american pale grade gra			and the second second	1	
-21		Poorly graded. Moist. 18.5-20.0 Cobbly zone.	8	AS	2-1/2	20.0 to 21.0	TC	34 90,
-22								
-23								
-24			9	AS	2-1/2	24.0	18	24
-25			•			to 26.0		54

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK

#### DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

Borrow Site D

P5700.55 JOB NO.

Susitna Hydroelectric Project

CLIENT ALASKA POWER AUTHORITY HOLE NO. AH-D-29

₽570C.55

PROJECT SITE

SHEET NO. 3 OF 11

∹--D-29 HOLE NO.

SITE

PROJECT

Borrow Site D

Susitna Hydroelectric Project

SHEET NO. 4 OF 11

DEPTH	SOIL TYFE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PENETRATION
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	\$IZE	DEPTH	RET'D	TEST
-25 -26	Sand (cont)	Brown-rust, gravelly, silty. Little clay. Mostly fine	9	(cor	tinued)			50 59
-20		grained sand with some coarse and little medium.			•			¥
-27		Gravel is subangular to sub- rounded. Very dense. Poorly graded. Moist.				•		
-28			10	AS	2-1/2	28.0 to	9	32 58
-29						29.1		50/.1
-30			11	AS	2-1/2	30.0	6	22
-31				, A3	2-172	to 32.0	0	48 52 60
-32		Cobbly zone.				32.0		
-33								
-34							**************************************	
-35		Brown, gravelly, silty.	12	AS	2-1/2	35.0	14	1-
-36		Little clay. Very dense. Poorly graded. Moist. Gravel in sample is fine			- 1, -	to 37.0		3 61 63
-37		grained.  Cobbly zone. Very rocky.						
-38		No sampling due to coarseness of material.						
-39								
-40			13	A	2-1/2	40.0- 40:3	0	60/.3
-41				<u> </u>		70.3	<del>                                     </del>	

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			3 A M P L	£		PENETRATION
41		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RETE	( TEST
41	Sand	Brown, gravelly, silty.						
	(cont)	Little clay. Sand mostly						
42		fine grained. Occasional					•	
		cobbles. Very dense.						
		Poorly graded. Hoist.						
43								
				1 1			1	
Λ.Α.			4.					
44							•	
15					2.5			
, ,			14	AS	2-1/2	45.0	-	35,
					•	45.0. 45.5	- CONTRACTOR OF THE CONTRACTOR	tie til g
16		Cobbly zone.						:
17								
8							1	
10			15	A	2-1/2	48 0-	-	<b>ED(1</b>
					- 1/-	48:P-		N. 67. 1
9	t, i	0.410						- Partesining
		Cobbly zone causing						
		sampling difficult.					100	
50								
								,
51	1414							
2								
,,,			16	Α	2-1/2	52.0- 52.4	C	80/.4
						52.4	- Merchenheimer aus auf	-
3								
							3	
	47.4							
4		Brown-mray very cilty cond	17	AS	2-1/2	54.0	-2	42
		Brown-gray, very silty. Sand mostly fine grained.	17	~	2-1/2	to	-	43
5		Some gravel. Sample taken		]		54.9		90/.4
•		between cobble zones. Very						
		dense. Moist.						
6							1	
7								
1				1 1		4 4 4		

ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS

BUFFALO , NEW YORK

DRILLING REPORT

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-29

SITE

Borrow Site D

SHEET NO. 5 OF 11

DEFTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENC'STRUCTURE, WATER CONTENT, PLASTICITY, COME CTIMES,			SEMPL	Ε		PENETRATION
		WATER LOSS OR GAIN, ETC.	HQ.	TYPE	SIZE	DEPTH	RET'D	TEST
57 58	Sand (cont)	Brown-gray, very silty. Sand mostly fine grained. Some small gravel in sample.						
		Very dense. Moist	18	Α	2-1/2	58.0- 58.2	0	50/.2
-59								
60		Cobbly zone.					143	
61								
62								
63								
-64								
-65		Sand sloughing into hole from above.	19_	Α	2-1/2	64.0	0	30/Ref,
66		Cobbly zone.			Kara establishing			
67						٠.		
68								
69				····				
70		Brownish gray, silty,	20	AS	2-1/2	69.0 ₩	12	28 62
		gravelly. Trace clay. Poorly graded. Woist. Gravel is subangular. Sand				70.5		70 30/Ref.
71		Gravel is subangular, Sand mostly fine grained.						
72		Cobbly zone.						
73								

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, HLW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

IOB NO. 25700.5

PROJECT

Susitna Hydroelectric Project

IOLE NO 5-7-29

SITE

Borrow Site D

SHEET NO. & OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMICTHESS,			SAMPL	Ε		
-73		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	: 1531
-/3	Sand (cont)	Brown-gray, silty, gravelly.				,		
-74	(conc)	Trace clay. Sand mostly fine and medium grained.						
-14		Poorly to partly graded.						
		Moist. Very dense.		l				
-75	1.4	The state of the s					Ĺ	
			21	A5	2-1/2		4	62
				compact sector		75.7	L.	701.2
-76					ŀ			
					1			
-77		Cobbly. Very difficult,						1
		slow drilling. Lack of						i.
70		samples due to rocky nature						
-78		of deposit.						
-79								
-13			22	Α	2-1/2	79.0	0	30/Ref/
-80								# · · · · · · · · · · · · · · · · · · ·
-81								
							1	
-82				· .				}
-83								-
-03			23	A	2-1/2	83.0-	MINISTER IN.	65/.3
						83.3		007.0
-84				-			Maria de Conse	Office of the College proc. Advanced
Ť.,		Cobbly zone.						
-85								
-86								
				1				
-87								
-01		Brown-gray, gravelly,	24	AS	2-1/2	87.0	10	78
		silty. Trace clay.		-			`	
-88		Occasional diorite gravel.				to		69
		Gravel is subangular to subrounded. Partly graded.				88.5		95/.5
00		Very dense. Moist.						
-89		reig delise. Hoist.						

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

#### DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

ECT Susitna Hydroelectric Project

HOLE NO. AH-D-29

SITE

Borrow Site D

SHEET NO. 7 OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PENETRATIO
00	ļ	WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	TEST
39	Sand	Brownish-gray, silty,						
10	(cont)	gravelly. Mostly fine and						
U	•	medium with some coarse						
		grained. Gravel subangular						
91		to subrounded. Partly graded. Moist. Very dense.	<u></u>	L				
		graded. Moisc. Very delise.	25	AS	2-1/2	91.0	11	19
						to		55
92						92.0		40/Re
				<del> </del>		32.0		40/ RE
3	1							
<b>,</b>								
14		V						
		Very rocky-cobbly. Little sampling done. Poor recov-						
		eries of samples due to						
95		coarseness of material.	26	A	2-1/2	95.0-	0	75/.4
				''	/-	95.4		757.1
96								
-								-
		•				:		
97								
					1			
98								
70			27	A	2-1/2	98.0	0	30/Re
				<del>                                     </del>				
99	ľ							
100								
101								1. 1. 1.
.UI								
02			28	A	2-1/2	102.0-	0	12
			20	^	2-1/2	102.0	"	30/Re
22			<b></b> -	1		202.0		207 NE
103								
				1		1000		
104		l ville in a to						
		Very cobbly.						
ins.				1				
05	1		i	i ·			1	

## ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO.

=5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO.

IH-D-29

SITE

Borrow Site D

SHEET NO. E OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,		PENETRATIO				
105		WATER LOSS OR GAIN, ETC.	MQ.	TYPE	BIZE	DEPTH	MET'S	TEST
105	Sand (cont)	Brownish-gray, silty. Some subrounded to subangular						
-105		gravel. Sand mostly fine and medium grained. Partly						
-107		graded. Very dense. Moist.						
-108	rij.							₹ 16 16
-109			29	AS	2-1/2	109.0- 109.8	1	41 50/ 2
-110 -	Cobbles	Sand is probably matrix for				103.00	ay .22, a	60/.3
-111	and Gravel	cobbles and coarse gravel.						
-112		None dian duilling						
-113		Very slow drilling. Approximate rate 1-1/2 feet per hour.						
-114			30	A	2-1/2	114.0-	-6	60/.3
316				<u> </u>		114.3	micone y o	007.3
115								
116					.*		1. 34 S	
117								
		Very rocky.					s) (ex principle)	
118			11				ent metropological section of the se	
119			31	А	2-1/2	119.0	0	30/Re1
120							Officienti	
121			: .				reciped resistor	

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CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-29

SITE

Borrow Site D

SHEET NO. 9 OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMMICTNESS,			SAMPL	E		PENETRATION
	<u> </u>	WATER LOSS OR GAIN, ETC.	NG.	TYPE	SIZE	DEPTH	RET'D	TEST
121	Cobbles	Very rocky. Difficult						
-122	and	drilling. No successful						· ·
-122	Gravel (cont)	sampling. Sand as above is						1
	(cont.)	probable matrix for cobbles and coarse gravel.	•	-				•
-123		and coarse graver.						
					}			
-124								
-124			32	A	2-1/2	124.0-	0	50/.2
	1		<b> </b>		ļ	124.2		
-125								
	i				ŀ			
100			l I					
-126								
								4.4
-127								
-128								1
-120								
-129								
		Very difficult, slow drilling.		ĺ				
-130	1							
-120								
-131								
-132								
-132							- '	
#							1	
-133								
-134								
-194								
				1				
-135 -	Sand	Grāy-tān, šilty, somē	33	AS	2-1/2	135.0	3	<del> </del>
	Julia	gravel. Fine to coarse	, ,,	Lu2	2-1/2	to :	١	100/.4
-136	1	grained. Well graded. Very			1	to 135.9		
-120		hard. Overconsolidated.	<del> </del>	<del> </del>	<b> </b>	<b> </b> -		<del> </del> -
155					1			1
137	1		1	1	1			1

## ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALD, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

08 NO. =5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. ---2-29

SITE

Borrow Site D

SHEET NO COF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			3 A W P L	E		PENETRATION
137		WATER LOSS OR GAIN, ETC.	NG	TYPE	SIZE	CEPTH	METO	t TEST
13/	Cobbles	Very rocky. No sampling	1 2 7 7					
138	and	due to coarseness of						
.50	Gravel	material. Sand probable	İ				6	ra Na santa da santa da santa da santa da santa da santa da santa da santa da santa da santa da santa da santa da
	(cont)	matrix for cobbles and					1	
139		coarse gravel.						V.
105							l	
							]	44
140								
								i.
	4							å
141								V v
	1						•	
	1							y .
142	1							
								i i
1.50								į
143	1						· ·	V 14.
								4
144	:							
144	1							
145								it
		Very rocky. Slow, difficult drilling.						
146								<b>u</b>
147								34 25
147								
	1	•						
148								K K
			}					
						Ť		
149	<del> </del>							
		Much softer material. No	34	A	2-1/2	149.5	0	8
•		sample recovery for	J. 7	^	r-1/C		0	28
150		description.	1			to		60
					1	151.2		50/.2
	]						***************************************	
151								
	14.1							
12^				1				
L								
	1					-		i
153	i	153.0-156 Boulder	1	1				

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK

### DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-29

SITE

Borrow Site D

SHEET NO. 11 OF 11

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION TEST
153		WATER LOSS OR GAIN, ETC.	HC	TYPE	SIZE	DEPTH	RET'D	1,531
155	Boulder	153.0-156.0 Boulder.						
154						1		
134	7 77							
-155								
							[	
						1		
-156 -		Much soften metaut.1						
		Much softer material. No sample for description.						
-157		sample for description.						
101								
-158		D-by						
		Bottom of Hole:						
			-					
-159	factors.					1		
						•		
-160								
-100								İ
					-	1		
						•		
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	ng et al.			1				
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Tables of

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#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

P5700.55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-30

SITE

Watana Relict Channel

SHEET NO. 1 OF 7

CONTRACTOR: Detali Drilling Inc.

METHOD

Detail Drilling Inc. STARTED 10:00 A.M. September 22 19 82 FINISHED 5:00 P.M. September 25 19 82 SOIL Rotary Casing and 3-7/8" Tricone CASING DIAM. HW, 4-1/2" 0.D.

ROCK NO Core Barrel with Diamond Bit CORE DIAM. NO, 1-7/8"

OF DRILLING:

LOCATION:

ELEVATIONS: DATUM

**Ground Surface** 2221.4

LATITUDE N 3,231,062 DEPARTURE E 746,716 BEARING INITIAL DIP 90° OTHER DIPS None

DRILL PLATFORM GROUND SURFACE 2221.4'

ROCK SURFACE BOTTOM OF HOLE 2121.4

WATER TABLE

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,		-		PENETRATION TEST		
		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	1831
0	Surficial Deposits	Tundra vegetation.						
- 1	Depos (CS						-	
2				No	Sampli	nq		
- 3								
- 4			<del>                                     </del>	A	2-1/2	4.0	0	4
- 5					.,,,,	to		3 3
- 6	a Innibistracijas ar myskazija ar artika					6.0		4
	Sand	Olive gray, fine to coarse graned. Silty, some gravel	2	AS	2-1/2	6.0	6	7
- 7		to 1-1/2 inch (subrounded to subangular). Medium density.				to 8.0		8 7 8
- 8		Moisture content 9%. Temperature 14°C. Well graded.		ļ			<u> </u>	
- 9			3	AS	2-1/2	8.0- 9.7	ΰ	9 14
73	AMPLING METHOD  A SPLIT TUBE  - THIN WALL TUBE  - PISTON SAMPLER  - CORE SARREL	E-AUGER N-IN F-WASH O-TU P-W/	SERT BE	TAINER		R - CLOTH B B - PLIOFILM L - DISCARD	PAG	

0 - TUBE P - WATER CONTENT TIN Q - BLASS JAR

B - THIN WALL TUBE G - PISTON SAMPLER O - CORE SARREL

INSPECTOR E.J. Kleinkauf

LOGGED B! R. C. Powell

DATE

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT

ALASKA POWER AUTHORITY

Watana Relict Channel

PROJECT SITE

Susitna Hydroelectric Project

SHEET NO. 2 OF 7

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	E		PENETRATION
		WATER LOSS OR GAIN, ETC.	NQ.	TYPE	SIZE	DEPTH	ST3n	TEST
9	Sand (cont)	Light olive gray, fine to coarse grained. Silty,	3	(con	tinued)		ويندن د د د د	52/2
-10		trace gravel. Medium dense to dense.						
-11		Temperature 15°C.						
-12		10.0-13.0 Boulder. Numerous cobbles and boulders from 9.5 ft.			· .			
-13			4	DS	1-7/8	12.5 to 14.0	\$	
-14		Danilla Manada I		AS	2-1/2	14.8		70/5
		Poorly graded. Very dense.				14.4	drayen ( a.	
-15								
-16								
17		Scattered cobbles.						
<u>-</u> 17								
<del>-</del> 18	Sand	Light olive gray, fine to coarse grained. Silty, some	6	AS	2-1/2	18.0	11	2]
-19		grave to 1 inch (subrounded to subangular). Well graded.			named park deleter the second	to 19.2	err i e	5 50/2
-20		Occasional thin silt layer. Moist. Yery dense. Tempe- rature 5 <sup>O</sup> C						
-21								
-22	Sand and Silt	Fine to coarse grained sand layered with fine sand to						
		silt. Well graded. Trace gravel to 3/4 inches (sub-	7	AS	2-1/2	22.0 to	10	23 50/5
23		rounded to subangular). Moist. Dense. Temperature 40C.				24.5	ad Name to	
-24		Light olive gray to grayish	8	AS	2-1/2	24.0	16	11
_25		tan, silty. Some gravel.				to 25.8		11 29

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK

DRILLING REPORT

ALASKA POWER AUTHORITY CLIENT

JOB NO. P5700,55

PROJECT

Susitna Hydroelectric Project

HOLE NO. AH-D-30

SITE	Watana F	Relict Channel				SHEET	NO. 3	3 of 7
DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			SAMPL	Ε		PENETRATION TEST
25		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	RET'D	
_26	Sand (cont)	Light olive gray to grayish tan, silty. Some gravel to 2 inches (subrounded to sub-	8	(co	ntinued	)		48 50/4
-27		angular). Very dense. Moist.	9	Â	2-1/2	26.0 to 28.0	0	11 20 38 38
-28 -29		Multicolored. Fine to coarse grained with fine at top of sample and medium grained at bottom. Trace silt. Dense. Wet. Temperature 3°C. Ungraded.	10	AS	2-1/2	28.0 to 29.8	13	5 24 62 50/3
-30 -31		paradare o or originates.						
-32	gri- speka agour sjaken apeni se							
-^3	Silt	Olive gray, sandy. Trace grayel (subrounded to subangular) to 1-1/2 inch.	11	AS	2-1/2	32.0 to 33.2	13	16 32 50/2
-34		Poorly graded. Very dense. Moist.						
-35								
-36		Thin cobble zone.	12	A	2-!/2	36.0- 36.2	0	50/2
-37								
-38								
-39								
-40 -41			13	AS	2-1/2	40.0 to 4].3	6	6 28

#### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO , NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. ₹5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. 5-1-10-30

Watana Relict Channel

SHEET NO. 4 OF 7

DEPTH	SOIL TYPE	OESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,		PENETRATION				
41	<u> </u>	WATER LOSS OR GAIN, ETG.	NO.	TYPE	BIZE	DEPTH	RETE	TEST
1 41	Silt	Brown and gray, clayey.	13	(con	tinued)			50/3
42	(cont)	Some fine to medium grained						
[		sand. Little fine gravel (angular to subangular).						
		Dense to very dense.						1
<del>-4</del> 3								
ŀ			ľ					
-44		Thin zones of gravel/cobble				-1 Takhiksa-amanan		
		rich material.	14	AS	2-1/2	44.0	15	36
<b>-45</b>						to		56
T43				Ì		45.3		50/3
						MATERIAL CONTRACTOR		
<del>-4</del> 6								
-47				-				
l .								
-48								
740		Sample refusal on cobble.	15	AS	2-1/2	48.0- 48.7-	5.	50/2
		Sumple letusat on comple.				48_7_		50/2
-49							d	
					4.		=	
-50								
-51			-					
-31							1	
							300	
-52		Light olive gray, sandy				- The State of the		
		(fine to coarse grained).	16	AS	2-1/2	52.0	5	6
<b>-</b> 53		Poorly graded. Trace sub- rounded to subangular		'''	- 1,1	to	S. C. C. C. C. C. C. C. C. C. C. C. C. C.	26
		gravel. Very dense. Moist.				53.4	Complex	80/5
-54			co projecimanos				3	
T-04				1		- 1	ind shotrak	
							*	
-55	in the state of th						1	
			1.	1			di Comi	
-56			i kipiya ji isang					
			17	AS	2-1/2	56.0-	9	43
57						56.8		50/3

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-30

SITE Watan

Watana Relict Channel

SHEET NO. 5 OF 7

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, WATER CONTENT, PLASTICITY, COMPACTNESS,			PENETRATIO			
		WATER LOSS OR GAIN, ETC.	NQ.	TYPE	SIZE	DEPTH	RET'D	TEST
57 -58	Silt (cont)	Light olive gray to grayish tan, sandy. Sand fine to coarse grained. Poorly graded. Trace subrounded to						
-59		subangular gravel to 1-1/2 inch. Dense to very dense. Moist.			·			
60								
61			18	AS	2-1/2	60.5 to 61.3	10	45 50/4
62								
63								
64		Light olive gray, sandy,	19	AS	2-1/2	64.0- 64.3	4	50/4
65		gravelly. Gravel is sub- angular and fragmented. Sand is fine to coarse				U		
66		grained. Partly graded. Very dense. Moist.						
67								
68								
69		Temperature 8°C.	20	AS	2-1/2	69.0-	8	45
70	Silt and Clay	Olive gray, sandy, gravelly. Sand fine to coarse grained.				69.7		50/2
71		Gravel is subrounded to sub- angular, disintegrated diorite. Poorly graded. Very dense. Moist.						
72								
73					1			1

## ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIENT ALASKA

ALASKA POWER AUTHORITY

JOB NO. =5700.55

PROJEC

ROJECT Susitna Hydroelectric Project

HOLE NO. 58-0-30

SITE Watar

Watana Relict Channel

SHEET NO. 5 OF 7

DEPTH	SOIL TYPE	DESCRIPTION: COLOR, CONSISTENCY, STRUCTURE, MATER CONTENT, PLASTICITY, COMPRETMESS,			SAMPL	ε		<b>FEWETRATION</b>
73		WATER LOSS OR GAIN, ETC.	NO.	TYPE	SIZE	DEPTH	MET'S	TEST
-74	Silt and Clay (cont)	Olive gray, sandy, gravelly. Poorly graded. Sand fine to coarse grained. Gravel sub-						
-75	•	rounded to subangular. Very dense. Moist.	21	A	2-1/2	3 <b>4</b> :8-	*****	100/3
-76								7.7
-77								
-78								
-79		Trace striated gravel. Some	22	AS	2-1/2	79.0-		35
-80		gravel disintegrated diorite. Partly graded.		****		to _ 79.8	**************************************	50/3
-81		50% drill water loss.				•		
-82								
-83		Full drill water returns.						
-84		Olive gray, sandy, gravelly. Gravel to 1-1/2 inch (sub-	23	AS	2-1/2	84.		40
-85		angular to angular). Sand fine to coarse grained. Partly graded. Very dense.	in the contract of	eptopae de la		<b>t</b> _84.0	Name of States	50/4
-86		Moist.					ed Albert Section	
-87								
-88								
-89							345	1

### ACRES AMERICAN INCORPORATED - CONSULTING ENGINEERS BUFFALO, NEW YORK DRILLING REPORT

CLIERT

ALASKA POWER AUTHORITY

JOB NO. P5700.55

PROJECT Susitna Hydroelectric Project

HOLE NO. AH-D-30

Watana Relict Channel SHEET NO. 7 OF 7

DEFTH	SOIL TYPE	DESCRIPTION: CGLOR, CONSISTENCY, STRUCTURE,			SAMPL	E		PENETRATIO
	SUL TIPE	WATER CONTENT, PLASTICITY, COMPACTNESS, WATER LOSS OR GAIN, ETC.	NO	TYPE	SIZE	DEPTH	PETO	TEST
- 90	Silt and Clay (cont)	Olive gray, sandy. Sand is fine to coarse grained. Partly graded. Some gravel	24	AS	2-1/2	39.0 to 90.3	13	16 49 50/4
- 91		to 1-1/2 inch. Gravel is subangular to angular. Some gravel pieces are disintegrated diorite. Very dense. Moist.						
92		MOISC.			-			
93								
94	e e							
- 95								
96								
97								
98						· •		
99			25	A	2-1/2	99.0	0	21
-100	and the state of t	Bottom of Hole 100 Ft.				to 100.0		
101		doctor of hate for te.						
102					:			
103								
104								
105						٠.		

APPENDIX B WATANA RELICT CHANNEL/ BURROW SITE D-LABORATORY TEST DATA LABORATORY TEST DATA LEGEND SHEET (EXPLANATION IN ITALICS)

## SUSITNA HYDROELECTRIC PROJECT WATANA BORROW SITE D AND RELICT CHANNEL SUMMARY OF LABORATORY TEST DATA



# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/16/82

SHEET \_\_OF \_

HOLE NO.	SAMPLE NO.	DEPTH	SOIL				STAN	DARD	SIEVE	SIZES	( PE	RCENT	FINEF	THAN	I BY V	VEIGHT	·):			₩ <sub>C</sub> %	L.L.	P.L.	P.	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2"	١"	3/4"	3/8"	#4	#10	井20	#40	# 60	#100	<b>GPI</b> #	#200	70				CEASSIIICATIO
AH- D19	19-28	93.0	Е						100	98	89	83	76	67	57	48	41	36	32	8.5				SM-SC
	19-29	97.0- 97.3	E	Too	Fiall	To !	est	SMAI	L RE	COVER	У													
	19–30	99.0-  100.0	E			ļ		100	95	91	85	80	73	64	55	47	40	36	31	8.9				SM
- 1 <sub></sub> - 1	19-31	110.5	E							100	99	97	99	86	81	78	75	73	70	15.3	25	20	5_	ML-CL
······································	19-32	114 0-	<u> </u>	No R	ecove	ry !	VO SA	MPLE	RECO	JERE1	)													
golindas ir manipulindas d	19-33	114.8 117.0-	E								100	99	98	96	94	93	91	87	83					ML-CL
	19-34		<u>E</u>	<u>С; Н</u>	bld_	SAMP	LE NO	TES	TED.	SAVE	D								*					
	19-34	120.7	· · · · · · · · · · · · · · · · · · ·	On H	bld_	SAMP	LE NO	T TES	TED,	SAVE	D											×		
	19-35	125.4	E		<u> </u>	Ì					10C	99	98_	97	96	95	94	92	90	17.0		INDEX		CL-CH
		151.0- 151.5							<u>.</u>															
		169.0-	F		<u> </u>			100	95		85	80	74	66	57	51	47	44	41	10.6	99	LASTICITY		SM-SC
<del></del>	19-46	169.4	G			ļ				100	98	98	98	97	97	96	96	96	95		423-	- \$\frac{1}{7}		CL-MC
		- Atlantica de la companya de la companya de la companya de la companya de la companya de la companya de la co	<u> </u>																		8	1 1		
ER			<u> </u>																	ENT (	ASTM	AND		
NUMBER	ABER	T)	PH.C	<u> </u>			DAT	TICL	= 277	E AN	11451	C OF	COTI	s as	น กม	22-5				CONTE	/ LI)	IMT+	59	NOI J
	NUM	(FEE	GRAP				TAN	1 (02)	- 312	L PUVI	16731	<u> </u>	SULL	3 73	IN UT	<u> </u>				RE C. 2216	13	7	24.	S01 1CAT 487-
를 :			1176																	32		7.TC	14	SIED
BOREHOLE	SAMPLE	рертн	STRATI	<b></b>								\		 						MOTSTU ASTM D	1704	PLASTI	AST.	UNIFIED SC CLASSIFICA ASTM D2487
		<b>1</b>	<u> </u>							111										24				2.74

REMARKS:				
			고, 왕인, 글랑바스 왕의 한 회의하기 1. 그들의 경기 경기 보는 기가 있다.	



# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/3/82

SHEET 1\_OF 2\_

									·						~ <del>~~~</del>								-	
HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT		1 7	·		DARD	SIEVE	·										₩ <sub>C</sub>	L.L.	P.L.	PI	UNIFIED SOIL
				12'	6"	3"	2"	1-1/2"		3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200					
AH- D15	15-1	2.5- 5.0	<u> </u>					100	97	91	85	80	75	67	58	*44	41	_	29					SM
	15-2a	5.0- 6.0	E			ļ						100	98	89	73	*48	44	-	28					SM
	15-25	6.0- 7.0	E				100	89	85	85	81	79	75	69	60	*45	42		31					SM
	15-3	7.0- 9.0	E					100	97	95	89	86	81	73	63	*47	43		29		سعب بنین, جس			SM
	15-4	9.0- 11.0	E	i i						100	95	90	85	78	<u>65</u>	*56	53	_	41					SM
	15-5	11.0- 13.0	E			<u></u> .			100	97	90	٤7	<u>83</u>	76	68	*54	52	_	40				the sections	SM
	15-6a	13.0- 15.0	E						100	97	92	88	83	76	67	<u>*54</u>	51		39		and the second			SM
	15-6b	13.0- 15.0	E																					
	15-7	15.0-	E						,	100	98	93	87	85		69	63	57	52		17	15	2	SM
	15-8	17,0- 19,0	E/F	Conta	ct			100	94	86	77	72	68	62	49	*44	42	-	32	9.0				SM
ļ	15=5	19.0- 21.0	E/F	Lunta	ct_		<u> </u>			100	95	90	85	78	69	*56	53		42	10.3		ļ		SM
<u></u>	15-10	21.0-	F			<u> </u>				100	95	92	87	79	70	*57	54		42	8.8				SM
	15-11	23.0- 25.0	<u>F</u>						100	96	94	91	86	78	69	*56	53		43	9.9		ļ		SM
	15-14	34.0- 35.5	F/G	Conta	ct					<u> </u>	<b></b>					<u></u>				21.0				
	15-15	35.5- 37.0	G		<u> </u> 					ļ			ļ							23.1			The state of the s	
	15-16		G												~4×2~~~					36.7				
	15-17	39.0 <del>-</del> 41.0	G					د واشتراسید							en syste <b>ksinini</b> ng				-	38.5		ļ	and the second States	
	15-18	41.0- 43.0	G								وسدا مسيد				. J. Williams McLange					30.6		<u> </u>		
	15-19	43.0- 45.0													مينياسو ي مستنيد	<b></b>				39.7			<u> </u>	
	15-20	45.0- 47.0	G																	31.2				

REMARKS: \* #80 sieve used in place of #60 seive.



# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BIFFALO, NEW YORK

DATE: 8/3/82

SHEET 2 OF 2

HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT			U.S	STAN	DARD	SIEVE	SIZES	<u> </u>	· · · · · · · · · · · · · · · · · · ·				·				w <sub>C</sub> %	L.L.	P.L.	P1	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	131	3/4"	3/8"	#4	#10,	#20	#40	# 60	#100	#140	#200	70				
AH- D15	115-21	47.0- 49.0	G																	35.3				
· · · · · · · · · · · · · · · · · · ·	15-22		G																	37.5				
	15-23	51.0- 53.0	G																	35.5				
	15-24	53.0- 55.0	G																1	35.4				
	15-25	55.0- 57.0	G																	33.5	55	28	27	СН-МН
	15-26	57.0- 59.0	G																	33.2				
	15-27	59.0- 61.0	G																	31.7				
	15-28	61.0- 63.0	G								-									31.9				
	15-29	63.0- 65.0	G												-			i.		25.7	42	24	18	CH ·
	15-36	65.0- 67.0	G																	26.0				
·	15-31b	68.5 69.0-	G									ļ	,							20.0				
	15-32	70.4	G						**************************************											22.9			······································	
· · · · · · · · · · · · · · · · · · ·	15-33	72.0- 73.5	H			100	79	63	55	55	54	54	54	53	21	4	2	1	1_	11.9		<b> </b>		SP
<del>, , , , , , , , , , , , , , , , , , , </del>	15-34	74.5		No Re	cove	гу	-hin													<u> </u>				
	15-35	74.5 75.9		Cobb1	es							-										<u> </u>		
													<u> </u>											
					ļ								<u> </u>							ļ			<b></b>	
				ļ					-											<u> </u>		<u> </u>		<b>.</b>
				<b> </b>			.,									<b> </b>	ļ					<del> </del>		
									•															

REMARKS:					
45 - Annual Control of the Control o	i de indentingual de la martin de la martin de la martin de la martin de la martin de la martin de la martin d	and the second desired the second property of the second s			



# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/15/82

SHEET 1\_OF \_4\_

											44.25											1		
HOLE NO.	SAMPLE NO.	DEPTH	SCIL UNIT		1 69	<u> </u>		IDARD	SIEVE									#140	14200	% 0.%	L.L.	P.L.	Pi	UNIFIED SOIL CLASSIFICATION
				12"	6"	3"	2"	1-1/2	1	3/4	3/8"	#4	#10	#20	#40	# 60	#100	41 140	#200		عربي كونجنان بارد			
AH- D16A	16A-1	3.0- 5.0	C						100	97	91	_87 .	84	77	_70	61	51	45	39	9.9				SM
	16A-4a	9.0- 11.0 9.0-	С							100	99.5	98	95	89	82	76	70	65	60	16.8				CL-ML
	16A-4b		С								100	.99	91	62	32	*9	7		11	11.2				SP
	16A-£	13.0- 13.5	G				10υ	89	89	89	81	78	71	61	49	38	30	25	21	9.2				SM-SC
	16A-7	15.0- 15.7	С				100	81	77	71	70	65	55	42	31	24	19	16	13	8.3				SM-SW
	16A-8	17.0 17.2	С						100	92	90	88	82	70	55	44	37	33	29	10.7				SM-SC
	16A-9	19.0- 19.7	C							100	92	88	82	71	59	49	41	35	31	11.6				SM
	16A-10	21.8- 23.0	С						100	99	94	89_	80	65	50	40	32	27	23	11.3				SM
	16A-11	24.0- 25.4	· C	Cobb	e Fr	agmen	ts	<u></u>										7						
	16A-12a	26.5 27.4-	C	Court	e Fr	agmen	ts	-							-				<u> </u>		<u> </u>	<u> </u>	<b></b>	
	16A-12t	28.2	C	ļ			ļ			100	99	97	92	85	76	67	60	54	49	15.3				SM-ML
	16A-13	28.2- 28.6	C	Cobb	e Fr	agmer	t.s			ļ						<b>}</b>								
	16A-14a	29.5- 30.0 30.2-	<u>M</u>	Cobb]	e Fr	agmer	ts		100	95	87	80	75	70	_63	55	47	43	39	11.7				SM
	16A-14E	31.0	M	<u> </u>	ļ	<u> </u>				100	95	93	89	84	78	68	60	54	49	13.0	ļ 			CL-SC
	16A-15	31.9-	М	Cobb	le Fr	agmer	ts_						<b> </b>									ļ		2
	16A-16		M	Cobb.	le Fr	agmer	ts			<u> </u>					<del></del>			•					· · · · · · · · · · · · · · · · · · ·	
ΛU	16A-17	36.0	. M			<b> </b>		100	84	78	71.	73	71	69	67	66	64	63	61	<u> </u>	33	20	13	CL
D16B	16B-18	38.0	<u>M</u> _		<u> </u>					ļ								***************************************		10.8		ļ		
	16B-19													<u> </u>						13.7				
	16B-20	38.2- 39.0	М	<u></u>								<u> </u>								12.5				

REMARKS: \* #80 sieve used instead of #60 sieve.



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/15/82

SHEET 2 OF 4

												<u> </u>												
HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT			<b>.</b>	. STAN		SIEVE			·····								₩ <sub>C</sub>	L.L.	P.L.	ΡI	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200					
AH- D16B	16B-21a	40.0-	M					100	92	92	87	84	81	78	74	71	67	. 64	60	11.5				CL
	16В-21Ь		M							100	99	97	95	93	90	87	80	70	60	17.2				ML
video /	1·6B-22	42.0- 43.5	M					100	94	91	90	88	85	80	77	73	70	66	63	13.8				CI.
and the first through the state of the state	15B-23	44.0 46.0 46.0-	D								100	98	89	69	48	29	16	9	5	12.9				SP
rankle control	16B-24a	46.6 46.6-	D*	.:																				GP
territorio de ser en enconsidera	16B-24b	47.5 44.0-	D								100	99	98	97	95	88	69	48	33	28.3	<u> </u>			SM
	23 16B-24	46.6	l D			100	93	88	79	77	72	69	62	49	35	22	13	8	4					SP
	16B-25	48.0- 49.5 49.5-	D					100	86	80	74	72	72	71	71	68	57	45	41	17.1				SM
	16B-26	50.7	D						100	96	94	93	89	83	7.2	69	57	43	32	15.9				SM
	16B-27	51.0- 51.3 51.0-		Not	Repr	esent	ative						<u></u>									ļ		
**************************************	16B-28	52.7	D*								· · · · · · · · · · · · · · · · · · ·		ļ									<u> </u>		GW
	16B-29a	54.9- 55.5 54.2-	D							100	100	100	99	98	96	90	77	58	38	21.9		NP		ML
	16B-29t	56.0					100	89	64	56	48	41	37	34	31	28	23	16	11	9.4				GW-GM
<del>*</del>	16B-30	56.7 58.0- 58.9	D*	<u> </u>																				GP GP
<del>&gt;</del>	16B-11c	58.9-					100	64	60	53		44	40		35	31	26	21	15			1		GM-GW
	16B-31b	59.3 60.5	D v								100	99	98	97	94	87	73	61	49	20.9				SM-ML
	16B-32	51.3 62.4	D'	Same	as	31b	- not	tes	ted			<del> </del> -								<del> </del>		NP		ML
	16B-33	64.3			<u> </u>							39.7			97	95		79		19.7	1			ML
	16B-34	65.3	-						100	98			94		90	87		79		17.9				ML
	1 3-35	66.9	D,		<u> </u>	<u> </u>	<u> L</u>	<u> </u>	<u> </u>	<u> </u>	100	99	99	95	90	88	85	83	31	26.2	47	31	16	ML

REMARKS: \* Not representative sample. Too small for maximum particle size.



# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/15/82

SHEET 3 OF 4

HOLE NO.	SAMPLE NO.	рертн	SOIL UNIT						<b>.</b>			RCENT	,	···						w <sub>c</sub>	LL.	P.L.	Ρį	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200					portion and
ИН— 016В	16B-36a	67.3- 67.8	D'/E								0									24.2	and the state of t	NP		ML
	16B-36b	67.8- 68.8 69.5-	L E							100		96	91	80	65	45	29	21	16	18.4				SM
	16B-37	71.0	E						100	99	96	93	83	78	62	45	33	25	19	16.0				SM
<u></u>	16B-38	72.9 75.0-	E					100	97	95	91	88	80	63	38	20	12	8	6	15.2		<u> </u>		SP
	16B-40	77.0	E								100	96	82	75	63	41	22	11	7	4.8				SP-SM
	16B-41	80.0- 81.0 81.7-	F				l	100	86	84	78	75	70	64	<u>58</u>	52	47	43	39	8.5				SM-SC
	16B-42	82.0	F																					
· · · · ·	16B-43	83.0- 84.0 85.0-	F				<u></u>	100	97	96	90	85	79	73	65	59	54	49	45	9.3	21	15	7	SM-SC
	16B-44	85.7 86.0-	F																	<u> </u>				
	16B-45	87.0 87.0-	F				100	85	82	82	80	77	69	57	47	40	35	31	29	16.9				SC
	16B-46	87.5 89.0-	F																					4
	16B-47		1																					
	16B-48	92.0	<b>7</b> F						100	93	79	73	66	58	51	44	38	34	31	7.3		<u> </u>		sc
	16B-49	<u> </u>																						
	16B-50	96.0- 96.4 98.0-	F																				ļ. <u></u>	
	16B-51	98.0- 98.5 100.6-	<u>F</u>																		ļ			
	16B-52	101.2	F					100	94	89	85	80	' 75 1	67	59	52	46	42	78	10.0				SC
<del></del>	166-53	102.3- 102.4 104.5-	<u> </u>		Frag																	<u> </u>	<b> </b>	
	16B-54	104.5- 104.6 106.5-	F	Too	Small	to	<u>l'est</u>				<u> </u>	1					-			<del> </del>		-	<u> </u>	
, ·	16B-55	106.7	F	Rock	Frag	ment	s					<u> </u>											<u>L</u>	

REMARKS:							



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/15/82

SHEET 4 OF 4

HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT			U.S	. STAN	DARD	SIEVE	SIZES	PE	RCENT	FINER	R THAI	V BY V	VEIGHT	Γ)			₩ <sub>C</sub>	L.L.	P.L.	PI	UNIFIED SOIL
				12"	6	3"	2"	1-1/2	!"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	70				C.ASSII IVATIO
AH D16B	16B-56	108.0- 108.1	F	Rock	Fra	ment	s												,					
	16B-57							100	91	89	85	30	76	67	60	53	48	45	42	10.0				SC
	16B-58	116.0- 118.0	G												No	Uppe	r Lin	it	98	29.3	52	29	23	МН-СН
	16B-59	$\frac{118.0}{120.0}$	G				_							- 1						28.2				
	16B-60	120.0- 121.7	G										•					:		28.9				
and the same and a	16B-61	124.0- 126.0	G						100	98	98	98	98	98	98	98	98	97	97	28.6				CL-CH
	16B-62	128·0- 130.0	G																					
	16B-63	132.0- 133.5	G																100	34.1	52	28	24	СН
	16B-64 16B-65	136.0- 137.5	G		. dans. — a															33.4				
	16B-65	140.0-	G		·				o de la constanta de la consta				منسبة وبريانية منسي						100	30.6				CL-CH
-	16B-66	144.0- 145.5	G												-					28.1	31	25	0	ML
	16B-67	148.0-	I				·.	100	93	85	69	63	58	52	46	41	37	34	31	10.4				SC
_	16B-68	151.0-	I						100	95	94	94	93	92	92	91	91	91	91	27.1				CL-ML
	16B-69	153.0- 154.4	I																					
	16B-70	155.0- 156.0	I					100	96	96	93	88	84	79	73	68	63	59	56	15.2				CL
:	16B-71	157.0- 158.3	J																	15.8			7.50	
	16B-72	159.0- 161.0	Ĵ				100	88	88	88	82	79	76	73	69	66	62	60	58	14.9				SC-SM
	16B-72 16B-73 16B-74	163.0- 164.1	J						100	98	96	95	94	93	91	90	89	88	86	25.5				ML-MH
·	16B-74	167.0- 168.4	J																	28.1				
	76 16B–79			NX Co	re -	Bedr	ock																	

NEMARKS:				
A STATE OF THE PARTY OF THE PAR			<del>van de la composition della composition della composition della composition della composition della composition della composition della composition della composition della composition della composition della composition della composition della composition della composition della c</del>	
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# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/15/82

SHEET 1 OF 3

													<del>Valina (188</del> 0)							,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			1110	
IC E NO.	SAMPLE NO.	DEPTH	SOIL UNIT	"	1 <u>6</u> 1				SIEVE		,			R THAN	1 BY 1 #40	·		# 140	# 200	₩c %	LL	P.L.	P.I.	Unified Soi Classificati
				12"	6''	3"	2"	1-1/2		3/4	3/8'	#4	#10	#20	#40	# 60	#100	+1 140	#200		~			
H- 17	17-1	2.0- 4.0	С				100	91	81	76	67	63	58	51	45	39	35	31	27	10.5				SM
	17-2	4.0- 6.0	C						100	99	94	89	79	64	52	42	35	30	26	11.1				SM
	17-3	6.0- 8.0	С							100	96	86	65	40	31	26	22	19	17	15.8				SM
	17-4	8.0- 10.0	C																		-			
	17-5	10.0- 12.0	С						100	97	94	91	85	75	64	54	46	40	35	9.6				SM
	17-6	12.0- 13.9	С																					
AND THE PARTY OF T	17-7	14.0- 15.3	C																					Treat Meabon
<u></u>	17-8	16.0- 17.3					100	85	81	80	77	74	68	61	53	46	39	34	30	7.5				SM-SC
·	17-9	18.0- 18.8								100			83	74	63	54		40	35	ļ				SM
	17-10	20.0- 20.6							100		94		83	74	64	55		41	35					SM
	17-11	22.0- 22.7	С																					
	17-12	24.0- 25.9	С					100	94	89	85	81	75	67	58	50	42	37	32	7.5				SM
	17-13	26.0- 28.0							100				82	70	59	48	40	34	30					SM
	17-14	28.0-	С					100	92	88	81	77	72	64	56	49	43	38	34	9.0				SC
	17-15	30.0-	С																					
	17-16	32.0-						100	90	82	74	71	64	56	47	39	33	28	24	7.6				SM-SC
	17-17	34.0- 34.8	C	•				100	80	77	75	71	66	59	52	46	40	36	33	8.6				SM
	17-18	40.0- 41.0	С																	7.5	18	15	3	SC
	17-19	42.0- 42.9	E				100	86	65	62	58	54	49	43	36	30	26	22	20	7.4				SM-GM
	17-20	45.3- 45.7	E					100	94	91	84	78	70	62	53	45	39	33	29	18.4				SM

REMARKS	*				



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/15/82

SHEET 2 OF 3

	<del>,</del>	·																			***************************************		ويوسينون والمستواسي	
HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT		· · · · · · · · · · · · · · · · · · ·	<b>P</b>					•					WEIGHT				₩ <sub>C</sub>	L.L.	P.L.	P.I.	UNIFIED SOIL
		•		12"	. 6"	3"	2"	1-1/2"	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	/0				
AH- D17	17-21	48.0- 48.4	E																					
	17-22	53.0- 53.7	E				100	84	79	74	70	65	59	51	44	37	32	27	24	7.8				SM
	17-24	60.0- 60.7	F					100	94	86	81	77	69	60	51	43	37	32	28	9.9				SM
	17-29	77.0- 77.8	G					100	92	92	91	91	90	90	89	88	86	82	76	21.3			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	CL
	17-30a		G					100	96	96	89	84	78	71	64	57	51	46	° 41	13.7				SC
	17-30b	81.0- 82.0	G	ļ			100	92	89	85	78	73	67	62	_56	51	45	41	38	9.1			**************************************	SC
	17-31	85.0- 86.9	G						100	98	94	91	86	79	72	65	57	52	47	12.2				SC-CL
	17-32	87.0- 89.0	G**			7									<del></del>							-	****	
	17-33	89.0- 90.6	G**																					
	17-34	-	No Re	cover	y		<u> </u>																THE RESERVE	
	17-35	<del></del>	G'			<u> </u>	100	94	94	90	88	83	78	72	63	54	48	43	40	11.3		<u> </u>		SC
	17-36		G¹											-						13.9	<b> </b>			
	17-3.	98.0- 99.7 102.0-	G'					100	97	97	91	86	81	73	66	59	54	51	48	ļ				SC-CL
	17-39	102.8	G'			ļ				100	93	87	79	70	63	56	51	46	42	13.6	<b>!</b>	-		SM-SC
	17-40		I	Cent	er	ļ				100	99	99	98	93	86	84	84	83	82	21.9	<b> </b>	<u> </u>	0	CL_
	17-41	122.0- 122.8	I	Cent	er					100	99.8	99.5	99	96	94	92	91	89	87	24.0	-	<u> </u>		CL
	17-43	136.0- 136.4	I							100	95	92	88	85	82	77	70	63	55	15.3	<u> </u>			CL-SC
	17-43	136*	I	Sand	Ran	Into	Spoo	n			100	99.9	99	78	29	20	16	14	12	24.6	<b></b>			SP-SM
		140.0- 145.8				<u> </u>					100	99	96	84	73	35	25	21	18	24.6	ļ	-		SM-SP
	17-47	147.C- 147.8	I							100	93	79	69	64	53	35	22	16	12	18.4	4			SW-SM

REMARKS: \* Sand that ran into spoon after sample 17-43 was taken.

\*\* Organics in sample. Held for carbon 14 dating.



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/15/82

SHEET 3 OF 3

	·							RP .	~		NO NE	160							···	<del></del>				
nULE NO.	SAMPLE NO.	DEPTH	SOIL UNIT			บ.ร	S. STAN	IDARD									1. 1. 1.			W <sub>C</sub>	LL.	P.L.	PI	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	/6				OCASSII ICATI
AH- D17	17-50 17-51*	164.0- 164.5	I							100	99	95	93	90	88	85	80	74	65	13.1			-	CL
· · · · · · · · · · · · · · · · · · ·	17-51*	169.0- 169.8	I				100	72	72	72	70	67	62	58	54	52	50	48	48					SC-CL
	117- 51a**	169.0	T																					SP
	17-53	185.0- 186.8	J'																	23.6	51	25	26	CH
	17-54	191.0- 191.7	J	NX C	bre										v									
						1			·															
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																	41 (100) 2000 (100)					<b></b>	THE TEXT PROPERTY.	
-									ر برخ <del>ان در در در در در در در در در در در در در </del>								7.5			7				
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				<del> </del>	<b> </b>		<u> </u>				ļ		<u> </u>				<del> </del>				<del> </del>			
<del>*************************************</del>				<del> </del>	-		<u> </u>	1			<b>+</b>			<del> </del>									The Particular Desired	and the second s
				- Colombia							<del> </del>									<del> </del>				
		<u> </u>									<u></u>				<u> </u>			<u>L</u>		<u> </u>			<u> L</u>	

REMARKS: \* Sample not representative. One large fragment.

\*\* Sand slough (wash), not representative.



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/3/82

SHEET 1 OF 3

			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	·	<del></del>																			
HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT	12''	6"	U.S	STAN		SIEVE				· · · · ·	R THAN	#40			# 140	#200	₩ <sub>C</sub> %	L.L.	PL.	P1.	UNIFIED SOIL
A 77		2	<del></del>	12	Ь	3		1-1/2	1	3/4	3/8"	#4	#10	#20	#40	# 60	#100	# 140	#200					
AH- D13	18-1	3.5- 5.5	С				100	74	68	63	59	52	46	38	31	25	21	18	15					GM-SM
	18-2	5.5- 7.5						100	96	96	90	86	81	72	60	50	43	37	33					SM
·	18-3	7.5- 9.5	C						100	96	91	84	77	67	58	48	40	34	29					SM
·	18-4	9.5- 10.3	C					100	92	91	37	83	78	70	61	53	47	41	37	14.9				SM-SC
	18-5	11.5- 12.0	С	Сорр	le Fr	agme	nts						-											The section of the se
	18-6	15.0- 16.3					•		100	97	92	86	79	68	59	49	41	36	31	12.0				SM-SC
	18-7	18.0- 18.7	С	Cobb	le Fr	agme	nts																	
	18-8	22.0- 23.3	С						100	97	94	88	81	72	63	55	48	43	39					SC
	18-9	25.0- 27.0							100	99	95	92	88	84	80	75		68	-	15.5				CL-CH
	18-11	29.0- 31.0		Samp	le To	o Sm.	a11 T	о Те	1															i or or
	18-12	31.0- 33.0	D'	On H																				
	18-13	33.0-	D'				100	84	71	65	56	51	45	40	35	32	29	27	26	9.8				GC-SC
	18-14	35.0- 36.5	D'	On H	lo1d																			
	18-15	37.0- 38.4	D'						100	97	89	83	78	72	66	61	56	52	50	11.5				CL-SC
	18-16	39.0-	D'	On H	o1d																			
	18-17	41.0-																		14.6	30	17	13	CL
	18-18	43.0-								100	99	99	98	96	94	92	90	89	87	22.2				CL
<del> </del>	18-24	70.0-	E/F			100	74	66	59	57		33		19	14	10		5	4	7.8	1			GW
	18-25	75.0-	E/F	Wash	and	Сорр																		
	18-26a	98.0-	1							100	99	98	95	93	90	85	77	68	59	18.0				CL-ML

REMARKS:			
			A Section 1



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/14/82

SHEET 2 OF 3

HOLE NO.	SAMPLE NO.	DEPTH	SOIL			U.S	. STAN	IDARD	SIEVE	SIZES	( PEI	RCENT	FINE	R THAN	I BY V	VEIGHT	r)			₩ <sub>C</sub> %	LL.	P.L.	PI	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#4C	# 60	#100	#140	#200	/0				
AH- D18	18-26b	98.0- 100.0	G																	26.0	44	26	18	ML-CL
	18-27	100.0- 100.9	G	Тоо	 Small	TO 1	est				- -													
	10 00	102.0- 103.0				1 [			المالية والمالية			-												
	18-28 18-29	104.0-	G		Small			-													<del> </del>			
	18-29	104.5 106.0-	G	Too	Small	To '	est						<u> </u>							<b></b>	<u> </u>			
	18-30a	107.8	G		ļ						100	99	99	99	99	99	99	99	97	22.7	ļ			ML-MH
	18-30a 18-30b	107.8	G																	14.7	27	20	7	ML-CL
	18-31	108.0- 108.7	G	Too	Small	To T	'est																	
	18-33a	112.0 - 1	G									100	99.5	99	97	95	93	87	76	23.9	)			ML-MH
	18-33ъ		G						•	100	99	97	93	82	64	50	40	34	28	13.1				SM
		114.0- 116.0	G							100	1	97	0;	87	75	59		26		18.1				SP-SM
		116.0- 118.0	G							1	99.5	97	91	80	68	58	51	45	42	17.5				SM
		118.0- 120.0	G						100	96		92	88	78	_	45	33	26	22	15.9	)		•	SM
	18-38		G			100	73	73	69	69	64	59	53	46	39	34	29	25	21	6.0				SM
	18-42	132.0- 132.8	G %	Piec	es Of	Bou	lder	Caugl																A Transport of the Control of the Co
	18-43	135.0- 136.3	G'					100		96		91	87	81	74	68	64	60	57	14.1	L			CL-CH
,	18-47	143.0- 143.5		Pebb	les ]	n Sp	pon																	
	18-48	152.0- 152.6	G'					100	93	89	84	81	77	71	66	62	58	55	53	12.0	d			SC
	18-50	157.3- 158.0	G ¹	On H	b1d		Ī																	
	18-51	160.0- 160.4	G'						100	97	94	90	84	75	67	58	51	45	41	9.3	3			**************************************
	18-52	162.5-																		7.8				SM

1400-1400-1400-1400-1400-1400-1400-1400



# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/14/82

SHEET 3 OF 3

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HOLE	SAMPLE NO.	DEPTH	SOIL UNIT		•	· · · · · · · · · · · · · · · · · · ·			SIEVE							WEIGHT				₩ <sub>C</sub> %	L.L.	PL.	Pi	UNIFIED SOIL
				12"	6,	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	70				
AH- D18	18-53	166.0- 166.6	G¹						100	96	94	92	86	76	70	65	61	<u>5</u> 7	54	15.8				CL-ML
	18-54	168.0- 168.7	G'						100	96	_88	84	79	72	65	59	54	50	46	10.4		مناعم والمجاورة		SC
	18-55	172.0- 173.0	G T								100	95	78	61	51	44	39	34	30	11.2				SM-SC
	18-56	166.0- 166.6 168.0- 168.7 172.0- 173.0 176.0- 177.3	G'						100	97	93_	91	89	82	79	77	75	72	67	18.1				ML-CL
	18-57	179.7	G'	Too	Small	То	Test															-	•	
and an antique of the second s	18-58	180.0- 181.3	G				N	100	91	91	_38	82	77	73	69	66	64	62	59	13.5				ML-CL
	18-59	185.0- 185.4	G.	Too	Small	То	Test																	
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	4545	<del></del>	<del>1</del>	<del> </del>	<del> </del>	<del>1</del>	·L	<del></del>	<del></del>	<u> </u>	<del></del>	-L	L	<del></del> _	<u> </u>	<del>1</del>	<del> </del>	<del></del>	<b>L</b>		<del></del>	<del></del>	<del></del>	American and discourse

REMARKS:			



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/16/82

SHEET 1 OF 3

									·															
HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT	12"	6"	υ.s 3"	. STAN	IDARD	SIEVE	·	3/8"	RCENT	FINEF	# 20				# 140	#200	₩ <sub>C</sub> %	L.L.	P.L.	P	UNIFIED SOIL
ΛIJ		2.0-		12	-	J		11/2		3) 4	3/0	77	7710	11 120	# 10	₩ 00	#100	W170	17 200					
AH- D19	19-1	4.0	A/B		<u> </u>		100	85	85	81	75	71	66	60	54	48	43	39	34		-			SM
	19-2	4.0- 6.0	A/B						100	94	89	83	78	72	<sup>-</sup> 65	59	53	49	45	15.7				SM
	19-3	6.0- 8.0	С			100	59	59	59	59	46	43	40	36	33	30	28	26	24	8.6				GM-GC
	19-4	8.0- 10.0	С					100	78	78	58	52	47	41	35	31	27	24	21	12.1				GM SM
	19-5	10.0- 12.0	С				100	82	76	71	64	60	56	50	44	39	34	31	27	13.4				SM
	19-6	12.0- 13.2	С						100	93	82	73	66	57	49	42	37	33	29	12.2				SM-SC
	19-7	14.0- 16.0	С					100	95	93	87	83	79	72	64	58	51	46	42	13.2				SC
	19-8	16.0- 17.8	М					100	89	89	83	76	70	63	55	49	42	38	34	13.0				sc
	19-9a	26.0- 26.5	M							100	98	89	45	16	9	7	5	4	3	12.0				SP
	19- °b	26.5- 28.0	М						100	95	91	87	81	74	67	60	54	49	44	10.9				SC-SM
	19-10	28.0- 28.8	M						100	97	89	84	78	72	65	54	52	47	43	9.7				SC-SM
	19-11	31.0- 32.9	<u> </u>						100	89	86	82	76	69	62	56	51	47	43	10.2	19	15		SC-SM
	19-12a	34.0- 34.3					100	59	59	55	49	45	41	30	18	14	12	9	7	8.3				GP
	19-12ъ	34.3- 35.8						100	97	95	91	86	79	71	63	55	48	44	40	8.6				SM-SC
	19-13a	36.0- 37.5	_M				100	92	79	75	72	69	61	32	17	12	10	9	7	11.6	<u> </u>			SW-SM
	<u>19-13ъ</u>	37.5- 38.0	M					100	84	83	76	70	63	56	50	44	39	36	32	6.1*				SC
	19-15	40.0- 42.0							100	99	92	88	82	7.4	٤6	58	52	47	43					SM-SC
angaran yang baran kanan sanah	19-16	43.0- 44.3	<u></u>				100	87	87	85	78	73	64	54	46	40	35	32	28	9.7				SM-SC
	19-17_	45.0- 45.7						100	76	74	70	66	60	53	47	41	37	34	31	8.6				SM-SC
	19-18	47.0- 47.8	M					100	90	89	06	 , 81	75	67	58	51	44	39	35	9.4				SM-SC

REMARKS: \* Small holes in sample bag. Moisture content may be low.



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/16/82

SHEET 2 OF 3

HOLE NO.	SAMPLE NO.	DEPTH	SOIL			U.S	S. STAN	IDARD	SIEVE	SIZES	· ·		FINE	THA	N BY V	VEIGH	Γ)			₩ <sub>C</sub>	L.L.	P.L.	21	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	70		ما المادين و نسو بند		
AH- D19	19-20	59.0- 59.9	M				100	91	81	81	77	70	59	49	42	36	31	27	24	8.0				SM-SC
	19-22	65.0- 65.7	M	Тоо	Small	To	Test	· ·																
	19-23	69.0- 69.5	M					100	92	84	76	68	60	52	44	37	32	28	24	7.4				SM-SC
	19-26	77.0- 78.0	E				100	88	88	88	80	75	69	61	53	46	40	35	30	3.3				sc
	19-28	93.0- 94.7	E						100	98	.89	83	76	67	57	48	41	36	32	8.5				SM-SC
prik wagang di panganana	19-29	97.0- 97.3	E	Too	Smal.	То	Test																	
	19-30	99.0- 100.0	E					100	95	91	85	80	73	64	55	47	40	36	31	8.9	-			SM
	19-31	109.0- 110.5								100	99	97	92	86	81	78	75	73	70	15.3	25	20	5	ML-CL
	19-33	114.0- 114.8	E	. :							100	99	98	96	94	93	91	87	83	22.9				ML-CL
and the second s	19-34	117.0- 117.8	E	On I	old																			
	19-35	120.0- 120.7	E	On I	old																			
	19-36	124.0- 125.4	E								100	99	98	97	96	95	94	92	90	17.1				CL-CH
	19-38	133.0- 133.8	E			<u> </u>		100	95	89	84	80	74	65	57	49	43	39	35	7.8				SM
·	19–40	144.0- 144.5						100	94	92	86	82	75	66	56	48	42	38	34	7.9				SM-SC
	19-43	151.0- 151.5	F					100	95	92	85	80	74	66	57	51	47	44	41	10.6				SM-SC
	19-46	169.0- 169.4	G							100	98	98	98	97	97	96	96	96	95					CL-ML
	19-47	171.0- 172.5	G																	25.5	33	23	10	CL-ML
	19-  Run 1a	164.0- 169.0	G	NX (	ore ·	Col	bles								- :									
- Company of the Comp	19- Run 1b	164.0- 169.0	G							100	99	97	95	92	89	87	86	84	83	28.5			200	CL-ML
	19-48	1	to the second								100	98	96	94	93	91	87	دنا	74	18.6				ML-MH

REMARKS:			
	<u> 18 ann an Airte an Airte an Airte an Airte an Airte an Airte an Airte an Airte an Airte an Airte an Airte an</u>	ante en la compaña e en la crista de las decidades de la granda de	
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## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/16/82

SHEET 3 OF 3

HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT	12''	6''	υ.s 3"		IDARD			3/8"							# 140	#200	₩ <sub>C</sub> %	L.L.	PL.	P. L	UNIFIED SOIL
AH- D19		177.0- 178.5		12	O	3		1 1/2		3/4	3/8		4710	#20	49 40	47 00	#100	41 170			A 7	0.0		
D19_	19-49	<u> 178.5</u> 1181.0-	G	<u> </u>											******					28.5	37	23	1-	CL-ML
	19-50	181.0- 182.6	G												No U	pper	Limi	t	98	29.3				CL
	19–52 19–54	187.0- 188.4	G																	27.4	34	27	Name of the last o	ML
	19-54	193.0- 193.8	<u>G</u>				•								No U	pper	Limi	t	99	27.6	-			ML
												•												
		All principles of the state of																						
				<u> </u>		•							7											
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	and the same and t	1423 280 280 4		1				<u> </u>			<u> </u>	ļ	<b> </b>									<del></del>		
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## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/4/82

SHEET 1 OF 3

IOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT				S. STAN	DARD	SIEVE	SIZES	( PEF		,							w <sub>C</sub> %	L.L.	P.L.	PI	UNIFIED SOIL
7.20				12"	e,	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	70		<u></u>		
AH- D20	20-1	5.0- 5.0	С				100	91	88	84	70	62	51	40	30	23	18	15	12	8.2				SM
	20-2	5.0- 6.3	C				100	87	72	63	53	43	33	25	19	15	12	9	7	6.9				GM
	20-3	7.0- 9.0	С				10C	92	92	88	79	66	56	46	36	28	23	20	18	8.1				SM
	20-4	9:9-	С				100	81	76	68	55	49	42	34	26	19	15	12	10	7.1			- Postal bridge	GM
	20-5	11.0- 11.5	C	No R	ecov	#2"/ #2"/													:				2016	**************************************
	20-6	13.0- 14.4	С	No F	ecov	ery																		
	20-7	15.0- 15.5	С	No F	ecov	ery																		The second secon
	20-8	17.0- 17.9		Not	Test	ed. 3	oo Si	ta11																
	20-9	19.5- 20.7	С					100	96	96	93	91	85	77	69	62	55	50	45	12.7				SM-SC
	20-10	22.0- 23.3	C						100	98	92	89	85	75	50	37	32	29	26	11.7				SM-SC
	20-11	24.0- 25.7	E					100	94	87	74	59	49	37	25	18	16	14	13	8.3				SC-SM
	20-12	26.0- 27.9	E					100	98	91	74	60	47	29	19	13	10	9	7	9.0				SW-SC
	20-13	28.0- 30.0	E					100	87	82	67	54	40	26	18	15	12	11	10	8.0				SP-SC
	20-14	30.0- 32.0		No I	ecov	ery																		
	20-15	32.0- 34.0	न								100	100	100	99	88	51	31	23	19	17.9				SM
	20-16	34.0- 36.0								100	99	99	99	99	71		13	8	5	21.4				SP-SM
	20-17	36.0- 38.0 38.0-							100	99	76	65	61	58	45		17	12		13.1				SP-SM
	20-18	38.0- 40.0	म							100	100		99	99	99		70	45		22.0				SM
	20-19	40.0- 42.0	F									100	100		99	95	91	82		22.5				ML-MH
	120-20	44.0- 46.0										100		100	99		39	19		22.3				SM

REMARKS:									



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/4/82

SHEET 2 OF 3

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HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT			U.S	. STAN	IDARD	SIEVE	SIZES	( PE	RCENT	FINE	R THAI	N BY V	WEIGHT	Γ)			₩ <sub>C</sub> %	L.L.	P.L.	PI.	UNIFIED SOIL
·				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	/6				CEASON ICANO
AH- D20	20-21	48.0- 50.0	F								100	100	100	100	99	84	38	19	14	29.1	· · · · · · · · · · · · · · · · · · ·			SM-SP
	20-22	52.0- 54.0								i.	100	100	100	100	100	99	82	53	35	21.6				SM
	20-23	56.0- 57.7	F								100	100	99	99	98	98	95	69	61	24.1				ML-MH
	20-24	60.0- 62.0	F						-		100	100	99	99	98	98	78	46	36	22.5				SM_
<b>*</b>	20-25	64.0- 65.1	G							100	93	84	75	67	58	47	36	28	21	13.0				SM
	20-26	66.0- 66.1		No I	ecove	ry																		
	20-27	69:9- 69:7								100	95	91	86	81	76	71	66	61	56	13.0				CL-CH
	20-28	71.0- 71.7							100	98	96	94	90	84	32	78	72	64	56	15.5				CL-ML
<del></del>	20-29	73.0- 73.8		No I	Recove	ery																		
	20-30	75.0- 75.6		Too	Sma1	То	Test																	
· · · · · · · · · · · · · · · · · · ·	20-31	79.0- 80.3	G					100	94	85	78	73	67	62	57	53	45	39	36	13.4				SM
	20-32a	81.0- 81.4	G.					100	58	56	52	46	42	37	33	31	29	28	24	8.2				GM-GC
	20-32ъ									100	95	91	88	85	81	78	75	73	71	18.1				CL
	20-33	83.0- 84.7	G						100	99	95	92	89	85	82	78	75	72	67	16.1		ļ		CL-CH
	20-34	87.0- 89.0	G							100	97	95	91	88	87	85	82	70	59	15.8				CL-CH
	20-35	89.0- 90.4	G							100	98	97	95	94	93	91	89	87	85	24.0				ML
	20-36	83:8-																	100	30.2				ML
	20-37	97.0- 98.7	G									1.:							100	28.3	49	29	20	ML
	20-38	101.0- 103.0	G												No t	pper	Lim:	ts	98	29.1	47	29	18	ML
	20-39	105.0- 107.0	G'																100	29.1	43	28	15	ML

REMARKS:_	·							
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### ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/4/82

SHEET 3 OF 3

HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT			U.S	. STAN	IDARD	SIEVE	SIZES	S (PE	RCENT	FINEF	AHAT S	N BY V	WEIGH.	Γ)		, d s	₩ <sub>C</sub> %	LL.	PL.	P.I	UNIFIED SOIL
		9		12"	6"	3"	2"	1-1/2	- 1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	/6				CEASSII ICATIO
AH- D20	20-40	128:3-	No F	ecove	ry																			
	20-41	111.0- 111.6	G'							100	97	95	93	91	90	88	86	83	77	20.9	".			ML
	20-42	113.0- 114.2	g'							100	97	94	89	84	78	71	64	59	54	10.5				ML
	20-43	122.5- 122.8	Т	No F	ecov	erv											•							
	20-44	124.0- 124.6	I		Frac		S								÷									
	20-45	137:8	I	1	Fra																			
· · · · · · · · · · · · · · · · · · ·	20-46	135.2- 137.0	BR	Rock	Fra	ment	s HX	Core			-													
	e de la companya de l																			<del></del>		•		
	and an experience of the state	South grave and restriction on the state of the field of the state of	Contraction of the Contraction o														:							
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· · · · · · · · · · · · · · · · · · ·	\$20m	engle (illima majorinam rajo																					*********	9
													17.7			,								
	and resistance structures of the second structures and the																		•					
**************************************	(San (San (San (San (San (San (San (San	-544-0-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1				<u> </u>				<b>†</b>													1	



### ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/2/82

SHEET 1\_OF 3

	<b>-</b>			-				- سيدنسس													-		-	
HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT				· :	·	SIEVE	·	·	,		R THAN	· · · · · · · · · · · · · · · · · · ·					W <sub>C</sub>	LL.	P.L.	Pi	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200					S. C. C. C. C. C. C. C. C. C. C. C. C. C.
AH- D21	21-1*	2.0- 4.0		Orga	nics												:		-					
	21-2	4.0- 6.0	С				100	93	86	84	77	71	64	55	45	38	32	28	24	10.5				SM
	21-3	6.0- 7.0	С				100	88	80	80	72	64	52	41	33	28	23	20	18	9.4				SM
	21-4	8.0- 10.0	C				100	83	78	78	74	69	62	52	43	36	30	26	22	8.0	<b> </b>			SM-SC
	21-5	10.0-	C					100	94	92	84	78	70	59	48	40	33	29	25	8.2				SM-SC
	21-6	12.0- 14.0	C					100	92	89	82	76	69	59	47	38	29	24	20	8.5				SM
designation and the same	21-7	14.0- 16.0	C	1				100	94	93	87	82	74	64	53	43	34	28	23	9.9	)			SM
	21-8	16.0- 18.0		No R	ecove	ry				<u></u>														
·	21-9	19.0- 21.0	E	1			100	89	80	75	68	63	_55	47	38	32	26	22	19	7.8	3	<u> </u>		SM-SC
	21-10		E			ļ			100	94	79	73	65	56	48	41	36	32	29	9.4	H		والمراجعة المراجعة المراجعة المراجعة المراجعة المراجعة المراجعة المراجعة المراجعة المراجعة المراجعة المراجعة ا	SC
	21-11	24.0- 26.0			ļ			100	91	87	83	78	72	64	55	48	41	36	32	10.5				SC-SM
	21- 12**	26.0- 28.0					100	62	56	53	47	43	37	32	26	22	19	16	14	5.2	2			GC
	21-13		E			1		100	97	93	87	82	76	67	57	49	41	36	32	8.4	,  <del> </del>	<u> </u>		SC
	21-14	**************************************	E					100	92	89	82	77	69	61	52	45	39	35	30	8.4	4		a de la companya de l	SC
	21-15							100	92	92	82	76	70	61	52	44	37	32	28	8.4	4			SC
	21-16	34.0- 34.4	1	No F	Recove	ry				<u> </u>		<u> </u>				<u> </u>					-			
	21-17	36.0- 36.1		No F	Recove	ry				<u> </u>								]						
	21-18		F					100	81	72	59	54	47	39	32	27	24	21	19	6.9	9			SM
· · · · · · · · · · · · · · · · · · ·	21-19			No I	Recov	ry_												<u> </u>				<u> </u>		
	21-20	43.5- 44.3	F						100	92	78	72	62	50	33	22	18	16	14	9.	5			SM

REMARKS: \* Organics, sample not tested.

\*\* Supler size too small for maximum particle size, large pieces suspected to be fragments of larger pieces.



### ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/2/82

SHEET \_2 OF \_3

HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT			บ. ร	S. STAN	IDARD	SIEVE	SIZES	( PEF	RCENT	FINE	AHT S	BY V	VEIGHT	7)			₩ <sub>C</sub> %	LL.	P.L.	Pn	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	76				CLASSIFICATION
AH- D21	21-21	45.0 45.4		No R	ecove	ry																		
	21-22	47.0- 47.9		No R	ecove	ry																		
	21-23*	49.0-	F		Repre		ative																	GP
	21-24	52.0- 52.3			ecove										-									
	21-25	54.0- 54.3			ecove																			
	21-26	56.0-			ecove											·								
	21-27	58.0- 58.2			ecove	] -																	X = 44 x = 1, 4	A. A. C. C. C. C. C. C. C. C. C. C. C. C. C.
الله المواديد المداد المداد المداد المداد المداد المداد المداد المداد المداد المداد المداد المداد المداد المداد	21-28	60.0- 60.3			ecove																			
	21-29	62.0-	G	INO IN	ECOVE	1 y							a.===		······································					21.8	37	25	* )	ML-CL
	21-29	64.0-	G								100	100	100	99	99	98	98	97	97	25.1		25		ML-CL
· · · · · · · · · · · · · · · · · · ·	21-31	66.0- 68.0	G								100	100		98		96	96	95		28.0			alway	CL-ML
	21-31	68.0-	G								100	100	99			0	70	100	99	26.0	4		CH)	ML
· · · · · · · · · · · · · · · · · · ·	21-32	74.0-								1.00	100	99	99	98	98	97	97	96		24.4				CL
		78.0- 79.5	G							100	100						88	82	74	Í		21	9	CL
	21-34	80.0-		-	<del> </del>					100	100		100	99	97	93	81	l		16.8		21	65	
	21–35	83.0-	G							100	100	100	99	98	96	90	0.1	70	58	17.4				CL
-	21–36	84.0 85.0-			Recove		<u> </u>																	
	21-37	87.0-	G	Wash	Mate	rial	1	ļ									,							<u> </u>
	2138a	87.7 87.7-	L G	<del> </del>						100	96	90		72		52	49	46				<b></b>		SM-SC
	21-38b	88.1	G			<b> </b>			100	97	96	95	94	91	88	86	84	83	82	17.2				СН-МН
	21-39	91.0	G															<u> </u>		30.0	51	30	21	МН

REMARKS: \* Clean gravel not representative (fines washed out).



### ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/2/82

SHEET 3 OF 3

HOLE	SAMPLE		SOIL			U.S	. STAN	IDARD	SIEVE		( PE		FINE	R THAI	V BY V	WEIGH	?`)			W <sub>C</sub>	***************************************			UNIFIED SOIL
NO.	NO.	DEPTH	UNIT	12"	6"	3"	2"	1-1/2	1''	•	3/8"		#10					#140	#200	%	L.L.	P.L.	P.B.	CLASSIFICATIO
AH- D21	2.1-40	93.0- 94.6	G					100	95	95		94	94	94	93	93	93	92	92	24.5				МН
	21-41a		G	No U	pper	  Limit													98	28.8	38	28	10	ML
	21-41b	99.0- 99.3	G	No U	pper	Limit													94	19.4	33	28		ML
	21-42	101.0- 101.3	G*						106	94	82	73	66	58	50	46	44	42	37				The state of the s	SM-SC
	21-43	104.0- 104.2 108.0-	G'_	Smal	L San	ple_				100	96	91	80	67	64	62	60	59	56	15.1				CL
	21-44	108.0- 108.8 110.0-	H				-			100	99	98	97	95	94	94	94	93	83	21.9			The Land	ML
· · · · · · · · · · · · · · · · · · ·	21-45	111.4 114.0-	H	Sma1	L Sam	ple					100	98	94	92	91	91	89	84	71	26.5				ML
· · · · · · · · · · · · · · · · · · ·	21-46	114.6 123.0-		No R	eccve	гy									<del></del>							<b></b>		
<del>-</del>	21-47	123.5		NX C	ore_																	<u> </u>		
	21-48	130.0-		No R	ecove	ry, 1	lo Pe	netra																
<del>-</del>	21-49	134.0	I						100	96	87	76	58	40	27	20	17	14	12	11.6				SM-SW
	21-50	135.0-			ecove	ry																		
	21-51 21-52	136.0-		NX C																<b> </b>				
		139.5-	J	INA C	DIE.			100	84	78	65	53	41	32	26	22	18	16	14	8.6			<del> </del>	SM
<del></del>		149.5-		No R	Recove	rv		1																
	21-55								100	94	77	68	54	42	.33	26	21	18	15	8.9				SM
												•				***************************************								
				2 1																				

REMARKS:				
	*			



### ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 8/21/82 SHEET 1 OF 1

HOLE	SAMPLE NO.	DEPTH	SOIL UNIT			υ. s	S. STAN	IDARD	SIEVE	SIZE'	γE	RCENT	FINE	R THAI	N BY V	WEIGH	Γ)		17	₩ <sub>C</sub> %	L.L.	P.L.	Pt	UNIFIED SOIL
140.	110.			12"	6"	3"	2"	1-1/2"	1	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	%				CLASSIFICATION
AH- D22	22-1	0.5- 4.5 4.5- 8.0		No R	ecove	ry ()	enis	on Sa	mple	)														
·	22-1	4.5- 8.0		No R	ecove	ry (	Denis	on Sa	mple	)														
	22-3	9.0- 9.9		Bedr	ock															P-1-10-10-10-10-10-10-10-10-10-10-10-10-1				
· ·																						•		
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REM	ARKS:	<del></del>		<u>.l</u>	<del></del>	<u> </u>	1	<u></u>	<b>!</b>	L,,	<u></u>	<u> </u>	<u>1</u>	*		<u> </u>	<del> </del>	<del></del>	<del>1</del>	<u> </u>	<del></del>		<del></del>	



# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/7/82

SHEET 1 OF 3

HOLE NO.	SAMPLE NO.	DEPTH	SOIL		•	U.S	. STAN	DARD	SIEVE	SIZES	) ( PE	RCENT	FINE	R THAI	V BY V	VEIGH	Γ)			W <sub>C</sub> %	L.L.	P.L.	P.L	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	<b>#100</b>	#140	#200	/0				GEASSII ICATIO
AH- D23	23-1a	2.3- 5.2	A&B	Rock	Frag	ments																		
<del> </del>	23-1ъ	2.3- 5.2	A&B	Rock	Frag	ments																		
	23-2	6.0- 6.1		No R	ecove	ry																		
	23-3	8.5 10.5	С						100	99	97	93	84	72	59	41	28		17	11.0				SM
	23-4	11.0- 11.3		No R	ecove	ry	•																	
	23-5	11.3- 13.1	С				100	91	91	91	87	78	63	48	37	28	21	17	13	9.1				SM
and the same of the same of the same	23-6	14.5- 16.5	C						100	99	97	05	90	80	65	49	36	27	20					SM
	23-7a	17.0- 19.0	С						100	96	85	80	74	67	60	51	41	30	21	12.5				SM
-	23-7ъ	17.0- 19.0	С							100	98	97	91	81	71	63	52	40	31	15.5	<b>)</b>			SM
	23-8	21.0- 21.4		No R	ecove	ry									a injulation and a special							<u> </u>		
	23-9	23.0- 23.3		No R	ecove	ry																		
	23-10	27.0- 29.0	D									100	100	98	71_	41	24	16	11	14.9	*			SM-SP
	23-11	29.0- 31.0	D							100	99	98	97	93	72	47	32	23	18	15.2	2			SM
	23-12		D							100	98	97	95	91	71	45	27	19	14	15.1				3M
	23-13		D							100	100	100	99	97	78	44	26	16	11	16.7	7			SM-SP
	23-14	37.0- 38.3	D				100	84	71	64	56	51	46	41	33	25	20	17	14	9.1				SM-GM
	23-15			No R	Recove	ry.	No Pe	netr	ation															The state of the s
	23-16	41.0- 42.3	E							100	95	83	73	63	47	27	17	13	10	13.3	3			SM-SW
	23-17	43.0- 43.8		No F	ecove	ry																		
	23-18	45.0- 46.5	E					100	99	95	90	85	78	72	64	56	48	42	37	10.5	3			SC

REMARKS:					



## GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/7/82

SHEET 2 OF 3

HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT				STAN		SIEVE	<u> </u>								مه، مد	عممه	₩ <sub>C</sub> %	L.L.	P.L.	P.L.	UNIFIED SOIL CLASSIFICATION
				12"	6,	3"	5,	1-1/2	1	3/4	3/8"	#4	#10	#20	#40	# 60	#100	# 140	#200					
AH- D23	23-19	47.0- 48.0	Е	Same	Mate	rial	As 1	8 and	20											10.9				
	23-20	49.0- 50.3	Е						100	98	96	93	89	82	75	66	56	49	44	12.0				SM-SC
	23-21	51.0- 52.4	E								100	96		79	72	56		32	24	16.2				SM-SC
	23-22	53.0- 53.8	F.	Not	Renre	sent	itive	Fir	es W					, ,				<u> </u>	<u> </u>					
	23-23	55.0- 55.5	E	100	XCP C	SCILL		<del>- 1 - 1</del>	100	90	84	75	29	5	3	2	1	1	1	14.9				SP
	23-24	57.0-	E	Smal	Com	ple			100	100		53	44	36	30	25	21	18	14	11.5			***************************************	SM-GM
		59.0-		omaı	L Jan	DIE		7.06	00									9	7	8.2				
	23-25	61.0-	E					100	92	84	72	53	33	23	18									SM-GM/SP-G
···	23-26	63.0-	E					100	94	91	88	87	82	61	32	19		10	8	13.1				SW-SM
	23-27	63.4 66.0-	E				100	81	81	79	74_	70		58		44		34	31	8.3		* -		ML
····· <u>:</u>	23-28	68.0-	E							100	97	91	81	70	60	52	45	40	35	12.0				ML
	23-29	68.6 71.0-	<u>E</u>	Sma1	1 San	ple,	Rock	Frag	ment	5									•					
· ·	23-30	71.2	16-18-18-18-18-18-18-18-18-18-18-18-18-18-	No R	ecove	ry																		
	23-31	80.0- 80.1		No R	ecove	ry																		
	23-32		G						100	97	90	82	74	66	60	55	51	47	44	13.2				SM-ML
	23-33	95.0- 96.3	G					100	96	94	81	74	65	46	25	17	14	12	10	12.5				SM
	23-34	98.0- 99.4	G				100	93	93	90	81	74	63	44	27	19	16	14	1z	11.1				SM
	23-35	100.0-	G						100	96		85		59		25		16		11.7			TALL	SM
	23-36	103.0-	G						100	1		77		57				19		14.6	1			SM
	23-379	107.0- 108.8	G	Not	Renra	sent	ative						, j										11222	
	22 276	107.0- 108.8		1,,,,,,,	T. D. C.	1	1			100	99	99	97	97	95	47	28	20	16	23.6				SM

REMARKS:	<u>. Tanaharan baratan b</u>			



### ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/7/82

SHEET 3 OF 3

HOLE NO.	SAMPLE NO.	DEPTH	SOIL			U. 9	. STAN	DARD	SIEVE	SIZES	( PE	RCENT	FINE	R THAI	V BY V	VEIGH	Γ)			W <sub>C</sub>	L.L.	P.L.	PI.	UNIFIED SOIL
	,,,,			12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	70				CLASSIFICATION
AH- D23	23-38	109.0- 109.8	G							100	99	98	97	96	94	83	53	35	25	21.8				SM
	23-39	111.0- 112.3	G								100	99.9	99.5	99	98	88	61	41	29 .	22.3				SM
	23-40	113.0- 114.3	G									100	99.6	99	98	65	32	20	13	24.4				SM-SP
		118.0- 119:3	G				<u> </u>			100	99	99	99	99	98	97	67	41	26	24.9				SM
	23-42	122.0- 123.3	G									100	99.8	99	99	95	48	29	25	22,4	•		The Contract of the Contract o	SM
· · · · · · · · · · · · · · · · · · ·	23-43	126.0- 127.2	G							100	99	99	98	96	95	94	93	91	87	22.4				ML
	23-44	128.0- 129.2	G						100	98	98	97	96	95	94	93	93	89	80	21.4			10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10 mg 10	ML
	23-45	130.0- 131.3	G								100	99.7	99	98	98	98	98	95	92	22.9				ML
· · · · · · · · · · · · · · · · · · ·	23-46	132.0- 133.3	G							100	100	99	99	98	97	96	91	71	59	21.3			No.Com	ML °
	23-47	136.0- 137.0	G					100	97	97	96	95	94	93	92	91	89	84	76	20.0				ML
-	23-48	140.0- 141.0	G						100	99	97	95	93	90	88	86	84	81	76	19.4				ML
		144.0- 145.2				<u> </u>				100	99.7	99	98	97	96	95	89	81	75	22.2				ML-CL
<del></del>	23-50		G							100	99	99	98	97	96	95	93	90	87	24.1				ML
· · · · · · · · · · · · · · · · · · ·	23-51		G							100	99.6	99	99	98	98	97	97	96	95	25.5	23	24	-1	ML
· · · · · · · · · · · · · · · · · · ·	23-52	152.0- 153.0	G	<u> </u>							100	100	99	98	98	97	97	96	91	21.0				ML
	23-53	156.0- 156.7	G			<u> </u>						100	100	99	98	98	94	85	70	23.1				ML
					. San an in in-																			
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REMARK	S:				
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## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/9/82 SHEET 1 OF 1

HOLE NO.	SAMPLE NO.	DEPTH	SOIL			U.S	. STAN	DARD	SIEVE	SIZES	S (PEI	RCENT	FINE	R THAI	N BY V	WEIGH	Γ.)			₩ <sub>C</sub>	L.L.	P.L.	P.E.	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	70				CLASSIFICATION
AH- D24	24-1	1.5- 3.5	A&B			100	78	78	69	64	49	39	32	27	23	19	16	14	12					SM-SW
	24-2	4.8- 6.3	E		<u> </u>			100	93	84	70_	_60	49	40	34	29	25_	22	20	8.6				SM-SC
	24-3	7.0- 9.0 9.0	E					100	88	79	67	57	47	37	31	27	24_	22	19	8.6	: 		200.00	SM-SC
	244	11.0	E	Fine	s Was	hed (	Dut																	Catalogue Catalo
	24-5	14.0- 16.0	F					100	82	77	57	47	41	34	24	20	18	16	15	7.3				SM-SC
	24-6	17.0- 18.5					100	90	90	87	78	70	61	52	44	37	31	25	20	9.7				SM
	24-7	19.0- 19.7	F				100	90	90	87	81	73	65	59	53	49	46	44	43	7.9				SM
<u> </u>	24-8	20.0	F	No R	ecove	ry,	No Pe	netra	ation															With the little
	24-9	22.0- 22.1 24.0- 24.7	F	No R	ecove	rv																		
	24-10	24.0- 24.7	F	Not	Repre	sent	ative	, Fra	igmen	ts										11.7				
<u></u>	24-11	26.0- 26.3	F	No R	ecove	ry																		
	24-12	32.0	BR	No R	ecove	ry,	No Pe	netra	ation															
																							THE STATE OF THE S	
200	ADVC.							1.4.																

REMARKS:	-			industrial astro-		



# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/14/82

SHEET 1 OF 1

													رد استام استاما							·				
HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT		6"	U.S	S. STAN		SIEVE	·								#140	#200	₩ <sub>C</sub>	L.L.	P.L.	P.I.	UNIFIED SOIL CLASSIFICATION
			-	12"	6	5	2	1-1/2	1	3/4	3/8"	#4	#10	#20	440	# 60	#100	# 140	#200					<u> </u>
AH- D25	25-1	3.0- 5.0	D	NO R	ecove	rv								1										And the state of t
1125		5.0-							:						•						Met No. of the Party of the Par			The state of the s
	25-2	7.0	D	No R	ecove	ry														<del></del>		<u> </u>	ļ	<u> </u>
	25-3	7.0- 9.0	G'	No R	ecove	ry												N.						A de la companya de l
*	25-4	9.0- 11.0	G'				100	88	88	85	81	78	72	63	56	51	47	42	37	14.5				SC
		11.0-	<u> </u>	<del> </del>	<b>†</b>		100	00	-00	05	OI	70	12	05			-7/	72		1702				30
· · · · · · · · · · · · · · · · · · ·	25-5			No R	ecove	ry																<u> </u>		
	25-6	14.0- 16.0	G'			100	79	79	62	56	52	48	41	32	25	20	16	14	11	5.8				GM GM
-				1				_																
	25-7	20.0	<u>G'</u>	NO K	ecove	ry.	<u>kerus</u>	aı				<del>                                     </del>			· 								- SACROVETA	
	25-8	22.0	G'	No R	Recove	ry,	Refus	al				ļ											ļ	
	25-9	25.5- 27.5	G'						100	98	91	83	71	50	22	12	9	7	6	13.6				SP-SM
<del> </del>		1 29.0-	1	1			1			100				87	79	75	72	68	63	18.0		20		
	25-10	32.0-	<del>                                     </del>	<del> </del>	<u> </u>	-	<del> </del>	<del> </del>	<u> </u>			96										20	<del>  *</del>	ML-CL
	25-11	32.7	I	<u> </u>	ļ		100	70	64	63	56	51	45	39	35	32	30	28	26	10.6	ļ	ļ	<u></u>	GM-SC/SM-SC
	25-12	36.0- 36.4	I	No B	Recove	irv																		
	T	38.0-		= = =			1,00	7,5		70		E0	48	4.0	2.5	33	31	29	26	9.5				MI CI
	25-13	40.0-		<del> </del>	<del> </del>	<del> </del>	100	75	75	72	64	58	40	40	35	33	21	29	20	7.2	<b></b>		-	ML-CL
	25-14	40.5	I	No F	Recove	ry						<u> </u>												
	25-15	42.0- 42.3	Т	No F	Recove	rv																		
-		44.0-							<b>†</b>		<b></b> -	<u> </u>									<b> </b>			
	25-16		I	No I	Recove	ry				<del> </del>		-									<u> </u>	<b> </b>	-	
	25-17	46.0- 46.1	l	No I	Recov	ry																		
		51.0-																						
	25-18	53.0-		TNOT	Recov	ry_			<u> </u>	<del>                                     </del>		<del>    </del>	<b> </b>			<b> </b>			<b> </b>				1-	
	25-19	<del></del>	1	<del> </del>	<b>_</b>	<del>                                     </del>	<del> </del>	100	94	94	86	85	82	79	78	77	77	76	75	20.8	1	<b></b>		ML-CL
	25B-22	68.0-	† <sub>T</sub>							100	98	95	89	59	34	21	14	10	8	16.	1			SW
	ADVO	t	·			* <del>}</del>		· L.,	<del></del>	<u>.</u>	<u> </u>		<del></del>	<del></del>	<del></del>	<del> </del>		<del></del>	<del></del>			-	-	

REMARKS:			
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# ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/15/82

SHEET 1 OF 2

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HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT				S. STAN	· · · · · · · · · · · · · · · · · · ·	SIEVE			<del>,</del>	·							₩ <sub>C</sub>	L.L.	PL.	PI	UNIFIED SOII
ATT				!2"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200					
AH- D26	26-1	4.2- 6.2	C				100	89	<b>6</b> 8	64	5]	43	36	28	22	17	13	11	9	6.8		wat by him		GW-GM
	26-2	9:b- 11:0	С					100	98	83	77	71	64	53	41	31	24	19	16					SM
	26-3	14.0- 15.2	C					100	89	84	72	64	56	48	41	35	30	26	24	8.2				SM-SC
	26-4	19.0-	F	No F	Recove	ry																		
	26-5	22.5- 23.6	Ε					100	92	87	82	77	71	62	53	46	40	36	32	8.2				SC
	26-6	27.0- 28.4	E					100	90	86	78	75	69	61	53	46	40	36	32	7.7				SC
	26-7	32.0-	Е	No I	Recov	ery																		
	26-8	33.0- 34.3	F	No I	Recov	erv																		
	26-9		Е							100	94	90	84	76	67	59	53	47	42	8.2				SC
	26-10	38.0- 38.8 43.8- 43.8	E																					
	26-11	48.0- 48.8	F					100	96	96	91	88	82	74	66	59	52	46	40	10.8				SM-SC
	26 -12	53.2- 53.9	F																	9.7				sc
-	26-13	50 A	F						100	98	90	87	81	72	63	56	49	44	40	9.3	}			SC
	26-14	62 0							100	97	93	90	86	81	76	70	65	60	55	9.				ML-CL
	26-15	60 0	F						100	98	92	89	84	78	.71	66	62	59	56	10.7				ML-CL
	26-16	72 0	F	No	Recov	erv																		
•	26-17	70 0	G							100	99	99	98	98	97	96	95	94	92	25.8	42	29	13	ML-CL
	26-18	000	T	<b>)</b>		100	78	68	64		49	44	39	33	28		23							GM-GC
	26-19	0		Comb	ned	1	1					1												
	26-20			No	Recov	ery,	No P	enetr	ation	4											<b> </b>			*

REMARKS: 26-18 and 26-19 Ran as I sample combined.



### ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/15/82

SHEET 2\_OF \_2\_

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HOLE NO.	SAMPLE NO.	DEF H	SOIL UNIT					NDARD												₩ <sub>C</sub> %	L.L.	P.L.	PI.	UNIFIED SOI
				12"	6''	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#!00	#140	#200	70				OLHOON 10411
H- 26	26-21	91.0- 91.1	I	No	Recov	ery													. 1					
	26-22	0.3 U	T	No	Recov	erv																		
	70-77	- <del>33. U</del>																	7					
					+	<del> </del>	<del> </del>		ļ											<u> </u>				
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																							- Indiana in the state of the state of	
									<b> </b>	<b>†</b>		<u> </u>		<u> </u>					1. 1				<b> </b>	
		<u> </u>	<u> </u>	<u> </u>			1	<u> </u>	<b>L</b>	<u></u>	<u> </u>	1	<u> </u>	L	<u> </u>		<u> </u>			<u> </u>	<u> </u>		1	
REM.	ARKS:		- Androphoromy St.	بالسرو ومروسوس ويه		Alima direct			- Constitution of the Constitution of									· · · · · · · · · · · · · · · · · · ·		ود باسارها و دورونا الاستان در استان در	el <del>kirini di di</del> ambani ang ang ang		•	
							<del></del>				April 18 - Hall		,	<u>رون در در سیم امد .</u>	***					······································	ydird optomic production of			



### ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/30/82

SHEET 1 OF 2

HOLE	SAMPLE	DEPTH	SOIL			U.S	. STAN	DARD	SIEVE		PEF		FINE	R THAI	N BY V	VEIGH"	Γ)			W <sub>C</sub>	L.L.	P.L.	PI	UNIFIED SOIL
NO.	NO.		UNIT	12"	6"	3"	2"	1-1/2	1**	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	%	h			CLASSIFICATION
АН- D27	27-1	5:0- 7:0	С	-				100	62	53	45	4]	37	31	26	22	18	15	12	6.9				GM
	27-2	10.04	С	No Re	cove	ry																		
	27-3	15.0- 15.7	С				100	92	81	80	75	70	62	53	45	38	32	28	25	8.4				SM-SC
	27-4	15.7 20:2	D	No R	 ecove	cy																		de la companya de la
	27-5	28.0- 29.3	D					100	96	88	81	77	66	57	49	43	37	33	29	7.8	17	13	4	SC-SM
	27-6	35.0- 35.3	D	No R	ecove	ry																		
	27-7	35.U~ 35.3	D	No R	ecove	ry																		
	27-8	48:2-	D	No R	ecove	ry			. :											3.000			)	
	27-9	41:8-	D						100	92	83	77	66	52	44	39	35	31	27	11.9				SC-SM
	27-10	44:8-	D			<u> </u>			100	92	85	78	69	61	54	48	42	38	34	8.8			<u> </u>	SC
	27-11a		5					100	93	90	83	80	72	63	55	49	45	41	38	11.1	25	15	10	SC
	27-11b	1 30.0	D				100	85	85	83	77	74	68	60	53	48	43	40	37	13.7				SC
	27-12	54.0- 54.4	ט						100	98	94	92	89	85	82	77	74	72	70	11.7				CL
	27 -13	60.0-							100	99	94	89	82	71	60	52	45	40	36	9.5				SM-SC
	27-14	65.0- 65.6		COMP	1	ļ		100	97	93	84	79	71	63	54	46	40	35	31	9.2				SC
	27-15	70:2-		Colli	ined										·									· ·
	27-16	75.0- 75.3	E	Not	test	ed to	o sma	11																
	27-17tl	nru 24		No Y	ecov	ery																		
	27-25	125.0- 130.0	F	NX (	ore	cot	xbles,	bou1	ders														<u> </u>	
	27-26	130.0- 133.5	F		13		11																	

REMARKS: \_

27-14 and 27-15 ran combined

Samples 27-17 thru 27-24 No Recovery



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/30/82 SHEET 2 OF 2

HOLE NO.	SAMPLE NO.	DEPTH	SOIL			U.S	S. STAN	DARD	SIEVE	SIZES	( PE	RCENT	FINE	R THAI	N BY N	WEIGH	Γ)			w <sub>C</sub> %	L.L.	P.L.	P.I	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4	#10	#20	#40	# 60	#100	#140	#200	70				CLA55IFICATIO
AH- D27	27-27	135.0- 140.0	F	NX	Core	- co	bbles	/bou	lders										•					
	27-28	140.8-	F	n		11		п		-														
	27-29	145.0- 146.5	F	No	Reco	very																	· · · · · · · · · · · · · · · · · · ·	
	27-30	155:8-	F	No	Reco	very							i											· · · · · · · · · · · · · · · · · · ·
	27-30 27-31 27-32 27-33	160.0- 162.0	G																	29.8				The state of the s
	27-32	164.0- 166.0	G					-								No u	pper	limi	<del>.</del> 92	31.5				ML-CL
	27-33	170.0- 172.0	G																	30.4	31	23	8	ML-CL
	27-34	175:8	G					-								No U	pper	Limi	<b>c</b> 97.5	29.7				ML-CL
																							10	
			·						-													-		
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REMARKS:	Samples	: 27 <b>-</b> 27 .	27-28.	27-29, 27-30	No Core			



### ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/21/82 SHEET 1 OF 4

HOLE NO.	SAMPLE NO.	DEPTH	SOIL UNIT			u.s	. STAN	DARD	SIEVE	SIZES	( PE	RCENT	FINEF	THAN	N BY V	VEIGH	Γ)			₩ <sub>C</sub> %	LL.	PL.	Ρţ	UNIFIED SOIL
				12"	6"	3"	2"	1-1/2	1"	3/4"	3/8"	#4				# 60								
AH- D28	28-1b	2.0- 4.0- 6.0	AZB C						100	98 100	95 93	88 89	79 82	69 72	60 62	52 54	45 46	39 41	33 35	16.9 13.3				SM SM
	28-2			No F	ecove	ry											•							
	28-3	6.0- 8.0	С	No F	ecove	ry																		
	28-4	18:8-	<del></del>	<b>!</b>	ecove	····																		
	28-5	10.0- 12.0						100	87	84	76	70	59	48	40	33	27	23	20	9.0				SM
<del></del>	28-6	12.0- 14.0	С					100	93	89	84	80	74	66	58	51	46	42	38	11.7				SC
	28-7	14.0- 16.0	С					100	98	93	88	83	79	73	66	60	53	48	43	14.0				SC
No. Science	*28-8	18:8-	С				100	80	75	62	52	45	39	33	29	26	22	20	18					GC
	28-9	18.0- 20.0	М	<b> </b>						100	94	90	84	77	70	63	57	52	48	12.9				SC-CL
	28-10	20.0 20.0-	М							100	94	89	84	78	72	67	63	59	55	13.0	<b></b>			CL-CH
	28-11	29:8- 24:8-	М							100	96	92	83	74	69	65	61	57	53	17.7				ML-CL
	28-12	24:0- 26:0-						100	98	95	93	90	86	81	77	74	70	68	65	13.9			<b> </b>	CL
	28-13	29:8 <sup>-</sup>						100	100	94	89	84	79	74	70	66	62	59		11.3	28	17	17	CL
	28-14	28.0- 28.2	M	Too	sma 1				100	34	09	04	13	73	70	00	02	39	35	11.2	20	1/		UL.
	28-15	32:2	M		1	i i								:										
	<del>                                     </del>			INO	Recov	ery				<u> </u>			<b></b>											
	28-16	22.0	M		ļ	<u> </u>											<u> </u>				<b>+</b>			
	28-17	38:8	М						100	97	86	81	75	71	65	60	54	. 50	46	9.4				SC-CL
	28-18	TIO							1 1															
	28-19	44.0	M	No	Recov	ery																		
	28-20	44.0 44.2 45.0 47.0	М																					

RL RKS:

\*Not representative one large particle in sample



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SHEET 2 OF 4

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SHEET 4 OF 4

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SHEET 1 OF 2

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	29-3	8.0- 10.0	С					100	98	96	88	83	76	66	55	43	34	27	21	11.6				SM
	29-4	10.0- 12.0	С			,									-									
	29-5	12.8-	С						100	98	96	93	87	77	67	57	48	40	35	12.8				SM
	29-6	14:8	D					100	94	92	88	85	79	70	59	50	43	38	34	10.2				SM
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	29-10	28.0-							100	97	91	85	78	69	59	57	44	38	33	9.1				SM
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REMARKS: Samples 29-11 & 29-12 combined analysis



## ACRES AMERICAN INCORPORATED GEOTECHNICAL LABORATORY BUFFALO, NEW YORK

DATE: 9/24/82

SHEET 2 OF 2

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	29-23	83.0- 83.3	F	No F	ecov	ery																		The state of the s
	29-24	87.9-	F	Cobl	le f	ragme	nts																	
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	29-26	95.0- 95.4 98.0	F	No i	ecov	ery			·															
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	29-28	182:9-	F	No	Recov	ery																		The state of the s
	29-29	183:8-	F							100	93	88	80	68	56	47	40	35	31	10.1				SM-SC
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	29-34	149:5	G	<b></b>	Recov	<u> </u>																	1111	
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SHEET \_1 OF 2

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	30-2	6.0- 8.0	c )					100	96	93	85	80	75	67	58	51	44	39	35	10.2				SC-SM
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	30-4	12.5- 14 0	С	ŊХ	[ddop	e cor	)e												•					
	30-5	14.0- 14.4	С	Too	smal	to	test				•													
	30-6	18.0-	E/F						100	94	83	76	67	58	48	41	35	30	26	8.8				SC-SM
<del></del>	30-7	18.0- 19.2 22.0- 22.9	E/F																					
April and the second se	30-8	24.0- 25.8	E/F					100	90	86	77	70	63	55	48	42	36	32	28	9.2				SC-SM
	30-9	26:8-	E/F	No	Recov	ery																		
	30-10		E/F	Not	repr	esent	ativ	ę e																
	30-11							100	91	87	84	80	75	68	60		46	42	37	9.3				SC
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	30-13			On	Hold												ing a distribution							2
	30-14	44:0-	E/F					100	93	91	86	81	75	66	58	50	44	39	35	9.3				SC
<del> </del>	30-15	40.0	E/F	On	Hold															1				
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	30-20	64.0- 64.3 69.0- 69.7	E/F		Hold																Ĭ			

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SHEET 2 OF 2

NO.	SAMPLE NO.	DEPTH	SOIL UNIT		<b>\</b>		:				( PEF									₩ <sub>C</sub> %	LL.	PL	ВI	UNIFIED SOIL
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	30-22	79.0-	_ G '	On I	old																			
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APPENDIX C SEISMIC REFRACTION SURVEYS, SUMMER 1982

Susitna Hydroelectric Project Seismic Refraction Surveys 191

Prepared for

Acres American Incorporated Consulting Eningeers 1577 C Street Anchorage, Alaska 99501

### **Woodward-Clyde Consultants**

13 December 1982 Project No. 15434A

Acres American Incorporated 1577 C Street Anchorage, Alaska 99501

Attention: Mr. Vern Smith

SUBJECT: SUSITNA HYDROELECTRIC PROJECT

SEISMIC REFRACTION SURVEYS, 1982

FINAL REPORT

#### Geratlemen:

With this letter, we are transmitting our final report of seismic refraction surveys performed in the vicinity of the Watana Dam site during the summer of 1982. As specified by Agreement No. P5700.10.13, under which the surveys were performed, we are sending ten copies of the report, one to you in Anchorage and nine to your Buffalo office to the attention of Mr. Lance Duncan.

This report incorporates a number of changes prompted by your review of our draft report issued November 12, 1982. Your review comments, which we recieved on December 7, 1982, pointed out several areas in which preliminary interpretations from this year's surveys were in conflict with previous seismic refraction interpretations and, in a few cases, with boring or mapping control information of which we were not aware. In some cases, we were able to derive alternate interpretations of the data in order to minimize the conflicts. In other cases, wherein the data would not permit suitable alternate interpretations, we have suggested possible reasons for the apparent conflicts.

Several other items specified by the Agreement are being transmitted to your Buffalo office with copies of this report. These include: the original text and figures of the report; time-distance plots for the 1982 lines; original seismograph records; and field notes.



### Woodward-Clyde Consultants

Mr. Vern Smith 13 December 1982

Page Two

We have enjoyed working with you and your staff on the Susitna project over the past three years. If questions arise regarding this report, or if we can be of further service, please do not hesitate to call.

Very truly yours,

Jan D. Rietman

Deputy Director of Geophysics Registered Geophysicist, GP-58 Dennis E. Mensen Project Geologist

Certified Engineering

Geologist, RG3531, EG1034

JDR:DEJ/hab

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#### ACKNOWLEDGEMENTS

Preparation of this report by Woodward-Clyde Consultants was accomplished in close cooperation with Acres American Incorporated (AAI) personnel who critically reviewed draft text and figures, and contributed to the interpretations in the report based on their overall understanding of conditions at the Watana site. The agreement under which the 1982 seismic refraction survey was performed was administered for AAI by Mr. Vern Smith, Deputy Resident Manager. Technical coordination was through Mr. Robert Henschel (AAI, Anchorage) and Mr. Lance Duncan (AAI, Buffalo). Site coordinator for AAI was Mr. Thomas Drexhage.

Project Manager for Woodward-Clyde Consultants was Mr. Rupert Tart. Technical aspects of the survey were under the direction of Dr. Jan Rietman and were reviewed for conformance with Woodward-Clyde Consultants standards by Mr. Carl Stepp. Mr. Dennis Jersen supervised field operations, interpretation, and report preparation with the assistance of Mr. Stan Clarke. Woodward-Clyde Consultants field personnel included Mr. Ron Mees, second crew supervisor, Mr. Keith Mobley, and Mr. Dale Berry. Mr. Mark Winters assisted with drafting and computer operations.

#### 1.0 INTRODUCTION

This report presents the results of seismic refraction surveys performed during the summer of 1982 in the vicinity of the proposed Watana damsite on the Upper Susitna River, approximately 125 miles north of Anchorage, Alaska. These surveys were performed under contract to Acres American Incorporated (AAI) in accordance with Agreement Number P5700.10.13.

Following this introductory section in which the background, purpose, and scope of the refraction survey are discussed, a summary of the field operations and data reduction procedures is given in Section 2.0. The general limitations of the seismic refraction method are discussed in Section 3.0. The interpretations of the seismic refraction data from the damsite abutment areas, the Watana relict channel area, and the Fog Lakes area are discussed in Sections 4.0, 5.0 and 6.0, respectively.

#### 1.1 Background

The 1982 geophysical program was a continuation of surveys performed by Woodward-Clyde Consultants during 1980 and 1981 under contract to R&M Consultants (R&M) as part of their contract with AAI. Prior to the 1980 and 1981 surveys, seismic refraction data had also been collected at the site for the U. S. Army Corps of Engineers by Dames and Moore (1975) and Shannon and Wilson (1978).

#### 1.2 Survey Objectives and Scope of Work

The purpose of the 1982 seismic survey was to investigate the seismic velocities, distribution of shallow subsurface materials, and depth to bedrock at specified locations in the vicinity of the Watana damsite. The survey was

designed by AAI to supplement the previous seismic refraction survey results and to provide continuity of data among borings and outcrops. Survey lines were run in three areas: the proposed dam abutments, the Watana relict channel area, and the Fog Lakes relict channel area.

In 1982, a total of 94,725 linear feet (92,339 ft in horizontal projection) of seismic refraction lines was surveyed in the three areas (Figures 1, 2, and 3). Figure 1 covers the abutment areas of the damsite. Figure 2 covers a larger area and includes the emergency spillway alignment and the area of a large buried channel (the Watana relict channel). Figure 3 shows the Fog Lakes area southeast of the damsite, which is also underlain by buried channels (the Fog Lakes relict channels).

The base maps for Figures 1, 2, and 3 were provided by AAI. These maps show the location of previous years' seismic fefraction lines and selected boring locations. The locations of the 1982 refraction lines are based on surveying information provided by R&M. All three figures are oriented with the direction of river flow toward the right, consistent with AAI project standards.

Table 1 is a summary of seismic refraction lines run during the 1982 survey. The lines are grouped into the three previously discussed survey areas. Lines were numbered in chronological order as they were surveyed. The table indicates the number of the figure that shows the location of each line and the figure(s) showing the in erpreted profile for that line. The fourth column in the table indicates the letter designation for the planned lines as referenced in the Agreement. Letters in parentheses were assigned by AAI in the field. The remaining columns in the

TABLE 1
1982 Seismic Refraction Line Data

Line Number	Location Figure	Profile Figure	Planning Line	Line Length (ft)	Horizontal Length (ft)	Spreads/ Shots				
Dam Abutments										
82-1 82-2 82-3 82-4 82-5 82-6 82-7 82-8 82-9 82-10 82-11 82-12 82-13 82-14 82-15	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4 4 5 6 7 8 8 9 9 10 11 12 13 14	E K(a) F D J(a) H J(b) G K(b) O K(c) M N L P	1,300 550 550 1,950 3,375 1,650 350 1,100 1,100 1,650 2,200 1,500 3,150 1,100 22,625	1077.1 517.3 447.9 1897.1 3268.7 1609.1 306.5 916.7 1057.9 1025.9 1517.1 2160.7 1459.2 3083.3 1028.6 21,372.6	3/8 1/3 1/3 4/11 7/20 3/9 1/3 2/6 2/6 2/6 3/9 4/12 3/9 6/18 2/6				
Watana Relict Channel Area										
82-16 82-17 82-18 82-19 82-20 82-21 83-02	2 2 2 2 2 2 2 Subtot	15 16-17 18-20 2J 22-24 25 26-27 al Watana	C A B U S V (X)	1,100 6,500 6,600 1,700 6,400 1,100 3,200 26,600	1087.7 6214.9 6506.8 1677.9 6270.3 1087.6 3173.0 26,018.2	1/5 6/28 6/29 2/7 6/27 1/5 3/14				
Fog Lakes Area										
FL-1 FL-2 FL-3	3 3 3 Subtota	28-35 36-39 40-42 1 Fcg Lakes	FL-C FL-E FL-G	23,100 15,800 6,600 45,500	22788.8 15702.4 6557.1 45,048.3	21/91 14/63 6/28				
	TOTAL F	OOTAGE		94,725	92,439.1					

table list the nominal length of each line, the horizontally projected length, and the number of 12-geophone spreads and shots included in the line. Horizontal line lengths were calculated from R&M control survey data and do not include overlaps or distances of offset shots.

At the Watana damsite abutments, the primary objective of the seismic refraction surveys was to investigate the depth-to-bedrock and bedrock velocity variations. A total of 22,625 feet (21,373 feet in horizontal projection) of survey was run on 15 lines. The individual line segments were designed with a 12-channel spread over a 550-foot distance to accommodate a maximum expected overburden thickness of 100 feet. Three lines, totaling approximately 4,000 feet of line, were dropped from the original program because the steep topography restricted access.

Survey lines were run in the Watans relict channel area for the primary objective of obtaining top-of-rock profiles. Seven lines, totaling 26,600 feet (26,018 feet projected horizontally), were run in this area. These lines were predominately fill-in lines to supplement data collected in 1980 and 1981. Line lengths varied from 1,100 to 6,600 feet and were comprised of 12-channel spreads, 1,100 feet in length. Offset shots, typically 1,100 feet from the ends of each spread, were used to achieve a maximum planned depth of investigation of 800 feet.

The survey lines in the Fog Lakes area were designed to investigate the relict channels that had been identified during the 1981 survey. The primary objective of the survey lines was to obtain rock velocity data and estimate the depth to bedrock. The original survey program planned for this area totaled 37,400 feet of line following the

projected thalwegs of the channels. However, after consultation with the AAI field engineer, the survey program was modified during the course of the field operations to cross the channels and more acurately identify the locations of the thalwegs. A total of 45,500 feet (45,048 feet projected horizontally) of refraction data were collected on three lines. Each line consisted of between six and twenty-one, 1,100-foot segments.

During the course of the field operations, daily progress reports and preliminary interpretations were submitted to the AAI site engineer. The final interpretations of the seismic data are presented on 39 figures and are discussed in the following sections of the report. One copy each of the field notes, seismic records, and time-distance plots are being submitted with the original copy of this report.

# 2.0 DATA ACQUISITION AND REDUCTION

## 2.1 Field Operations

The field work began on August 23rd and continued through September 20ti. Two Woodward-Clyde Consultants' seismic refraction crews participated in the field work. The first crew was on the site for the entire field survey. The second crew worked at the site for the last 10 days of the project. Each crew included a geophysicist/supervisor, an explosives handler, and a lead lineman. Two helpers were supplied for each crew by R&M. R&M also flagged and brushed traverse alignments under the direction of AAI field personnel prior to the refraction survey. Geophone locations were staked during the seismic work by Woodward-Clyde Consultants and later surveyed by R&M.

Refraction survey procedures used during the 1982 surveys were similar to those used in the previous two years and are discussed in detail in the report of 1981 surveys (Woodward-Clyde Consultants, 1982). As before, data was recorded on a Geometrics/Nimbus model ES-1210F 12-channel seismograph and explosives were used as an energy source on all lines. Most shots were detonated by long wire lines between the blasting machine attached to the seismograph, and the charge. The second Woodward-Clyde Consultants crew, also utilized a short wire line and a radio seismograph trigger. This equipment allowed more distant and more rapid offset shots. Delays associated with the radio trigger were calibrated by periodic comparisons with hard-wired shots.

Typically, shots were placed at both ends and at the center of a 12-geophone spread. For end shots, the end geophone was moved back one-half normal spacing to prevent damage and

to provide more detailed coverage of shallow materials. In deep overburden areas, offset shots, normally 1100 feet from the end geophones, were used to extend the depth of investigation.

During the course of the field work, preliminary interpretations of the data were made for all lines. This procedure provided a check on the quality and adequacy of the data for the intended objectives of the investigation. Additional offset shots were made to further extend the depth of investigation when a need was indicated by preliminary checks.

# 2.2 Factors Affecting Data Quality

Several local environmental conditions existed at the survey sites that affected the quality or quantity of data. These included surficial soils conditions, vegetation, and adverse weather and topography.

The ability of a geophone to sense the arrival of an incoming seismic wave depends to a large extent on the coupling of the geophone to the ground and on the ability of the ground to transmit vibrations from deeper layers to the geophone. Two conditions in some parts of the Watana arca produced coupling and shallow transmission deficiences: surficial talus blocks or residual boulders; and thick mossy vegetation cover.

Surfici; 1 blocks of rock provide a poor surface on which to anchor a geophone. In most cases, it was possible to place the geophone in a .ud pack molded onto the rock surface. In some cases, the surface was simply too steep to support a mud pack, thereby preventing placement of the geophone and producing a loss of data at that station. Often, even

though geophone placement was possible, air voids were visible within the talus or residual boulder deposit that reduced the ability of the deposit to transmit the seismic signal.

Most flat portions of the survey area were covered with thick mossy vegetation. This vegetation provides a poor medium in which to seat a geophone and greatly attenuates a seismic signal. This problem was overcome in most cases by placing the geophones in shallow holes dug through the uppermost drier vegetation. In some areas, however, the vegetation was too thick to provide adequate geophone coupling, even in deep holes.

Brushy vegetation and archaeological clearance constraints restricted the possibility of changing line locations or of adding auxiliary lines, since it was necessary to obtain clearance and remove the brush before laying geophone cable. Lines were flagged and brushed well ahead of the seismic crew, and few changes or additions were made during the survey.

Heavy rains and high winds that occurred several times during the survey produced sufficient noise to require operations to stop. During marginally noisy periods, operations were continued and records were carefully examined to assure, in the judgment of the field supervisor, that first arrivals could be discerned. Records collected during those periods were not, however, of the same quality as those collected on quiet days. Under the time an fiscal constraints of the project, it was not possible to collect records only on quiet days, so some detail in interpretation was thereby lost.

Topography restricted the ability to run seismic lines in some areas. The area west of line SL82-8 in the damsite abutment area (Figure 1), where an extension of SL82-6 and two additional lines had been planned, was too steep to flag and brush, much less to run seismic lines. Another topography limitation involved the irregularity of recorded arrival times when nearby geophones were placed at widely varying elevations. This was particularly evident in the abutment areas. These irregularities are corrected, for the most part, by the computer-assisted data reduction techniques used for this project. The irregularities, however, made it difficult to assess the adequacy of the data in the field.

## 2.3 Data Reduction Procedures

Geologic velocity models were developed from computerassisted data reduction programs using a combination of reciprocal, delay-time, and intercept-time methods similar to those used for the 1980 and 1981 surveys (Woodward-Clyde Consultants, 1982). The delay time and intercept time methods are explained in a practical seismic refraction manual by Redpath (1973). A more rigorous development of the principals involved in these two methods and in the reciprocal method is presented in a thesis by Palmer (1974).

The reciprocal method produces the most detailed model of subsurface conditions and was used for all lines for which sufficient data was available. The reciprocal method requires coincident seismic wave arrivals from shots at either end of a line of geophones (reciprocal shots) arriving at several geophone locations from the same refracting layer. The method also requires an accurate knowledge of the arrival times at the opposite far end shot points. The delay-time method requires less overlap

of coincident arrivals and the intercept-time method is independent of coincicent arrivals and requires only a knowledge of apparent velocities from a refracting layer from both end shot points. Intercept-time calculations were used in all cases to verify the resul a of the other two methods, especially where arrival times at reciprocal shots were not well known.

Computer processing was based on software developed by Heatherly (1978 and 1979), which has been adapted to and combined with Woodward-Clyde Consultants' proprietary of refraction reduction and plotting programs. These programs first produce the graphics necessary for interpretation, providing arrival time-distance, velocity analysis, and time section plots. The interpreter then selects appropriate time section values, making adjustments as required, for submittal to a program that graphically performs terrain corrections and migrates time-depth data for dipping refractors. Several crosschecks are incorporated into this system to ensure that the final interpretation is consistent with the basic geophysical data and available geologic information.

The presence of frozen ground in some portions of the Watana relict channel area was indicated on two of the lines run this year (SL82-18 and SL82-20 discussed in Section 4.0) by large delays in arrival times at the edges of challow, anomalously high velocity zones. Since borings in the area have not shown frozen ground to an appreciable depth, computer assisted interpretation methods were used in those cases to model a velocity inversion condition with frozen ground overlying unfrozen. Lower velocity channel fill materials. In previous years' seismic refraction surveys,

the effects of shallow frozen ground may not have been recognized. This may account for some of the misties among lines run over the past few years.

#### 3.0 LIMITATIONS OF THE SEISMIC REFRACTION METHOD

Seismic refraction is a common geophysical exploration technique used for the investigation of shallow subsurface soil and rock properties. However, under certain geologic and environmental conditions, the data is subject to uncertainties that need to be recognized and understood for the correct evaluation and interpretation of the data. Since several of these adverse conditions occur within this project area, they are discussed in general terms in this section and specifically referenced in the discussion of the lines to which they apply.

The effects of localized lateral velocity variations, irregular contacts between units, velocity anisotropy, thin layers, and velocity inversions are discussed below. Site environmental conditions such as weather, topography, vegetation, and surficial soils are discussed with respect to the Watana site in Section 2.3. These conditions also affect the quality and quantity of data that is collected, and therefore on impact the accuracy of the interpretations.

# 3.1 Lateral Velocity Variations and Irregular Contacts

The seismic refraction technique is based upon the measurement of the first arrival of seismic waves at geophones (receivers) placed on the ground surface at progressively further distances from an explosive charge or other seismic source. Arrivals at the phones nearest to the source generally indicate travel directly through low-velocity surface materials. At points further from the source, the seismic waves arrive sooner than would be expected from travel through low-velocity surface materials because they have been refracted and have traveled, in part, through deeper higher velocity layers. If the seismic velocities

within layers are relatively uniform, the layer velocities increase progressively with depth; and the thickness of the units changes gradually (in comparison with the geophone spacing) a mathematical model can be developed from the arrival time data that closely approximates actual subsurface conditions. However, several conditions may exist that make interpretation of the data less precise than desired and introduce ambiguity into the mathematical model.

In ideal situations, plots of arrival times versus distance produce straight lines, the inverse slopes of which represent the apparent seismic velocity of the subsurface material. Deviations of the data from straight lines indicate inhomogeneity within layers, irregular contacts, or inaccuracies in identification of the first arrival Sufficient data is seldom available to distinguish times. among these possibilities. It may also be difficult to determine if irregularities occur in the near-surface layer or at depth. In many cases, the data resulting from local lateral velocity changes in the surficial layers can also be interpreted as contact irregularities. Reciprocal data reduction procedures (discussed in the previous section) will tend to reduce these ambiguities, but experience has shown that uncertanties in the interpretation will still remain.

# 3.2 Velocity Anisotropy

The seismic velocity within a geologic unit may vary depending on the direction in which the velocity is measured. This condition is known as velocity anisotropy. It is most likely to occur in steeply dipping, thinly bedded sedimentary rock units where the velocity of the individual thin layers varies considerably. Steeply dipping zones of

alternating fractured and in-tact rock can have a similar geometry and contrast in velocities. Such zones are known to be present on the Watana site from outcrop mapping.

I.. the case of dipping thinly bedded units, velocities measured parallel to the strike of the unit will reflect the velocity of the nearest high-velocity bed. Velocities measured perpendicular to the bedding will tend to be an average velocity of both the high-velocity and low-velocity beds.

Fracture and joint systems that break up the rock and provide open spice within the rock body lower the apparent seismic velocity of the rock unit when measured across the fracture or joint system. However, velocity measurements made parallel to the fracture/joint system reflects the higher velocity of the nearest "rib" of unbroken rock. If the seismic line is aligned over a lower velocity zone, sidewards refraction produces a time-distance plot exactly the same as if the lower velocity material formed a discrete layer overlying the higher velocity material.

#### 3.3 Thin Layers

Ideally each velocity layer is represented on a time-distance plot as a separate straight line segment. Thin layers may produce no indication of their existance in the data regardless of the detail of the survey. This condition occurs when the refraction from a lower, higher-velocity layer arrives at the surface prior to the arrival from the "thin" layer. The minimum thickness of a layer that can be detected by the seismic refraction technique is dependent on the geophone spacing, the depth of the unit, and the velocity ratios. If an undetected thin layer exists, the calculated depth to the underlying higher velocity

layers will be too shallow. Depending upon the thickness of the undetected layer and the velocity ratios, the depth estimates for the deeper layers may be in error by as much as 50 percent (Redpath, 1973). However, based on the depth of investigations and velocity ratios observed in this study the error is not likely to exceed 30 percent.

# 3.4 <u>Velocity Inversions</u>

Layers with seismic velocities lower than overlying layers are not detectable by the seismic refraction technique. This situation is suspected to exist at several areas near the Watana damsite where unfrozen sediments appear to underlie frozen, high-velocity layers. Nonseismic information, such as boring data, is required to detect and resolve this "hard-over-soft" condition. Knowledge of the thickness of the low-velocity layer allows for correction of the refraction model, which is otherwise likely to be in error by as much as 20 percent for the depth calculations of deeper layers.

# 3.5 Depth Estimates in Channels

Accurate estimates of the deepest points along the thalwegs of buried channels require the identification of first arrival refractions from the base of the channel at several geophones. If the channel has steep walls and a relatively narrow base, refractions from the base of the channel may not be first arrivals and will not be detected. First arrivals may therefore be sidewall refractions and the estimated depths of the thalweg could then be too shallow. This situation may occur whether the seismic line is run parallel to the axis or across the channel.

The ability of the seismic refraction technique to "see" the base of a buried channel depends on a complex relation-

ship between: channel width; channel depth; the slope of the channel walls; velocity contrasts between the bedrock and channel fill material; geophone spacing; and line orientation with respect to the channel axis. Therefore depth estimates of the base elevation of buried channels should not be considered as maximum possible depths.

## 3.6 Summary

During this project, field data reduction was performed to assure the adequacy of results from each line and to recognize possible uncertainties in the interpretation at that time. However, access problems and time constraints precluded running additional lines that may have been required to resolve some of these uncertainties.

In interpreting seismic refraction data that is complex, the most efficient approach is to produce as simple a geologicvelocity model as possible without violating the restraints of the data. In these cases, the experience and judgment of the interpreter is important in producing a geologically reasonable picture. The presence of a geologist experienced with the geologic conditions at the site both during shooting of the lines and during interpretation, combined with the results of previous investigations, increased the likelihood that profiles presented herein reflect a fairly accurate model of existing conditions suitable for evaluation of the feasibility of the project. exploration will be required to resolve some of the uncertainties identified during these surveys. Many of the remaining uncertainties and apparent conflicts can best be resolved by additional borings at selected locations to provide control data against which the seismic interpretation can be adjusted.

## 4.0 DAMSITE ABUTMENT LINES

Seismic lines in the abutment areas (Figure 1) are grouped into four general localities which are discussed in separate subsections: the outlet portal area; near the centerline on the right abutment; the upper right abutment slopes; and the left abutment. Ranges of seismic velocities encountered in these areas and their interpreted material types are as follows:

1,500 to 4,000 fps Surficial deposits: soil, talus, and residual deposits, dry to partially saturated.

Recent sedimentary deposits at the edge of Watana relict channel, possible terrace deposites, and local till deposits. Also, may include zones of dry, highly fractured bedrock in areas of bedrock exposures.

7,000 to 12,000 fps Highly fractured bedrock.

13,000 to 14,000 fps Low-velocity bedrock, moderately fractured or altered.

15,000 to 19,000 fps Typical fresh bedrock.

20,000 to 22,000 fps

Very high velocity bedrock, probably small areas or zones of extremly fresh, unfractured rock.

## 4.1 Portal Area

Eight of the fifteen lines in the damsite abutment areas were run on the steep slopes on the right abutment, downstream from the proposed centerline of the dam. These lines, SL82-1 through SL82-4 (Figures 4 and 5) and SL82-6 through SL82-9 (Figures 7, 8, and 9) cover an area planned for the outlet portals of the diversion and tailrace tunnels.

Lines SL82-4 and SL82-6 were run low on the slope roughly parallel to the contours. Both encountered thin surficial materials (5 to 25 feet) with apparent seismic velocities of 1400 to 1800 feet per second (fps) overlying bedrock with apparent seismic velocities of 13,000 to 20,000 fps.

At the northwest end of line SL82-6, an intermediate 7,000 fps velocity layer up to 50 feet thick is found over 13,000 fps bedrock. The same intermediate layer and low bedrock velocity are reflected in lines SL82-7 and SL82-8, which cross SL82-6. Fractured bedrock is exposed at several locations on the steeper parts of the lines in that area, indicating that the fracturing and associated weathering may be responsible for the low The 7000 fps velocity appears to represent a surficial jointed and weathered zone overlying less weathered, but not entirely fresh, bedrock. Marked differences in depth of the 7000 fps layer interpreted for the three lines indicate a very irregular contact with underlying materials. This irregularity is apparently averaged out on any given line but is clearly indicated when the data from crossing lines are compared.

Lines SL82-1 and SL82-3 were run directly downslope across the contral portions of SL82-4 and SL82-6. Both lines

confirm the thin layer of surficial materials (including talus), but indicate a bedrock velocity of 21,000 to 22,000 fps compared to 18,200 fps and 15,500 fps on lines SL82-4 and SL82-6, respectively. The velocity differences are interpreted to reflect anisotropy across the north trending joint sets or fracture zones that have been mapped in the area. In this case, it appears that the lines running parallel to the set are reflecting the velocity of the least fractured rock in the area, whereas lines run at an angle to the joints indicate an average velocity of both fractured and unfractured rock (refer to section 3.2).

Line SL82-2 crosses the east end of SL82-4 at a low angle and line SL82-9 runs parallel to SL82-2 farther up slope. Both lines indicate widely varying bedrock velocities ranging from 13,000 to 22,000 fps. These two lines run nearly perpendicular to northwest-trending fracture and shear zones that cross the area and the velocity contrasts may be reflecting changes in bedrock properties across the zones.

The southwest end of line SL82-9 and the northern half of SL82-1 are relatively close to each other near the top of the steep abutment slope. Both lines indicate an intermediate velocity layer of approximately 6000 fps, to a depth of 50 to 100 feet. Although this intermediate velocity may represent highly fractured rock similar to that interpreted at the western end of line SL82-6, no outcrops were observed on this portion of the lines during the seismic survey. The configuration and location of these two intermediate velocity layers suggests the possibility that they may be portions of a remnant terrace deposit.

# 4.2 Lines Near The Proposed Centerline, Right Abutment

Three lines were run on the right abutment slopes upstream from the outlet portal area. Line SL82-10 (Figure 9) was run from north to south, downslope, connecting the other two lines (SL82-11 and SL82-13), which were run essentially parallel to contours. SL32-10 indicates thin surficial materials over a 9200 fps intermediate layer, apparently representing fractured bedrock, which thins downs ope and then appears to thicken abruptly near the lowest point of the line near the center of line SL82-11. Line SL82-11 (Figure 10) shows the intermediate velocity layer to be over 150 feet thick at the southwest end, thinning to the northeast. At the point where SL82-11 crosses line SL80-3, shallow and intermediate layers are indicated to be approximately 60 feet thick. The intermediate velocity layer was not shown on the interpretation of line SL80-3. The reason for this apparent anomaly is not clear from existing data.

Line SL82-13 (Figure 12) intersects the ends of four other lines and is in reasonably good agreement with them. At its northeast end, an intermediate velocity layer of 10,600 fps is similar to the 9,200 fps velocity indicated for SL82-10 and 12,000 fps indicated for SL81-15. A possible change to 20,000 fps "fresh" bedrock is indicated at that end of the line at approximately 220 feet below the surface. At the center of SL82-13, the northern end of SL80-3 shows a velocity of 14,800 fps. The velocity beneath nearby line SW-2 was interpreted to be 13,500 fps. SL82-13 shows the shallow bedrock velocity to be approximately 13,000 fps in that area, to a depth of investigation of about 200 feet.

# 4.3 Top of Right Abutment Slopes

The remaining two lines on the right abutment, SL82-5 (Figure 6) and SL82-14 (Figure 13) were run with northeasterly trends across the relatively gentle topography at the top of the abutment slopes. At the northeastern ends of these lines, both show the edge of the Watana relict channel with velocities of approximately 6,800 fps. These velocities are similar to those reported in Woodward-Clyde Consultants (1981) for the channel fill materials. Bedrock velocities under the edge of the relict channel appear to range from 14,500 fps to 17,400 fps.

The southwestern ends of SL82-5 and SL82-14 are close together near the intersection of lines SW-2 and SL80-2. Boring BH-1 was drilled at the approximate intersection of SL82-14 and SW-2. Both SL82-5 and SL82-14 indicate a 50-foot thick intermediate layer with a seismic velocity ranging from 7,000 to 9,000 fps at their southwestern ends. This layer appears to coincide with a zone of highly jointed bedrock encountered in BH-1. This layer is also present beneath the high end of SL82-8 (7000 fps), approximately 350 feet to the west, and can be traced downslope along that line to an area of exposed fractured bedrock (refer to the discussion in Section 4.1).

Data from the southern end of SL80-2 does not indicate the presence of 7000 to 9000 fps velocity layer. The wider geophone spacing (100 feet) used on the 1980 line may be responsible for the layer not being detected.

The low-velocity intermediate layer is indicated on Line SW-2, but was interpreted to have a velocity of 6,020 fps and to represent overburden (Shannon and Wilson, 1978). The 6,020 fps layer is carried the entire length of SW-2. We

believe that this velocity may represent overburden (terrace deposits) near the eastern end of SW-2 (refer to Section 4.2) in which case a transition from overburden to highly fractured bedrock must occur at some point east of BH-1.

## 4.4 Left Abutment Lines

Two lines, SL82-12 (Figure 11) and SL8 15 (Figure 14), were run on the proposed left abutment. SL82-12 extended northeastward from the end of SL81-20 along the top of the steep cliffs above the river. SL82-15 was run from the top of a prominent knob adjacent to the river near the proposed upstream cofferdam location, into a low saddle, almost at river level.

Surficial materials with velocities less than 2000 fps extend along the entire length of Line SL82-12 and are up to 20 feet thick in some locations. Thin layers (less than 20 feet thick) of intermediate velocity materials (7500 to 8000 fps) are indicated beneath surficial soils at two locations. Bedrock velocities are indicated to be 14,000 fps beneath the southwestern half of the line and 11,800 fps near the northeastern end. Since the line was run on a north-facing slope, it is possible that the 11,800 fps velocity could represent frozen material which, if not frozen, would have a velocity of 8000 fps similar to shallower intermediate velocity material. A narrow (150 ft), anomalously high velocity zone (20,000 fps) appears beneath the center of the line.

Bedrock velocity beneath the eastern end of Line SL81-20 was interpreted to be 18,000 fps which is similar to but higher than the 14,000 fps indicated for Line SL82-12 where the lines intersect. It is likely that a transition between these velocities occurs in the vicinity of the intersection

but it is not clear from the data where it is located. Boring DH-25, which is located approximately 180 feet southeast of the intersection, encountered glacial till to a depth of 50 feet. The till would be expected to have a seismic velocity as high as that of the 8000 fps intermediate velocity material indicated further northeast on line SL82-12. On the basis of the seismic data, therefore, it appears that the till thins southward and eastward from DH-25 and is either not present or is very thin beneath the intersection of Line SL82-12 and Line SL81-20.

Bedrock velocities beneath Line SL82-15 range from 16,000 to 17,000 fps. Surficial materials (2000 fps) are thin (10 feet or less) on the slopes on the northeastern portion of the line and thicken to as much as 25 feet at lower elevations. A 7700 fps intermediate velocity layer is indicated. At the southwestern end of the line it is 80 feet thick. This velocity zone could represent either sedimentary deposits or highly fractured bedrock.

# 5.0 WATANA RELICT CHANNEL LINES

Seven refraction lines, numbered SL82-16 through SL82-22, were run in the Watana relict channel area (Figure 2). These lines were intended to augment the existing seismic refraction coverage in that area, and to obtain additional top-of-rock profiles in the area of the channel and on the Susitna River (south) side of Borrow Site D. Material types interpreted for velocity ranges encountered in the Watana relict channel area are as follows:

1,500 to 2,000 fps Dry surficial deposits.

4,200 to 4,800 fps Partially saturated channel fill deposits.

5,000 to 6,000 fps Saturated typical channel fill deposits.

7,000 to 9,000 fps

More compact channel fill deposits.

May be more bouldery; may represent earlier episode of channel fill or locally derived fill material; may be partially frozen where it occurs on shallow channel edges.

9,500 to 10,500 fps Frozen ground: probably limited in depth; probably overlies lower velocity materials.

10,800 to 14,000 fps Fractured or altered low-velocity bedrock.

15,000 to 19,000 fps Relatively unaltered bedrock.

#### 5.1 Line SL32-16

Line SL82-16 (Figure 15) was run as a short (1,100 foot) line overlapping the ends of line SL80-2 on the southwest and line SL81-14 on the northeast. Offset shots were placed 1,100 feet from each end of the line. The line indicates a 6,000 fps velocity layer underlying thin surficial materials (2,000 fps) and overlying a 9,000 fps material at a depth of approximately 200 feet. The base of the 9,000 fps layer is shown by time-distance plots as rising rapidly toward the southeast. Because of the apparent steep dip of the bedrock contact, neither the depth nor its true velocity can be determined from data collected on line SL82-16 alone. However, the model shown on Figure 13 is suggested by the data and agrees well with the interpretations for adjacent Line SL81-14 shows the top of bedrock to be at an elevation of 1,700 feet at the point where SL82-16 data shows the 9,000 fps velocity layer to be very thick. SL80-2 shows 6,000 fps directly over bedrock with a velocity of 15,000 fps at the point where SL82-16 data shows the 9,000 fps layer to be thin. It is likely that 9,000 fps material does exist beneath the northeastern end of SL80-2, but the data at the end of that line was insufficient to detect it.

#### 5.2 Lines SL82-17 and SL82-18

Lines SL82-17 (Figures 16 and 17) and SL82-18 (Figures 18 through 20) were run across the relict channel northwest of SL82-16. SL82-17 shows the edge of the relict channel approximately 2,200 feet from the southwest end of the line. The deepest part of the channel is near the northeast end of the line and is indicated to be at an elevation of approximately 1,665 feet, somewhat deeper than expected from the elevation of nearby Tsusena Creek. Bedrock velocities are indicated to be relatively low beneath the

line (13,000 to 14,000 fps). The velocities of the channel fill material are between 5,200 and 7,100 fps.

The northeastern end of Line SL82-17, on which the deepest part of the relict channel is indicated, is within 500 feet of the southwest end of Line SL81-13 which shows a much shallower (150 foot) maximum depth to bedrock. The velocity of channel fill on Line SL81-13 was interpreted to be 7000 fps in that area in contrast to the 5200 fps velocity interpreted for Line SL82-17. It is possible that the 7000 fps may represent partially frozen ground that was not indicated by the data from this year's line. If an average channel fill velocity of about 6000 fps were used in the interpretation of both lines, the calculated depth to bedrock would be in closer agreement at about elevation 1700.

Data collected along Line SL82-18 (Figures 18, 19, and 20) indicates the deepest part of the channel is at an elevation of approximately 1,770 feet, which is much shallower than expected. Based on other refraction lines in the vicinity, the most likely location of the channel thalweg is about 3100 feet from the northeast end of the line. A dashed line has been added to the interpretation shown in Figure 19 to show its possible shape. The most probable reason that such a deepened thalweg cannot be interpreted from the data is that the channel width is relatively narrow and its base cannot be detected by refraction (see discussion in Section 3.5). 'Alternative possibilities include the presence of thin layers of high-velocity channel fill either near the surface (possible frozen ground) or at depth within the deepest part of the channel (basal deposits).

Shallow frozen ground with a velocity of 10,500 fps is interpreted to be overlying typical channel fill material with velocities ranging from 5,800 to 7,000 fps to the northeast of the most likely position of the relict channel thalweg. This velocity inversion situation prevents mapping the base of the frozen layers and limits the accuracy of the interpreted channel depths. In Figures 19 and 20, the base of the shallow high velocity layer is estimated. If the frozen ground is thicker than modeled, then the actual depth of the channel would be greater than indicated.

## 5.3 Line SL82-20

**3**.

Line SL82-20 (Figures 22, 23, and 24) was intended to approximately follow the thalweg of the main relict channel irom a point near the southwest end of SL81-16 near the Susitna River, northwest toward Tsusena Creek. It crosses lines SW-3, DM-A, SL82-16, SL82-18, SL80-1, and SL82-17 progressively toward the northwest. Shallow frozen ground has been interpreted in the vicinity of line DM-A, which also shows the velocity inversion condition. For the present interpretation a section of frozen ground (approximately 25 milliseconds thick) was assumed to overlie the 6,200 fps channel fill material. This assumption produced a model bedrock elevation of approximately 1,700 feet. This bedrock elevation about 100 feet deeper than interpreted for Lines DM-A and SW-3. This apparent mistie (about 20% of total depth) can be reduced by assuming a thinner layer of frozen ground.

The southeastern end of Line SL82-20 is coincident with the northeastern end of Line SL82-19 and the southwestern end of Line SL81-16. Interpretations of the coincident ends of Lines SL82-19 and SL82-20 are in good agreement but differ considerably from the previous interpretation of

Line SL81-16. We reviewed the data for that line and suggest that alternative interpretations are probable. In the 1981 interpretation, high channel fill and bedrock velocities (10,000 fps and 19,000 fps, respectively) appear to have resulted from averaging apparent velocities from different layers for reversed shots. The shallow depth to bedrock shown at the southwestern end of Line SL81-16 is based on only two arrival-time picks. The velocities used for the interpretation of the 1982 data are based on additional data points. If the 1982 velocities are used, the resulting re-interpretation of Line SL81-16 is similar to that for both Lines SL82-19 and SL82-20 where the end points are coincident.

Toward the northwest, Line SL82-20 appears to be located to the southwest of the main channel with bedrock elevations as high as 1,950 feet. Although not apparent from the data, a thin 9000 fps layer has been modeled directly overlying bedrock beneath the central portion of the line so that the interpretation more closely matches those for lines SL82-16 and SL82-18.

Bedrock velocities along the line appear to be approximately 14,000 fps. The channel fill velocities range from 5,000 to 6,200 fps and the frozen ground has an apparent velocity of 9,500 fps.

#### 5.4 Lines SL82-19, SL82-21, and SL82-22

Line SL82-19 (Figure 21) was run from the coincident end points of lines SL81-16 and SL82-20 southwestward to overlap the northeast end of Line SL81-15X. Bedrock is interpreted to be shallow under the end of Line SL82-15X, thickening to the northeast. At the northeast end of the line, channel fill material with a velocity of 7000 fps is approximately

350 feet thick. This is in 500d agreement with Line SL82-20 and with a reasonable reinterpretation of Line SL81-16 (see Section 5.3 for an explanation of the reinterpretation). Bedrock velocity is indicated to be 16,700 fps beneath the line.

Line SL82-21 (Figure 25) was intended to be a tie line between SL81-16 and SL81-18. The actual location of the line (based on R&M survey data), however, overlaps SL81-16 for approximately half of its length. Although the shape of the bedrock surface can be deduced from the data, the depth cannot be because reciprocal times from offset shots are not The profile for Line SL82-21 shows the inferred shape of the bedrock surface tied to the most likely depth interpreted for Line SL81-16. As previously explained (Section 5.3) problems exist in the 1981 interpretation of Line SL81-16. This interpretation is also shown in Figure 25 where the lines overlap. A reexamination of the 1981 data shows that the contact shown to be between 5000 fps and 9000 fps layers is more probably the channel-fill/bedrock contact. Also, the channel fill velocity appears to be in error and is more likely to be 8000 fps which is in good agreement with the present line. Averaging the velocities for the deeper layers previously interpreted for the northeastern end of Line SL81-16 produces a velocity of about 14,000 fps, similar to that indicated for bedrock by the present data.

Line SL82-22 (Figures 26 and 27) was run southerly from the south end of SW-4, across line SL81-18, to the top of the Susitna River bluffs, which are nearly vertical at that point. The southern end of the line indicates 15,000 fps bedrock very near the surface. Bedrock appears to deepen to an elevation of about 1,800 feet beneath

the south-central portion of the line. The intermediate velocity material near the ends of the line has a velocity of 7,000 fps. In the center, the velocity appears to drop below 5,000 fps.

### 6.0 FOG LAKES AREA

The two relict channel areas that were discovered on the 1981 Fog Lakes line (SL81-FL) were crossed during the present survey and more precisely defined. The largest and southernmost channel was encountered near the center of line SL82-FL1 (Figures 28 through 35), and near the center of line SL82-FL2 (Figures 36 through 39). The channel appears to be less than one-half mile wide beneath line SL82-FL2 and more than one and a quarter miles wide beneath SL82-FL1 Velocities within the channel at both locations are between 8,500 and 11,000 fps, which could represent frozen ground. If the channel deposits are frozen to the depth of the bedrock contact, the indicated minimum elevation of the deepest part of the channel on both lines w uld be approximately 1,750 feet. If the material is not frozen to bedrock (approximately 350 feet deep) a velocity inversion condition is indicated. Assuming that only half the total depth is frozen, the minimum elevation of the deepest part of the channel would be approximately 1,900 feet. This depth escimate is similar to that interpreted for line SL81-FL. There is not sufficient information to determine the thickness of the frozen layer soley on the basis of refraction data.

The second relict channel area on the south side of the river was crossed, at least in part, by the north end of line SL82-FL1 and by line SL82-FL3 (Figures 40 through 42). Several relatively narrow (1000 to 1500 feet wide) channels are indicated in that area. The deepest of these channels is apparent on both lines and appears to coincide with that interpreted on the west end of line SL81-FL. The minimum elevation in this deepest channel appears to be

approximately 1920 to 1950 feet, which is 70 to 100 feet lower than interpreted in the 1981 survey data. Again, if the shallow frozen ground in this area does not extend to bedrock, a velocity inversion condition may exist and the interpreted depth of the channel would decrease.

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- Woodward-Clyde Consultants, 1982, Susitna Hydroelectric Project, seismic refraction surveys, 1981; Report to R&M Consultants, Anchorage, Alaska, 33 pages, 23 figures, 3 appendices.

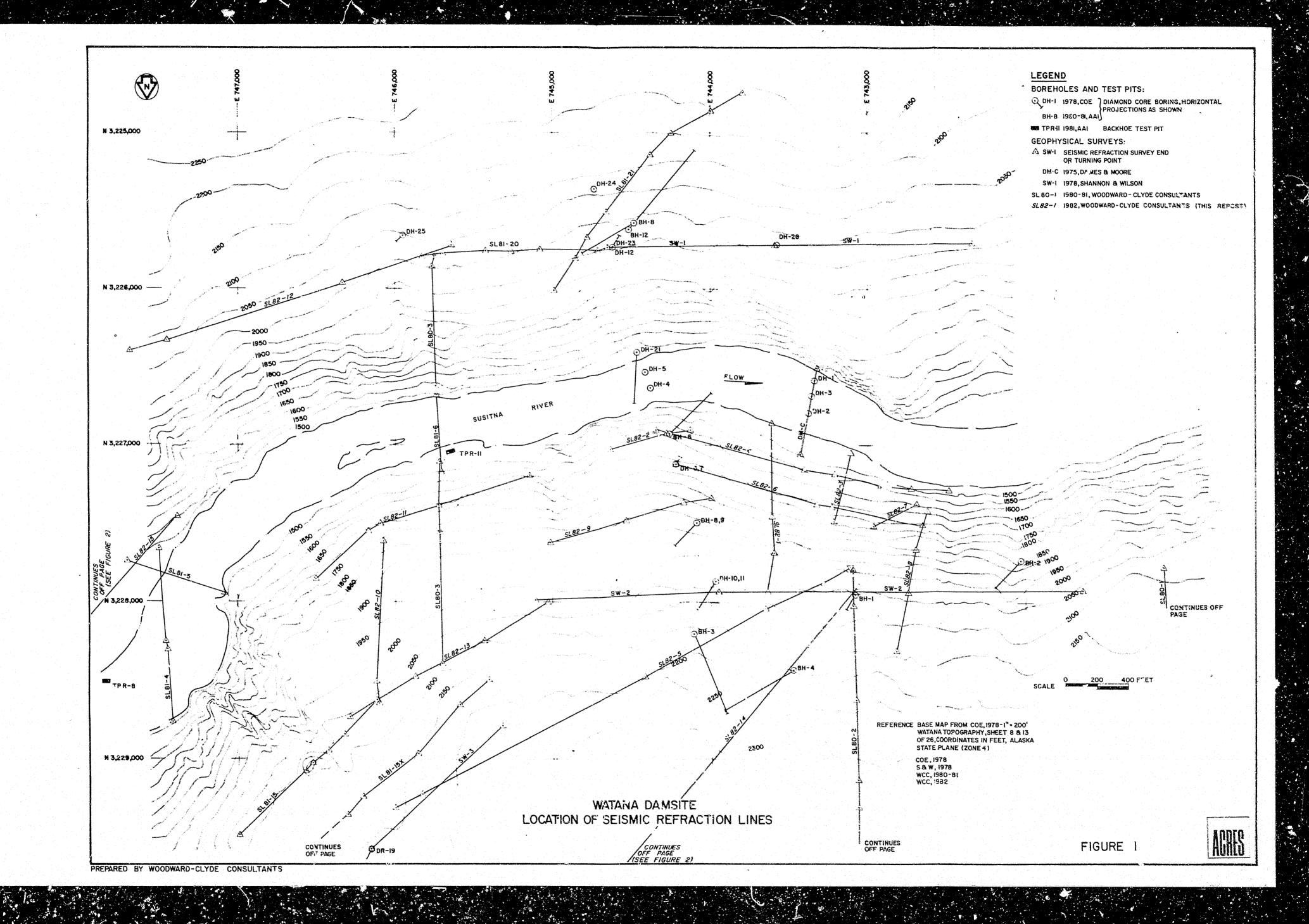
#### KEY TO NOTATION ON FIGURES

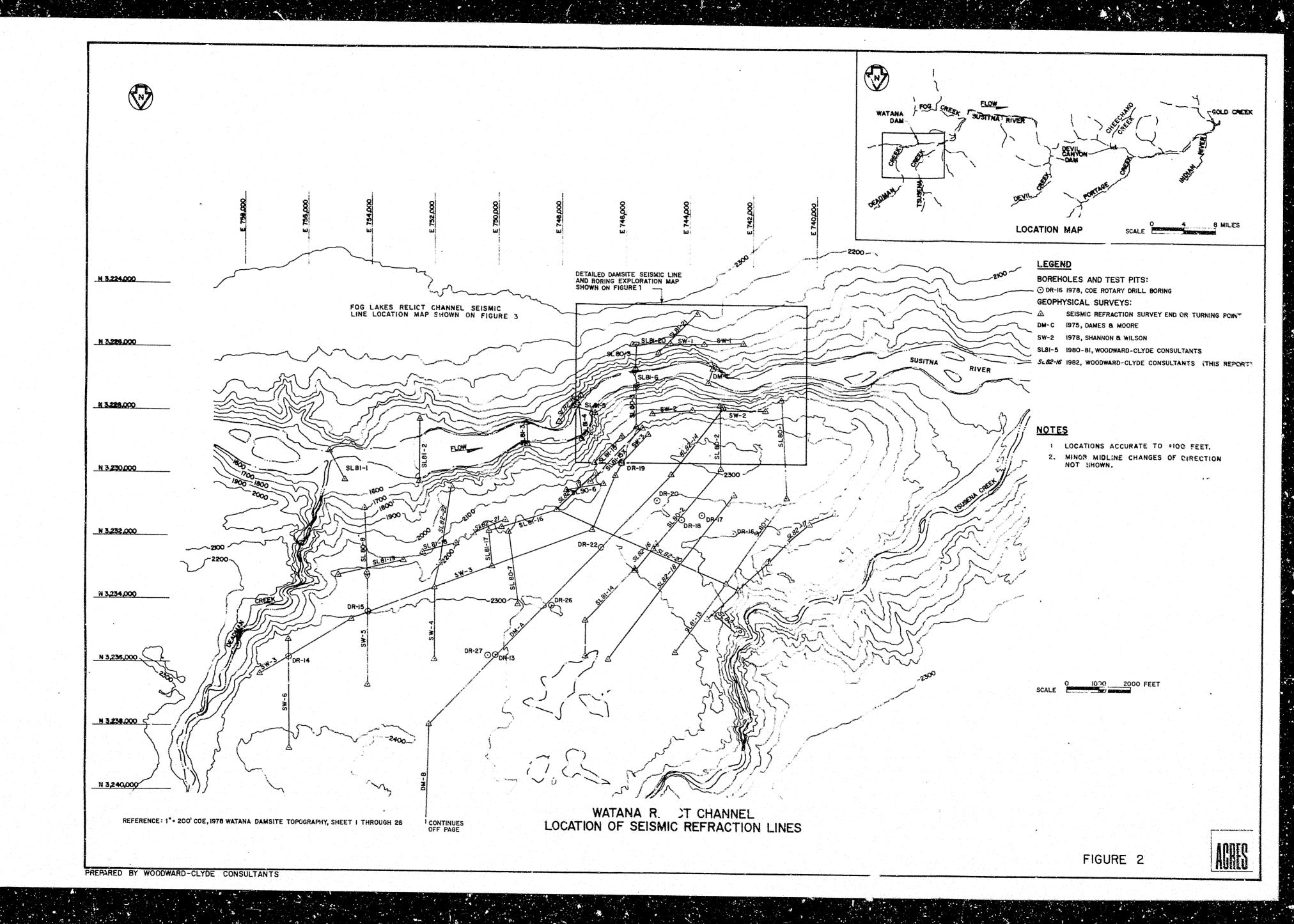
## Maps, Figures 1, 2, and 3

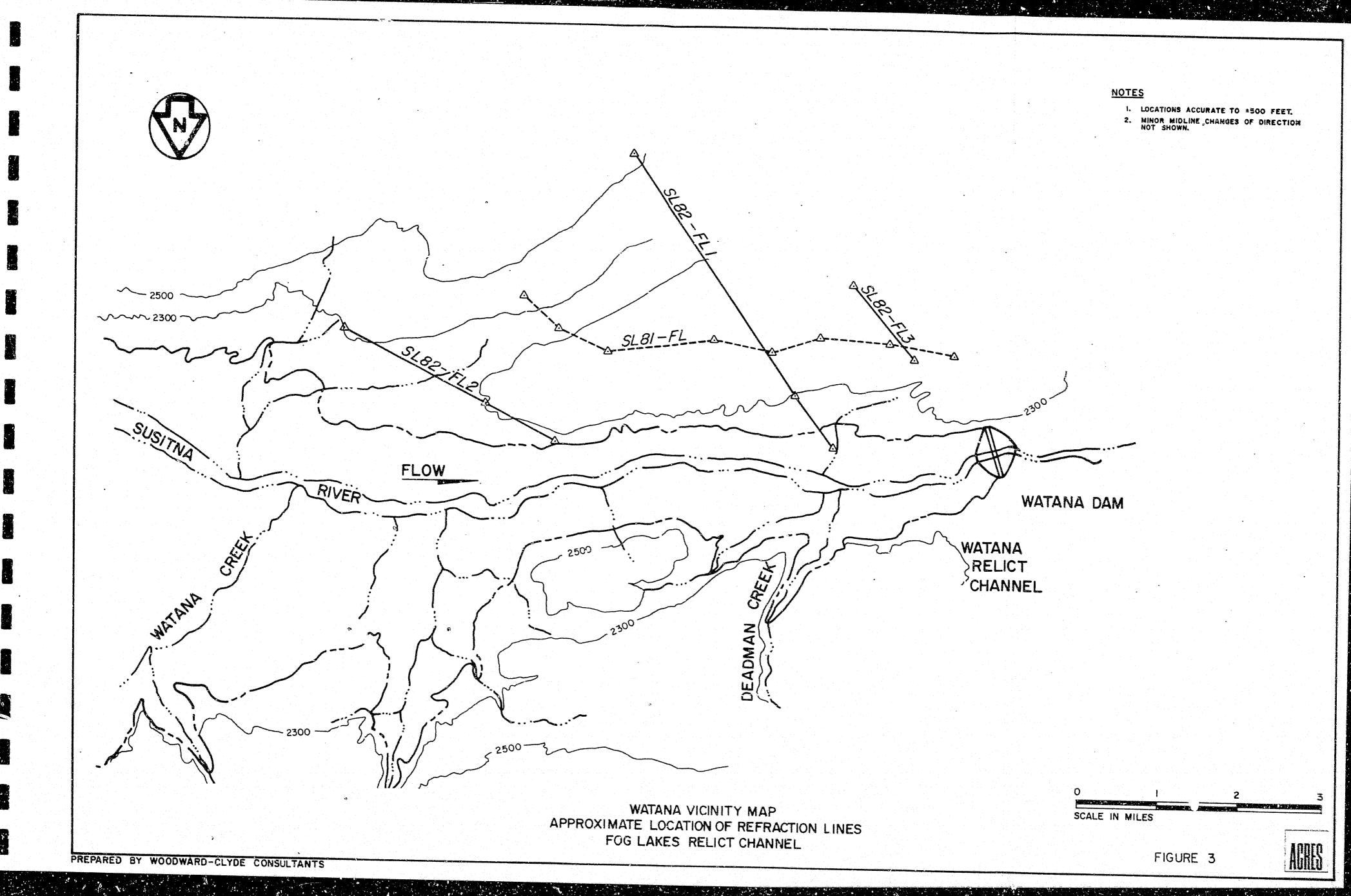
- 1. Line locations are shown as straight line segments that closely approximate the actual locations of the lines as surveyed in the field. Small deviations in line locations are not shown.
- 2. Triangles indicate the ends of lines and significant bends in the lines.

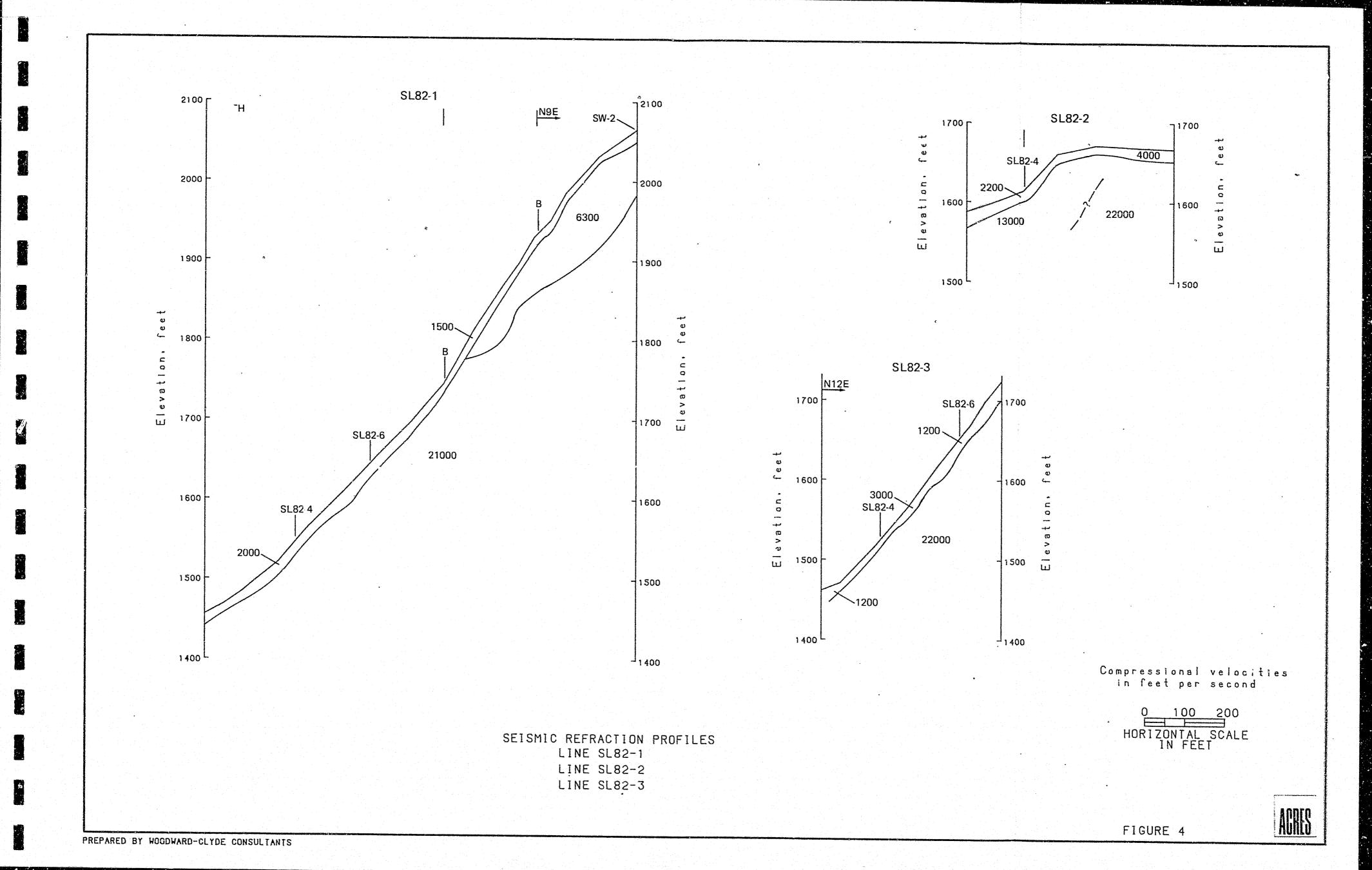
# Profiles, Figures 4 through 42

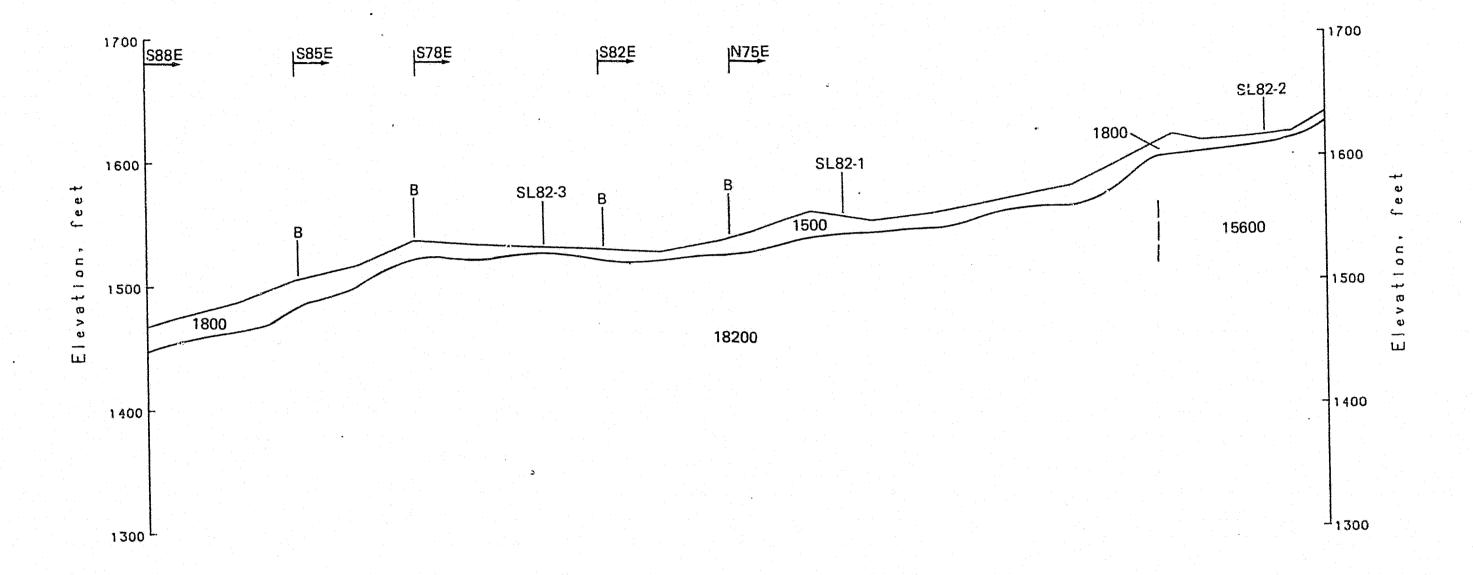
- 1. Locations of bends in the lines are indicated by the letter B. The orientation of each line segment is indicated by notation at the top of each profile.
- 2. The locations of crossing points with other lines are shown by reference to the crossing lines.
- Compressional wave velocities are given in fe per second.
- 4. Contacts between velocity units shown as solid lines are based on closely spaced data points and have an estimated accuracy of 10 to 15 percent of the indicated depth.
- 5. Contacts between velocity units shown as dashed lines indicate extrapolation between more widely spaced data points. The actual depth to the contacts is estimated to be within 25 percent of the indicated depth.
- 6. Queried dashed lines between velocity units indicate uncertainty as to the location of the contact. These contacts are based primarily on data from borings or previous refraction lines and are not the result of the reduction and interpretation of the 1982 seismic data.









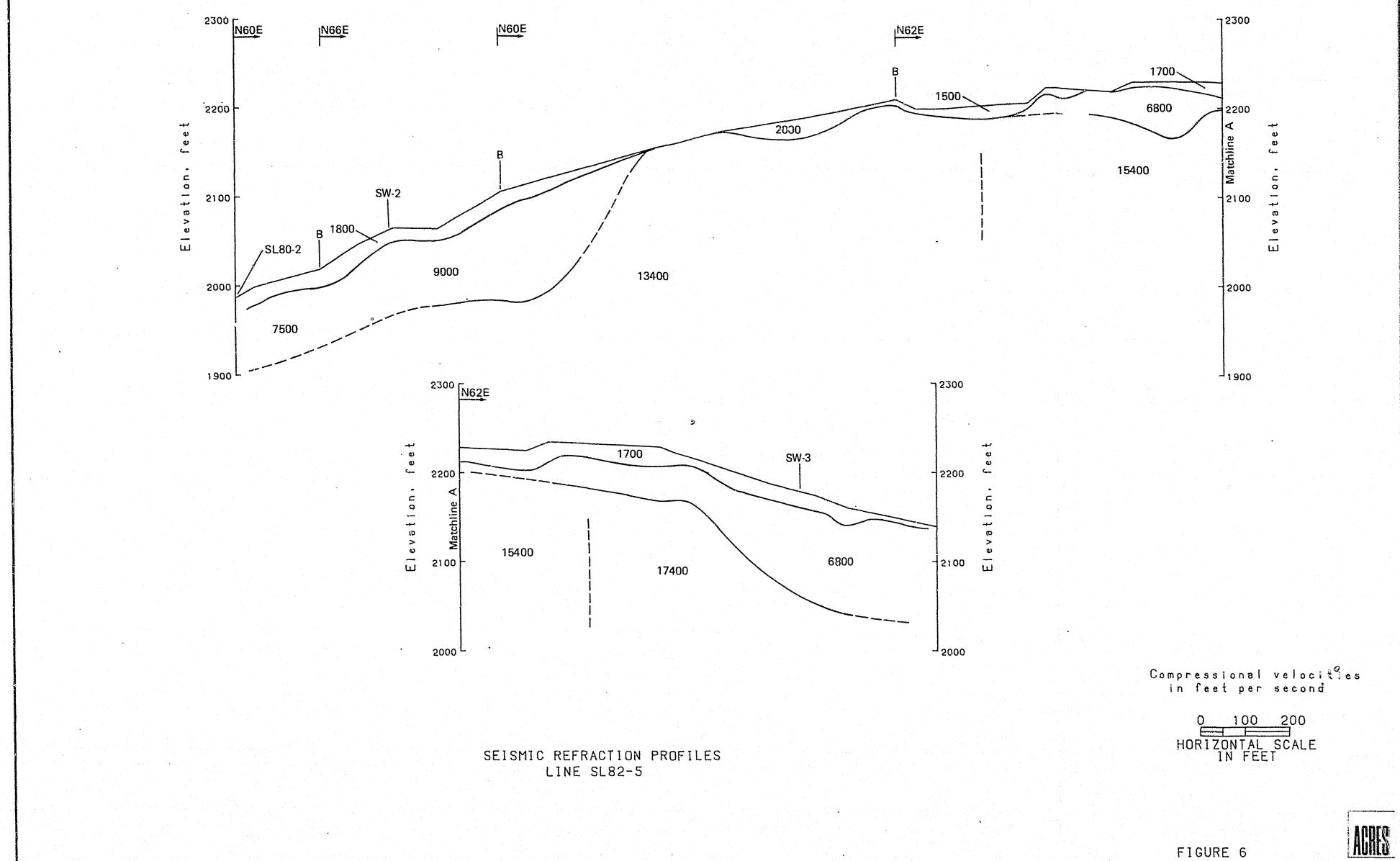


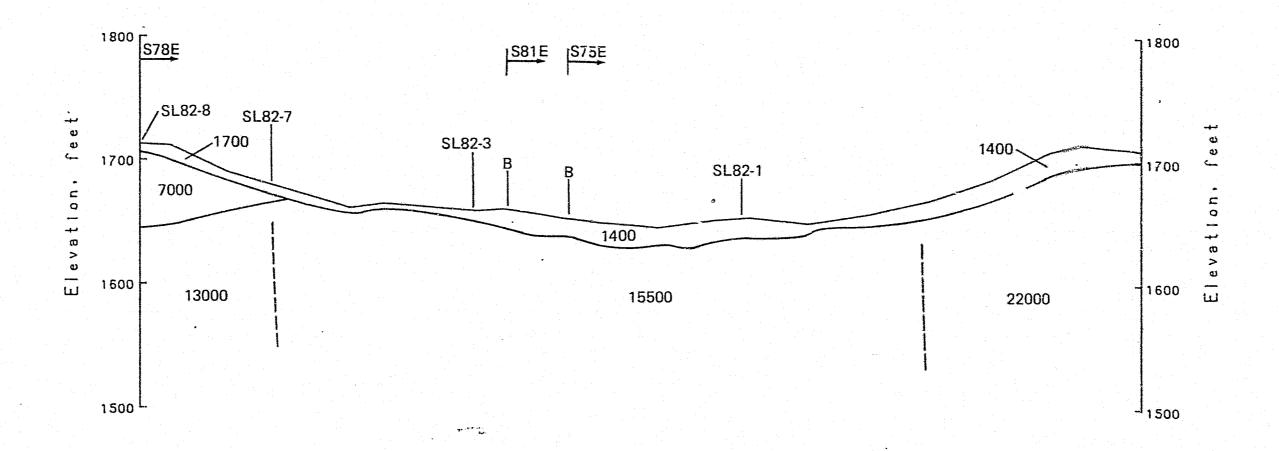
0 100 200 HORIZONTAL SCALE IN FEET

Compressional velocities in feet per second

SEISMIC REFRACTION PROFILE LINE SL82-4

ACRES

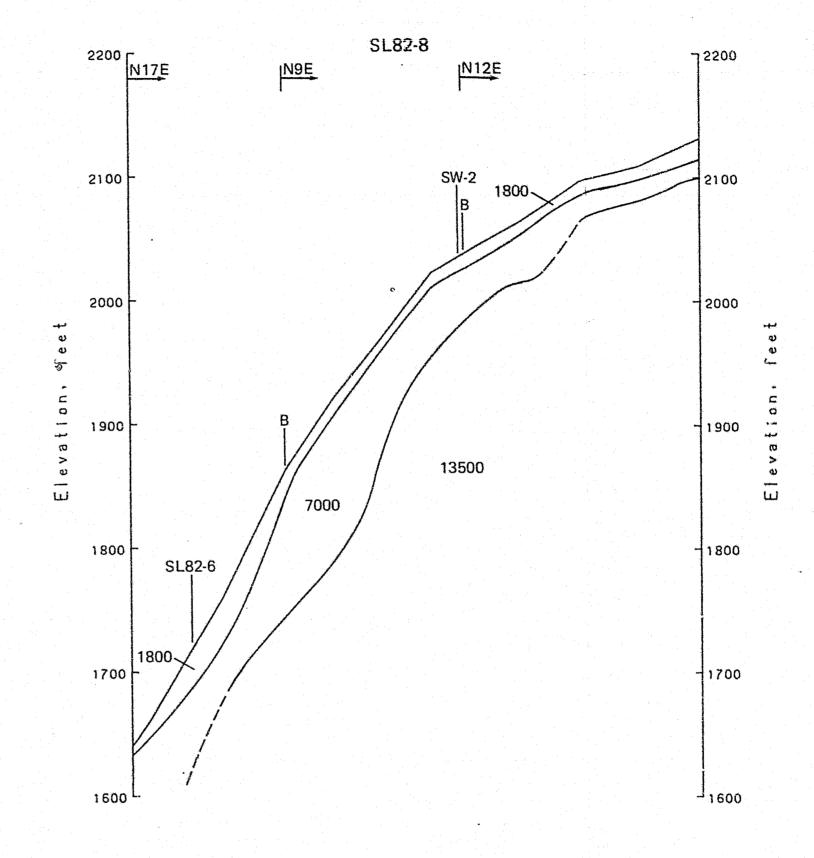




0 100 200
HORIZONTAL SCALE
IN FEET

SEISMIC REFRACTION PROFILE LINE SL82-6

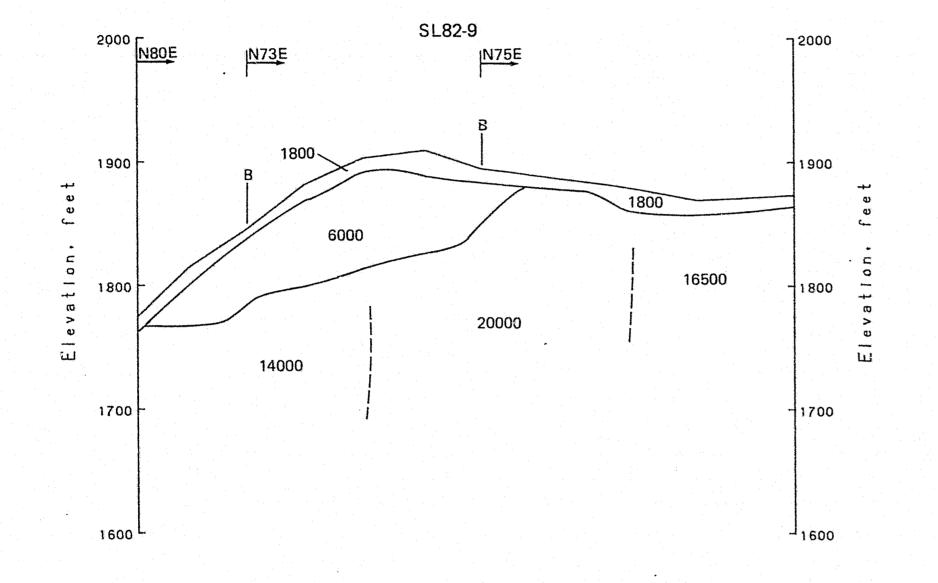


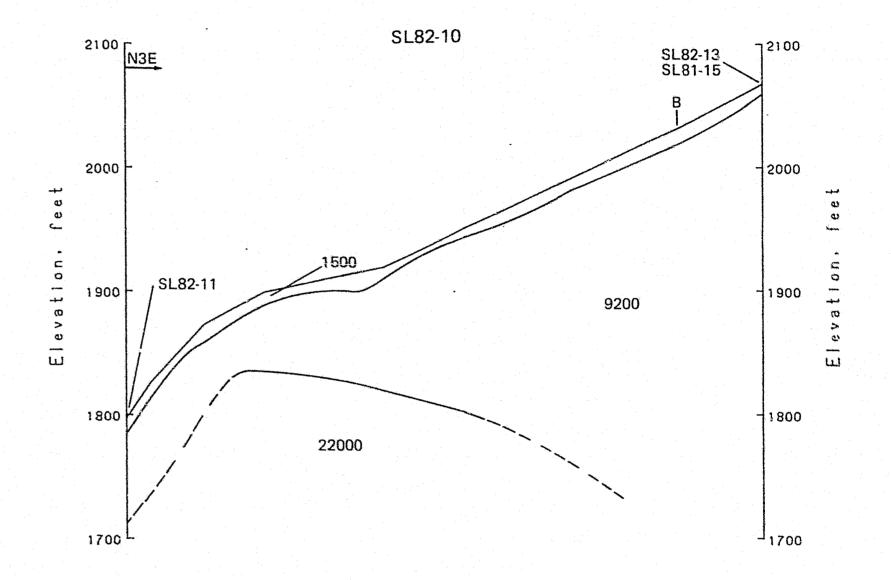


SEISMIC REFRACTION PROFILES
LINE SL82-7
LINE SL82-8

Compressional velocities in feet per second

0 100 200
HORIZONTAL SCALE
IN FEET

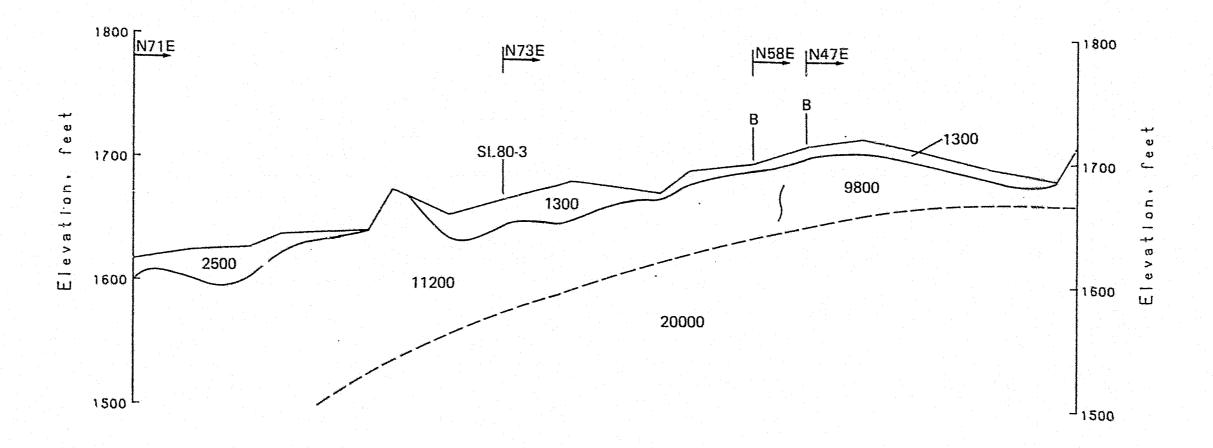




0 100 200 HORIZONTAL SCALE IN FEET

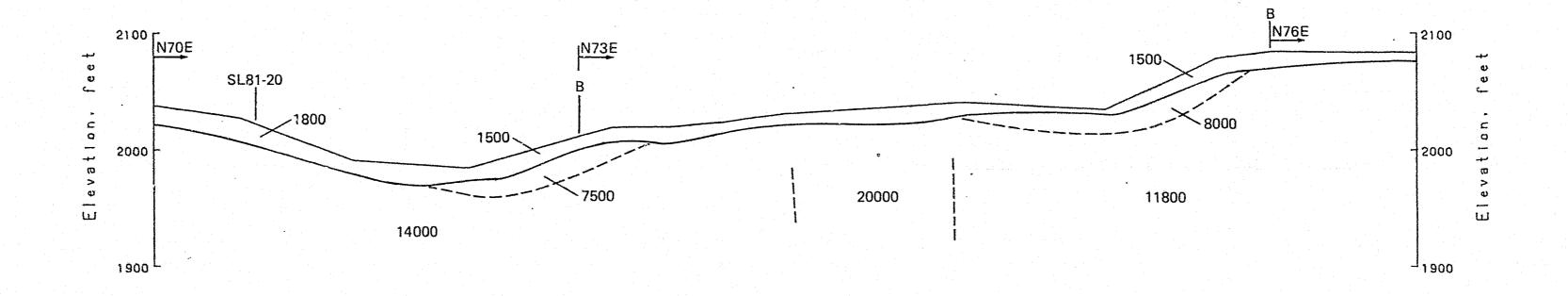
SEISMIC REFRACTION PROFILES
LINE SL82-9
LINE SL82-10





Compressional velocities in feet per second

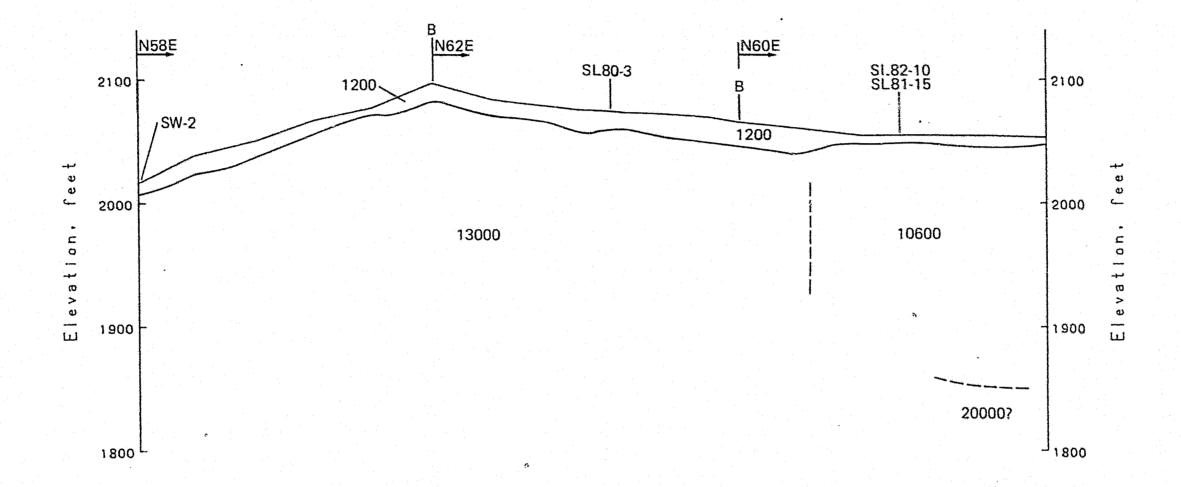
0 100 200
HORIZONTAL SCALE
IN FEET





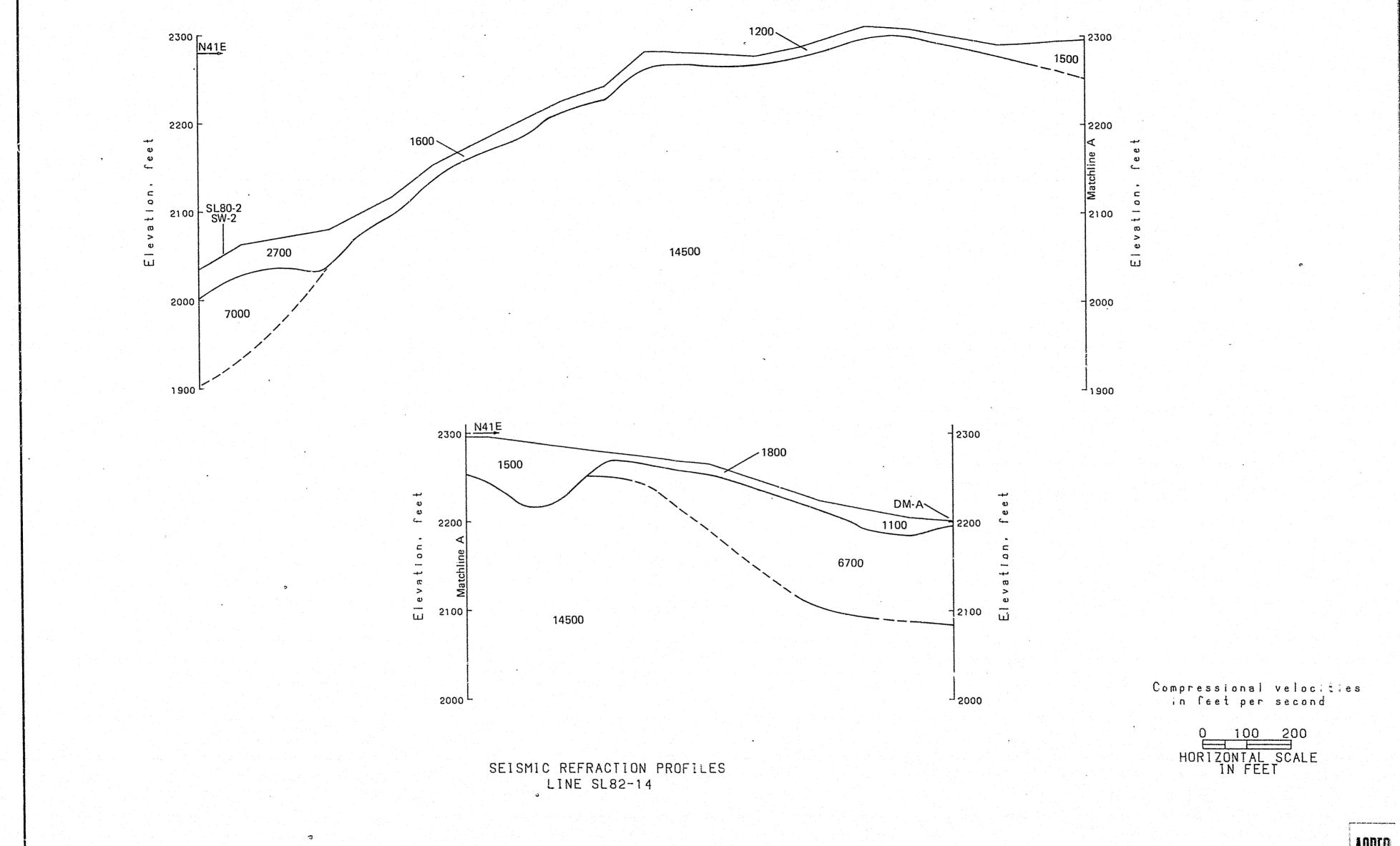
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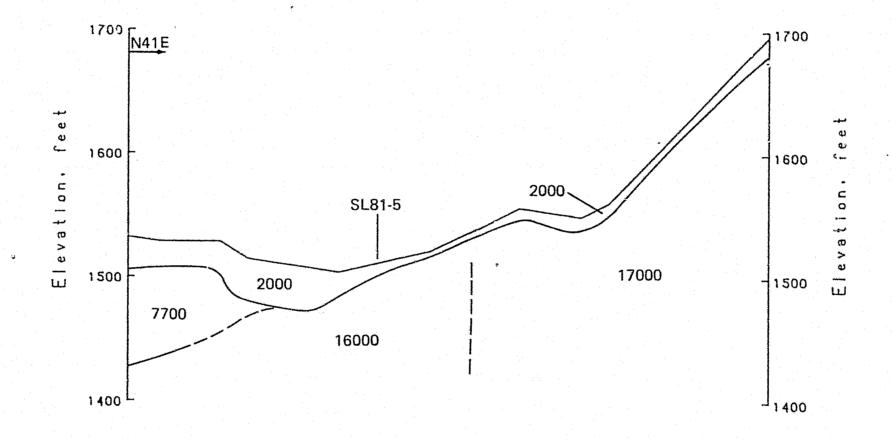




0 100 200 HORIZONTAL SCALE IN FEET

FIGURE 12

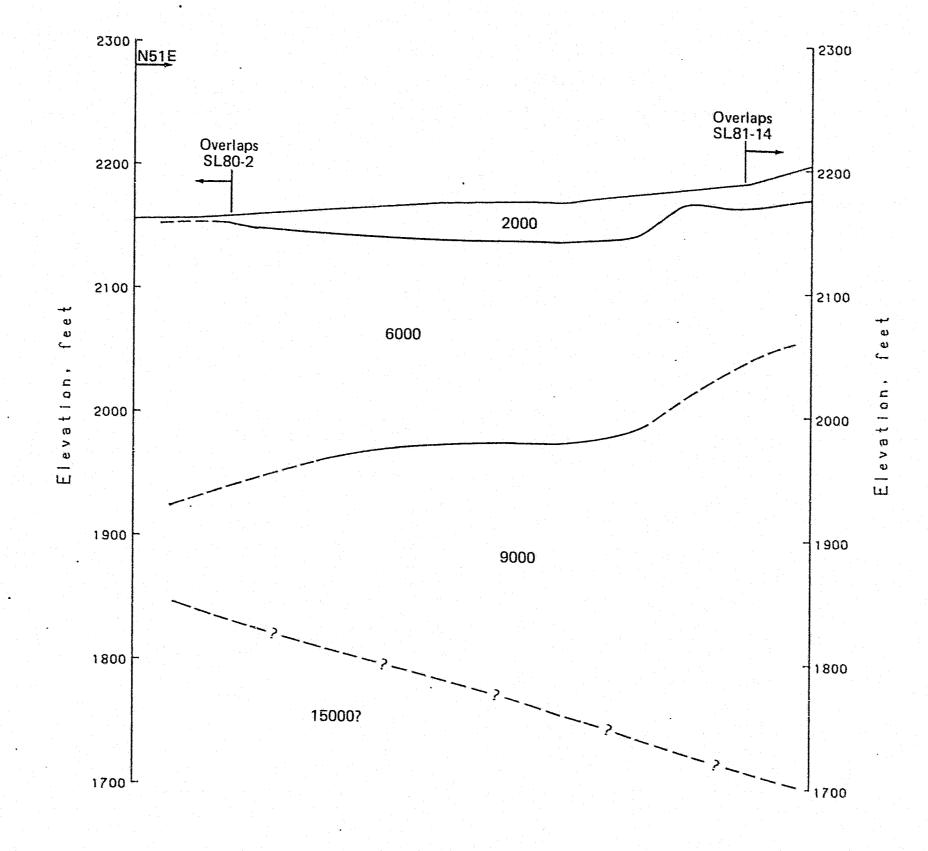




Compressional velocities in feet per second

0 100 200 HORIZONTAL SCALE IN FEET

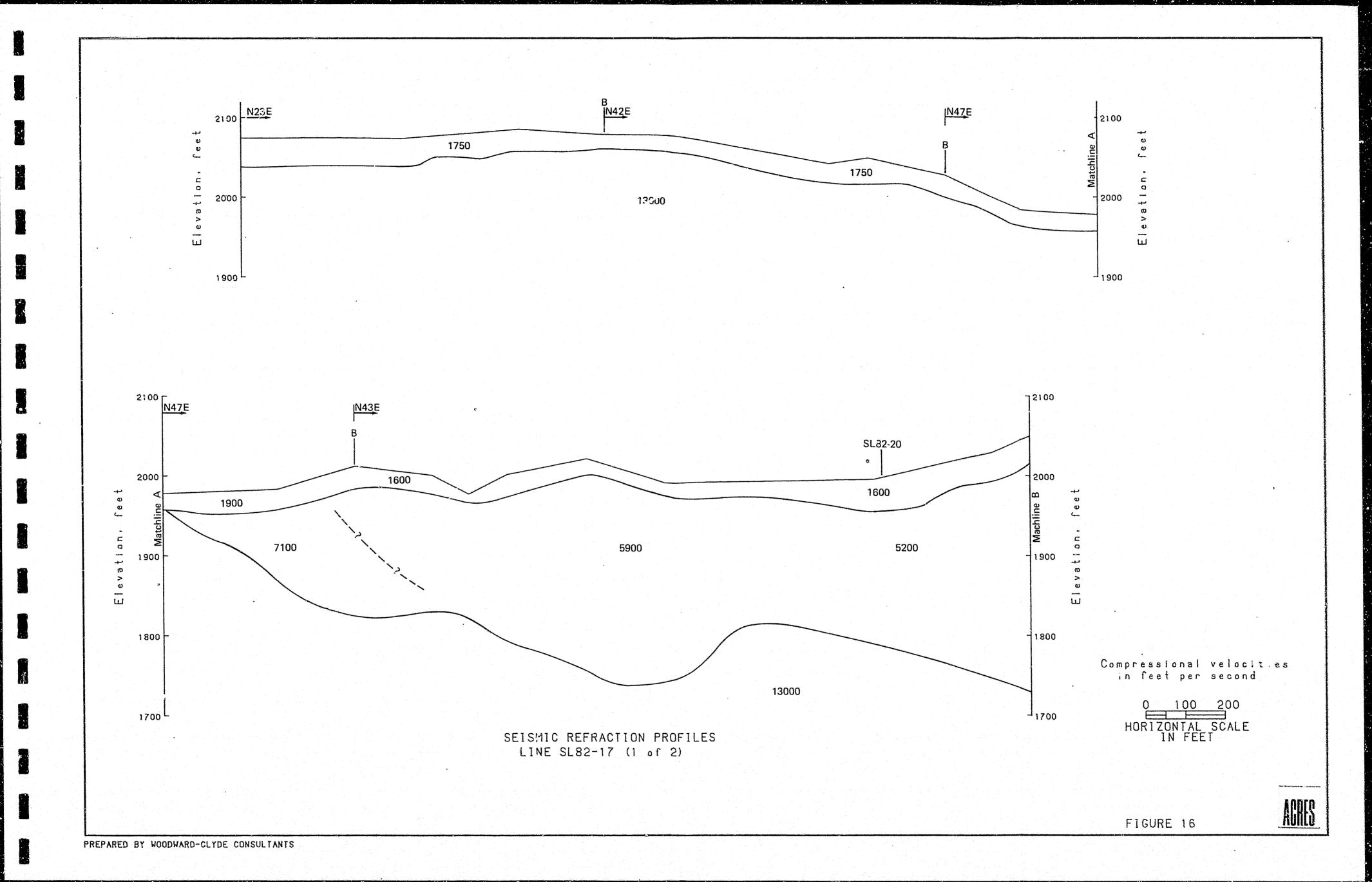
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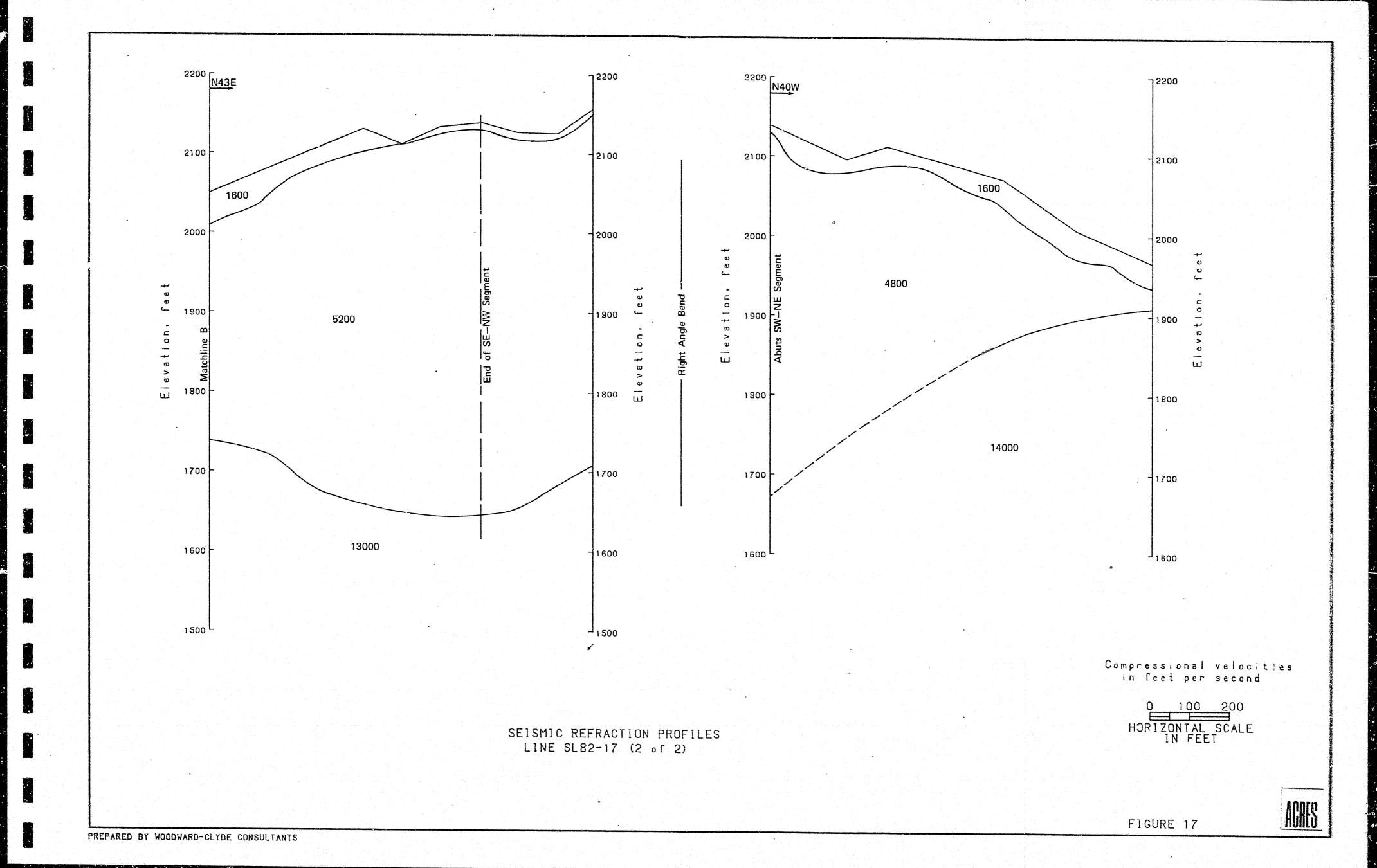


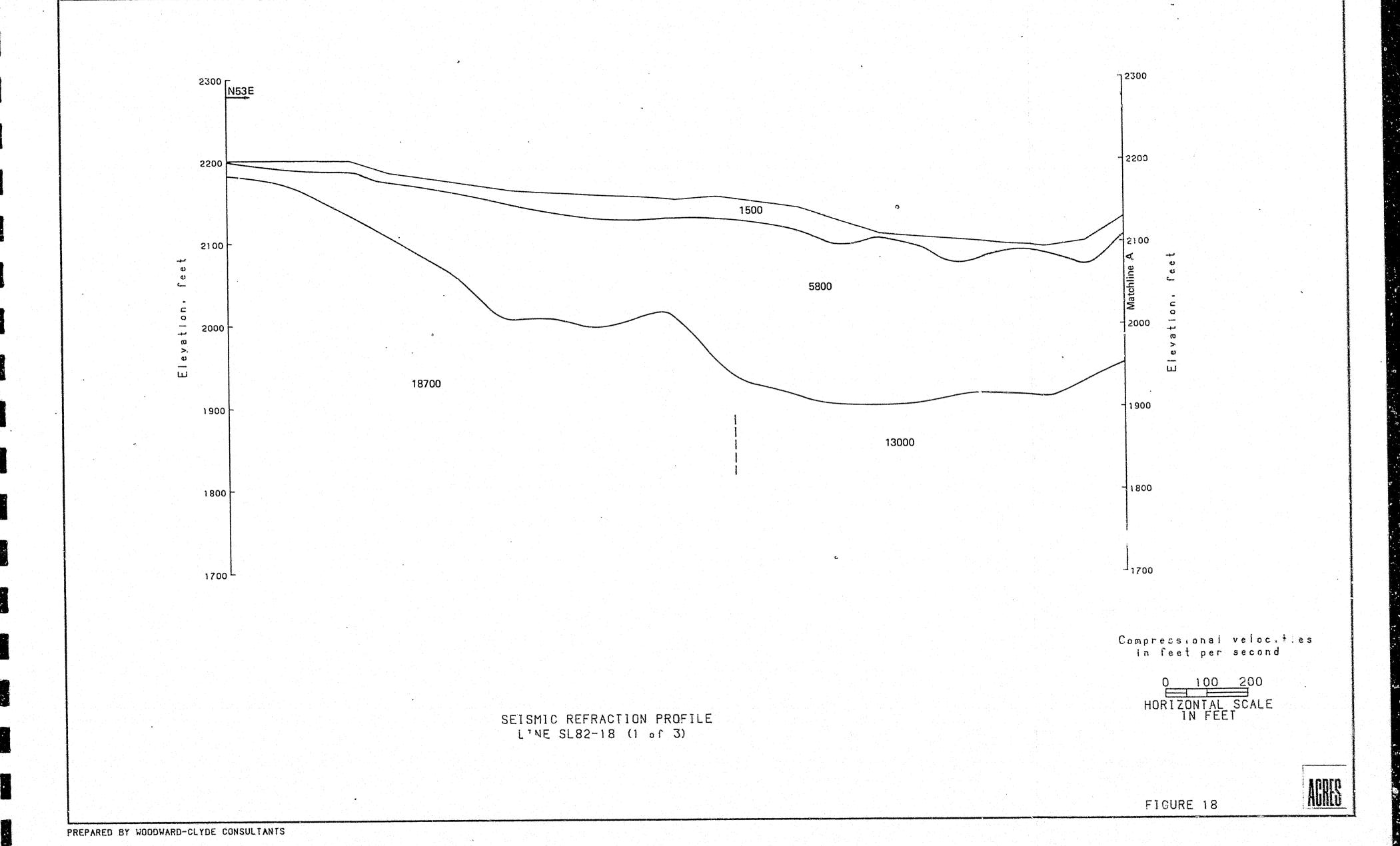
Compressional velocities in set per second

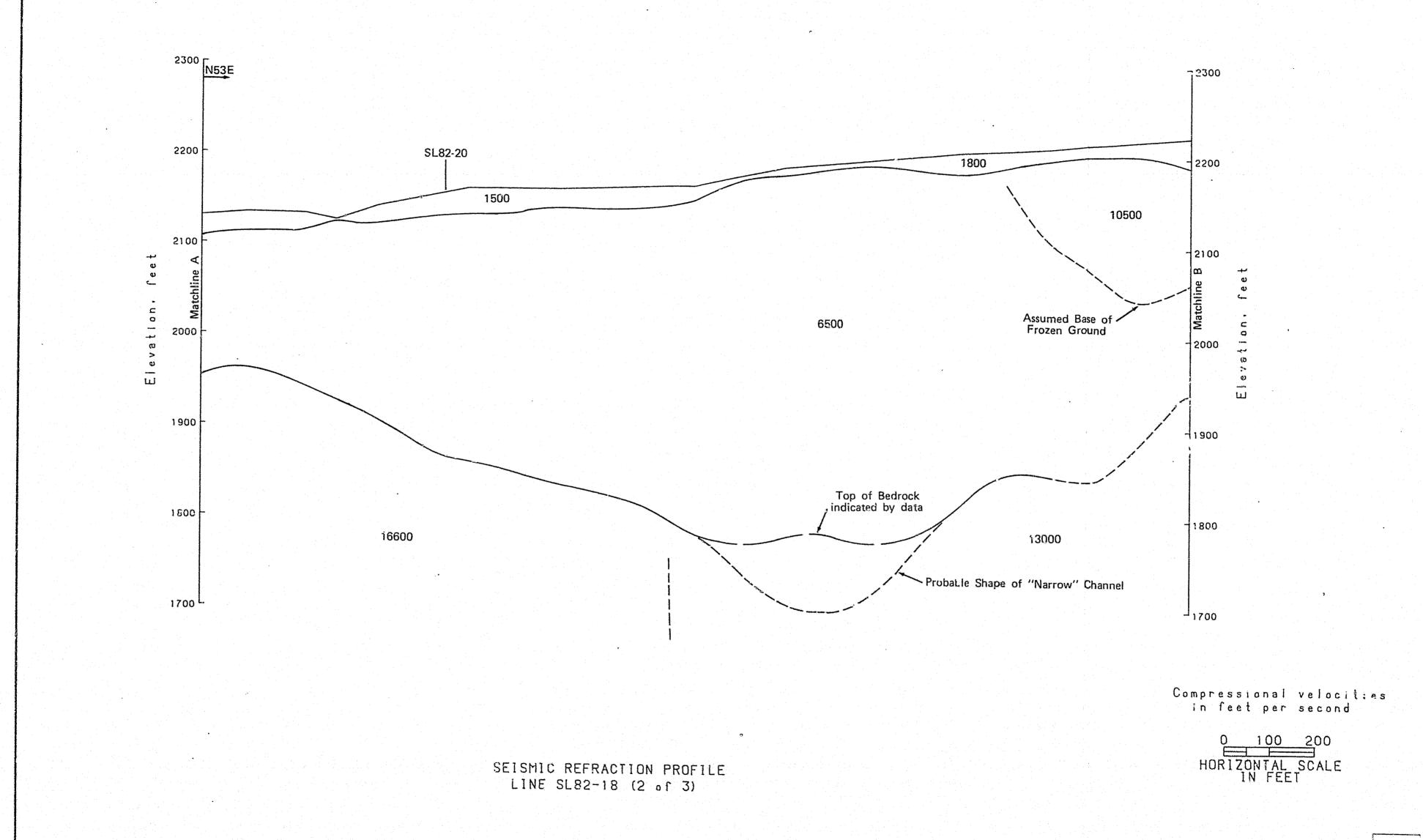
0 100 200
HORIZONTAL SCALE
IN FEET

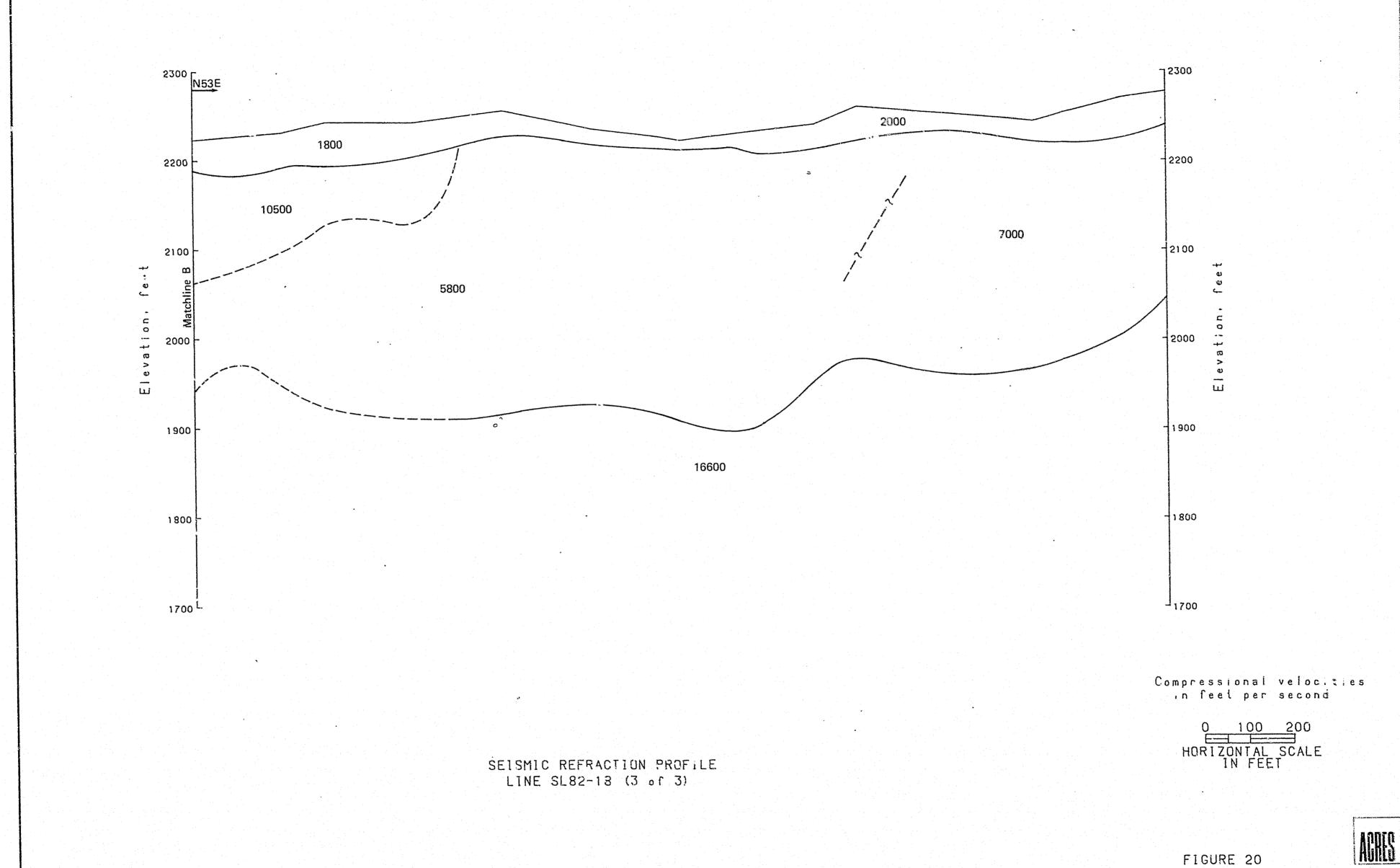
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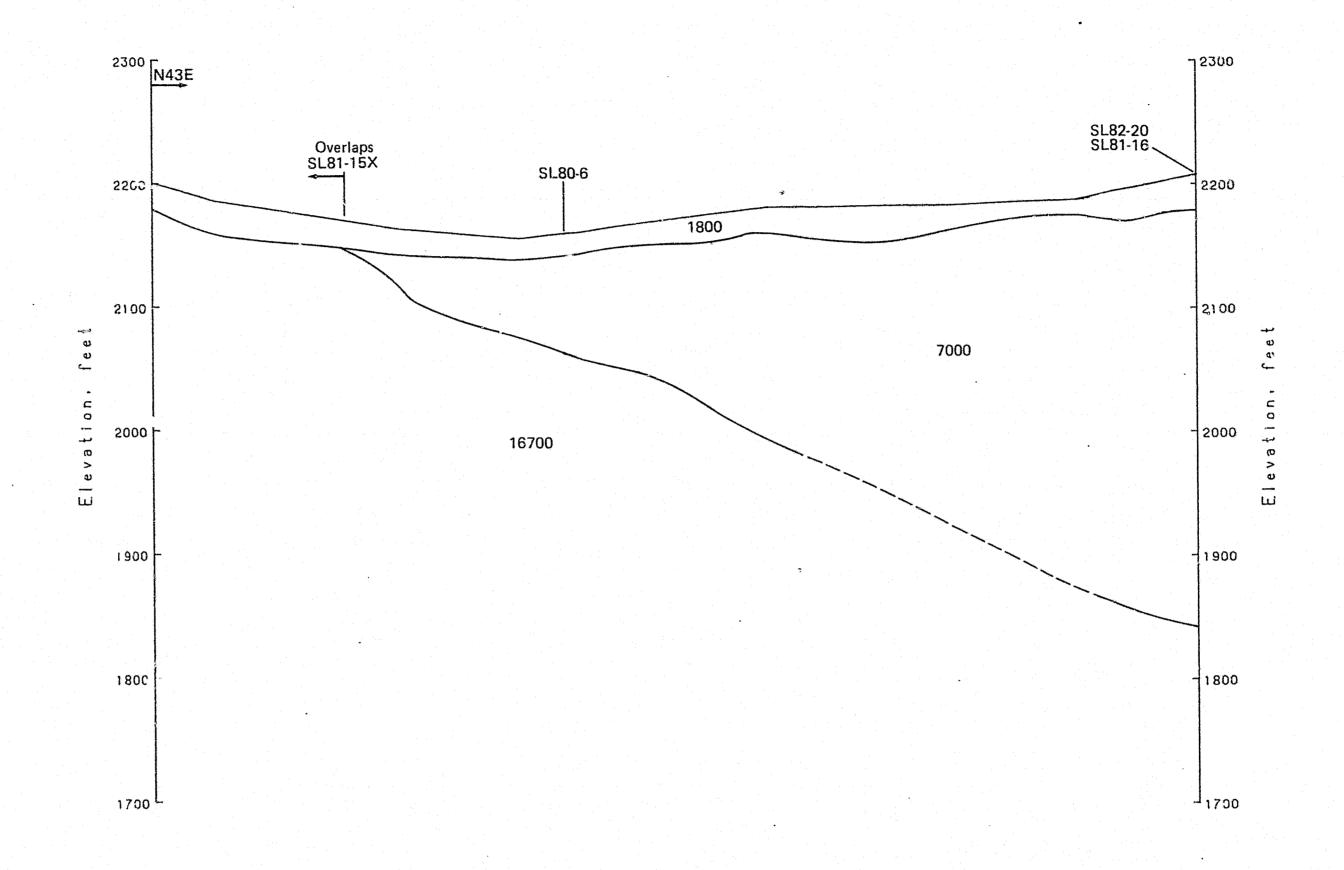








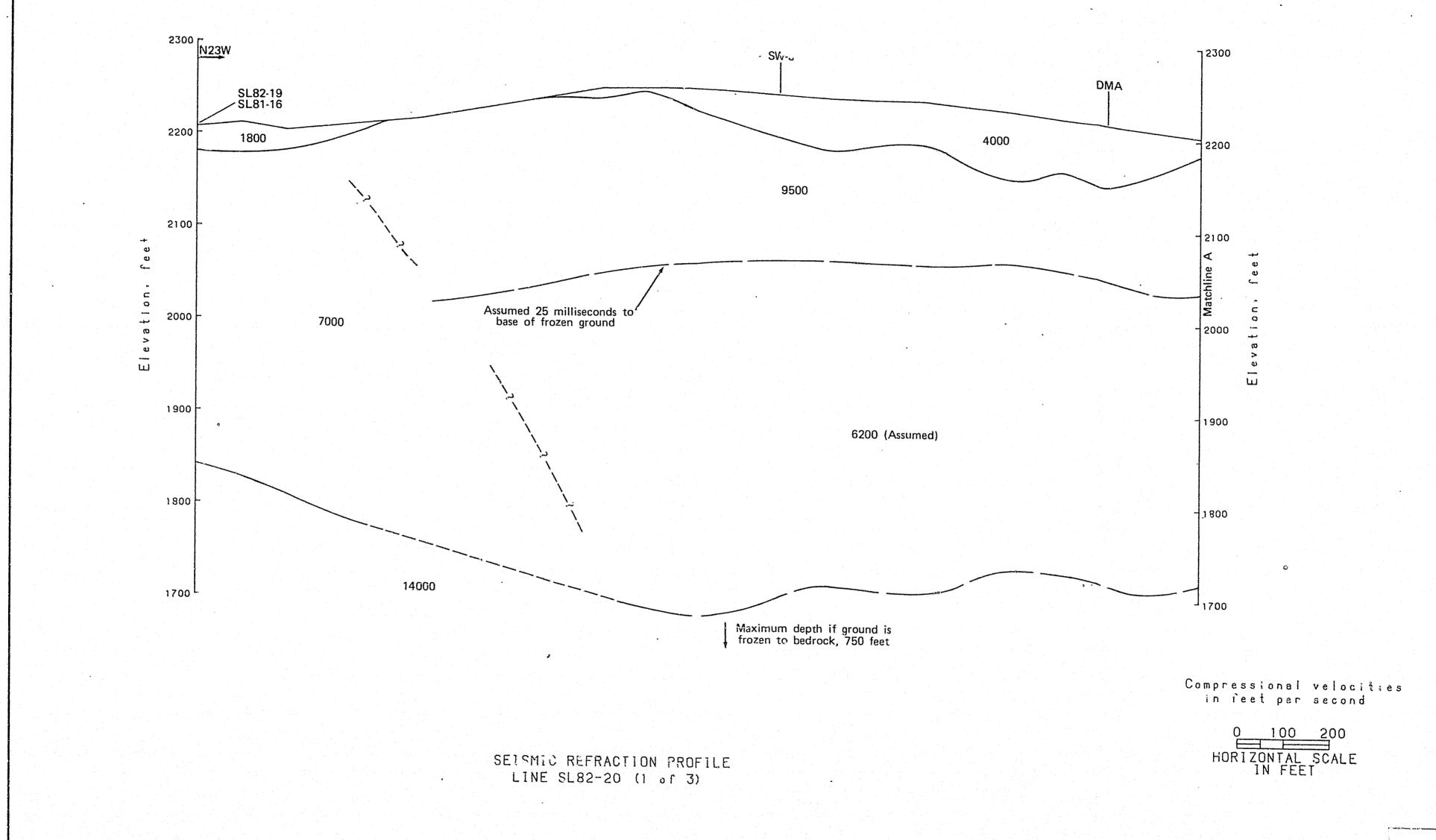


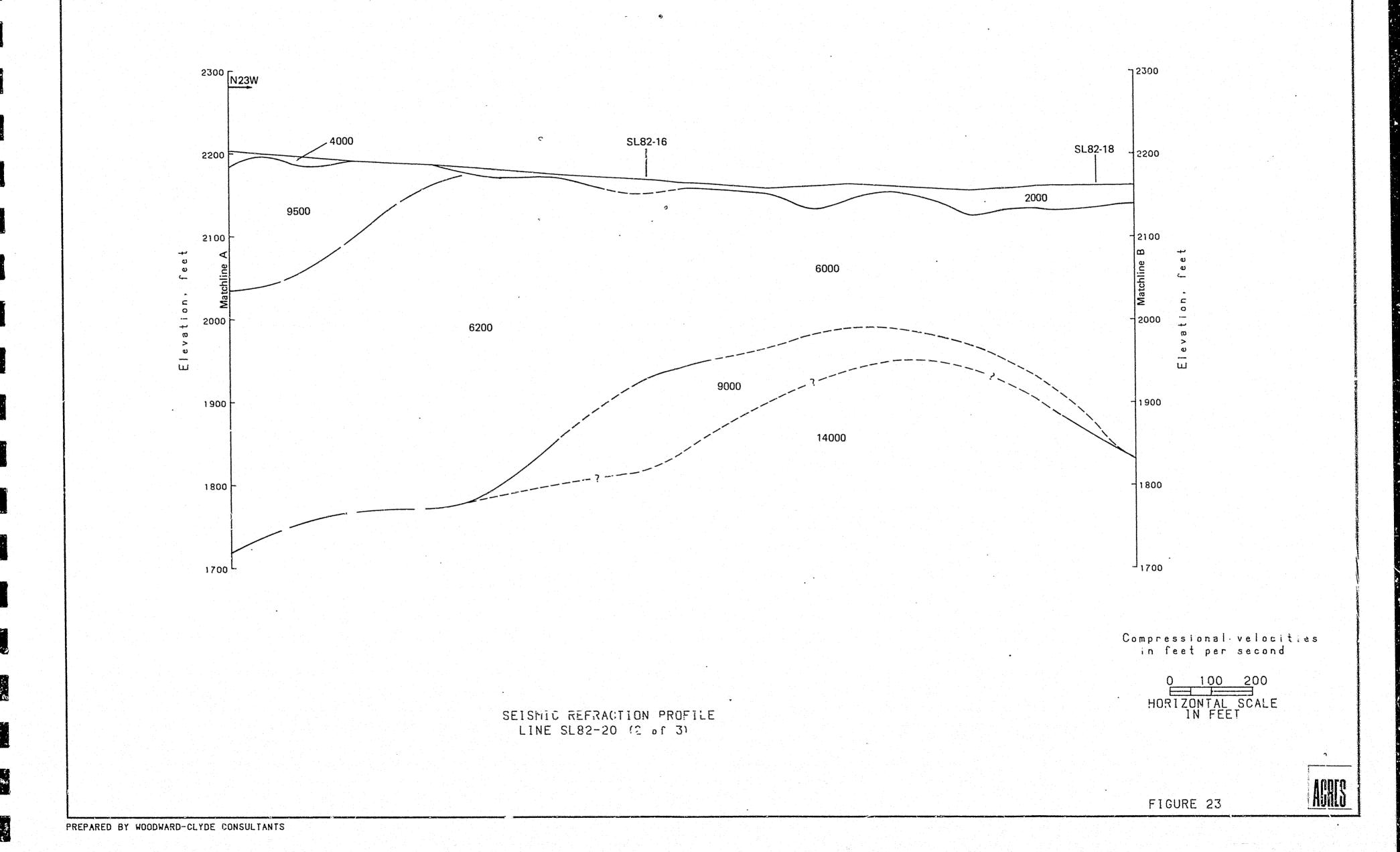


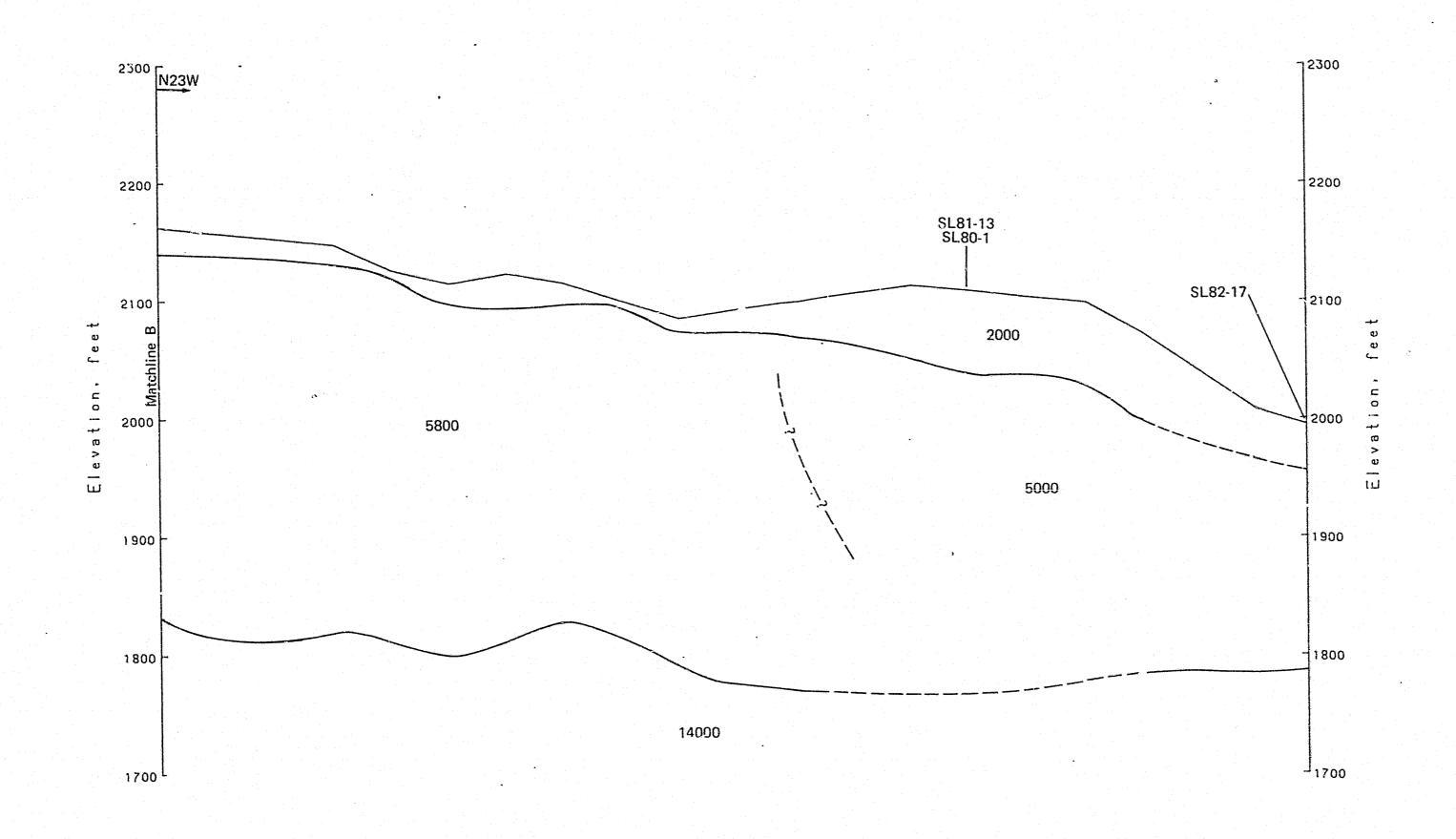
Compressional velocities in feet per second

0 100 200
HORIZONTAL SCALE
IN FEET

JRE 21





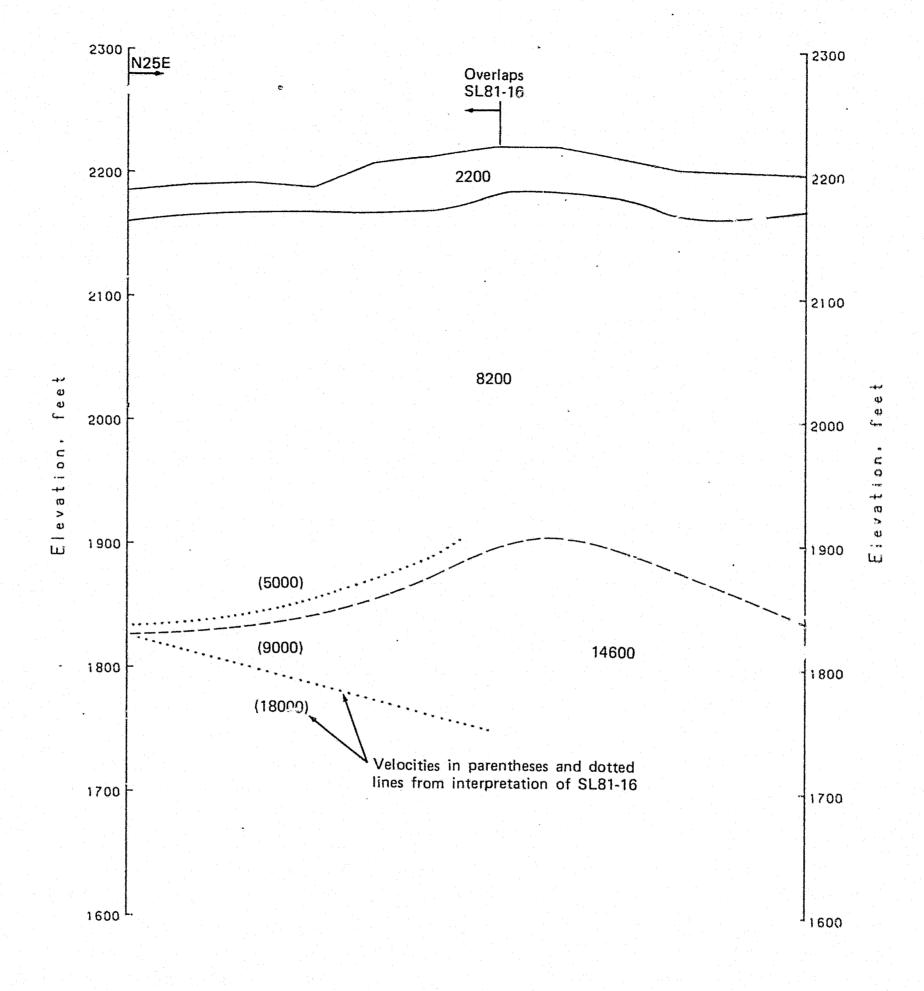


SEISMIC REFRACTION PROFILE

Compressional velocities in feet per second

0 100 200 HORIZONTAL SCALE IN FEET

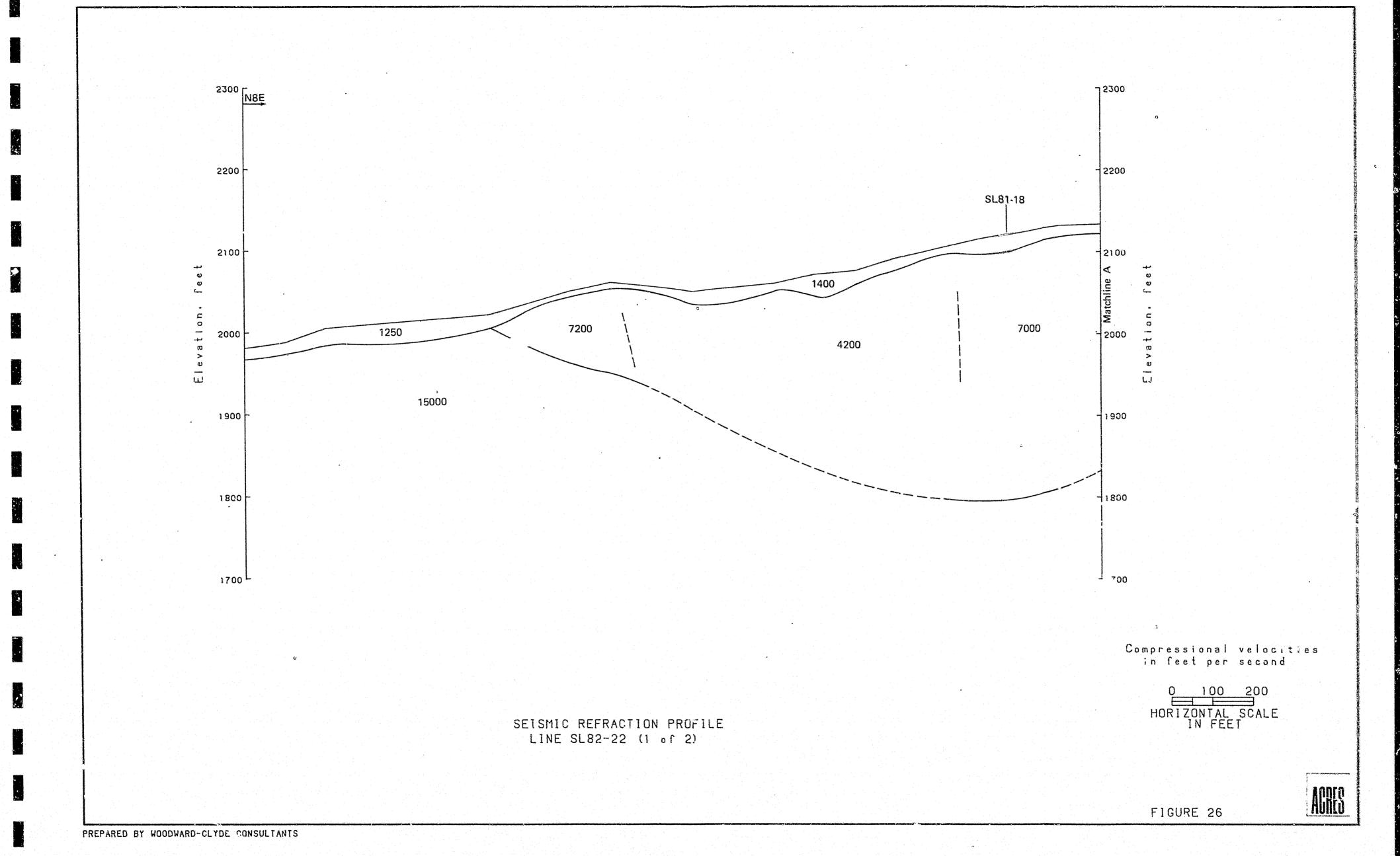
FIGURE 24

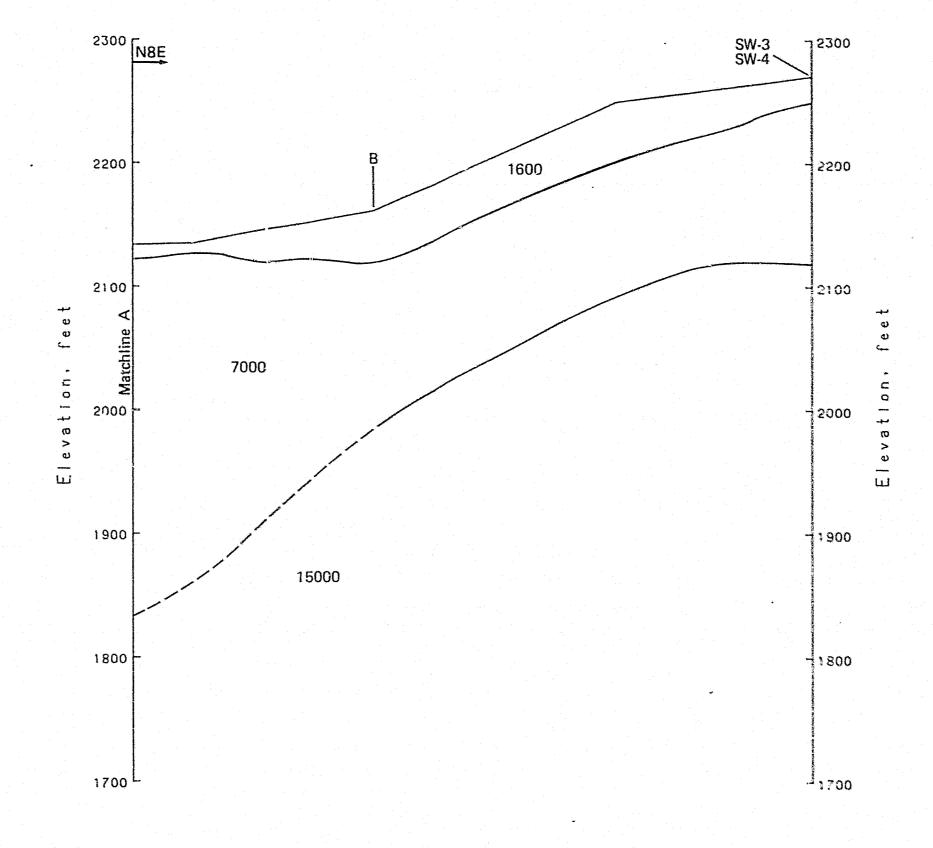


Compressional velocities in feet per second

0 100 200 HOR1ZONTAL SCALE IN FEET

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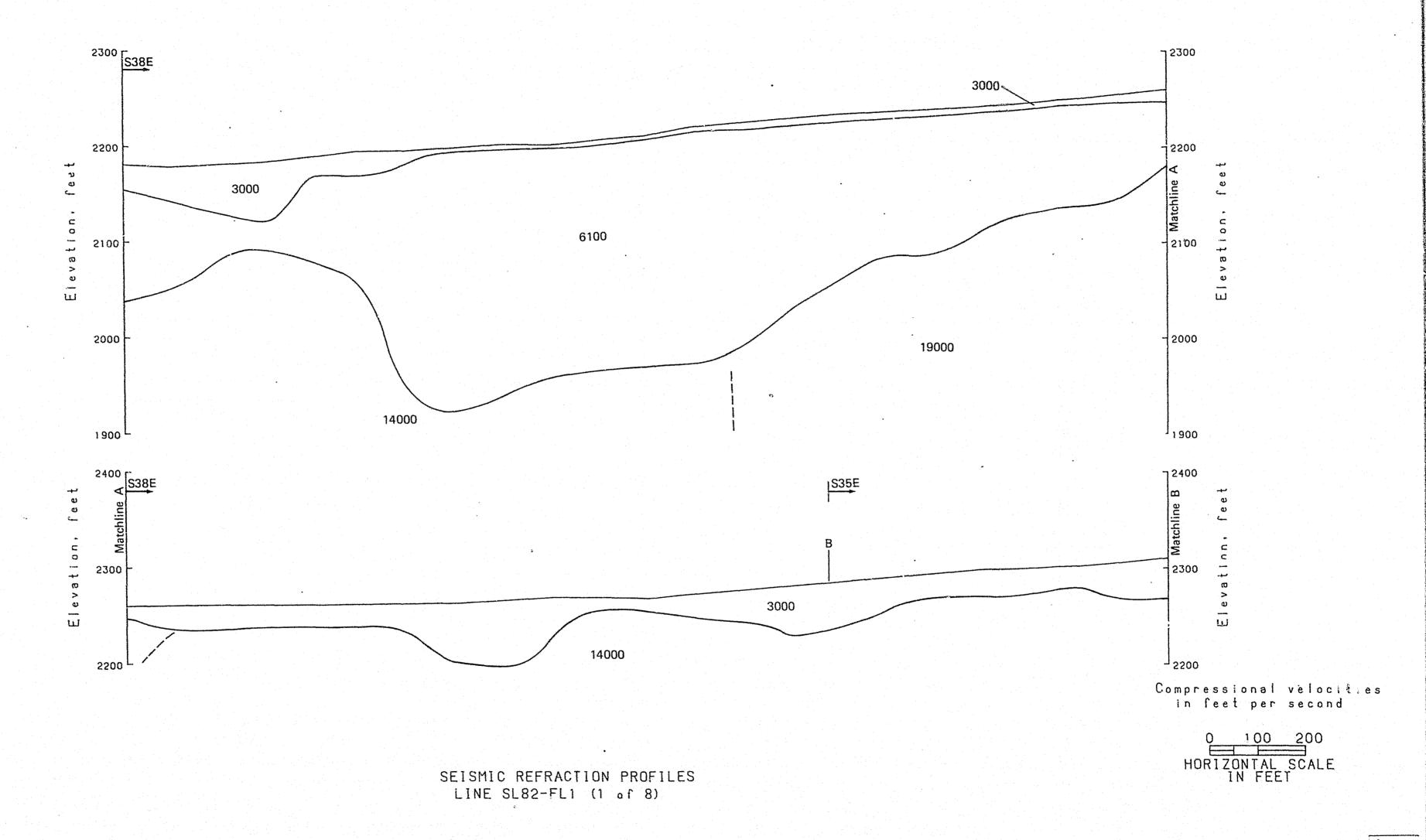


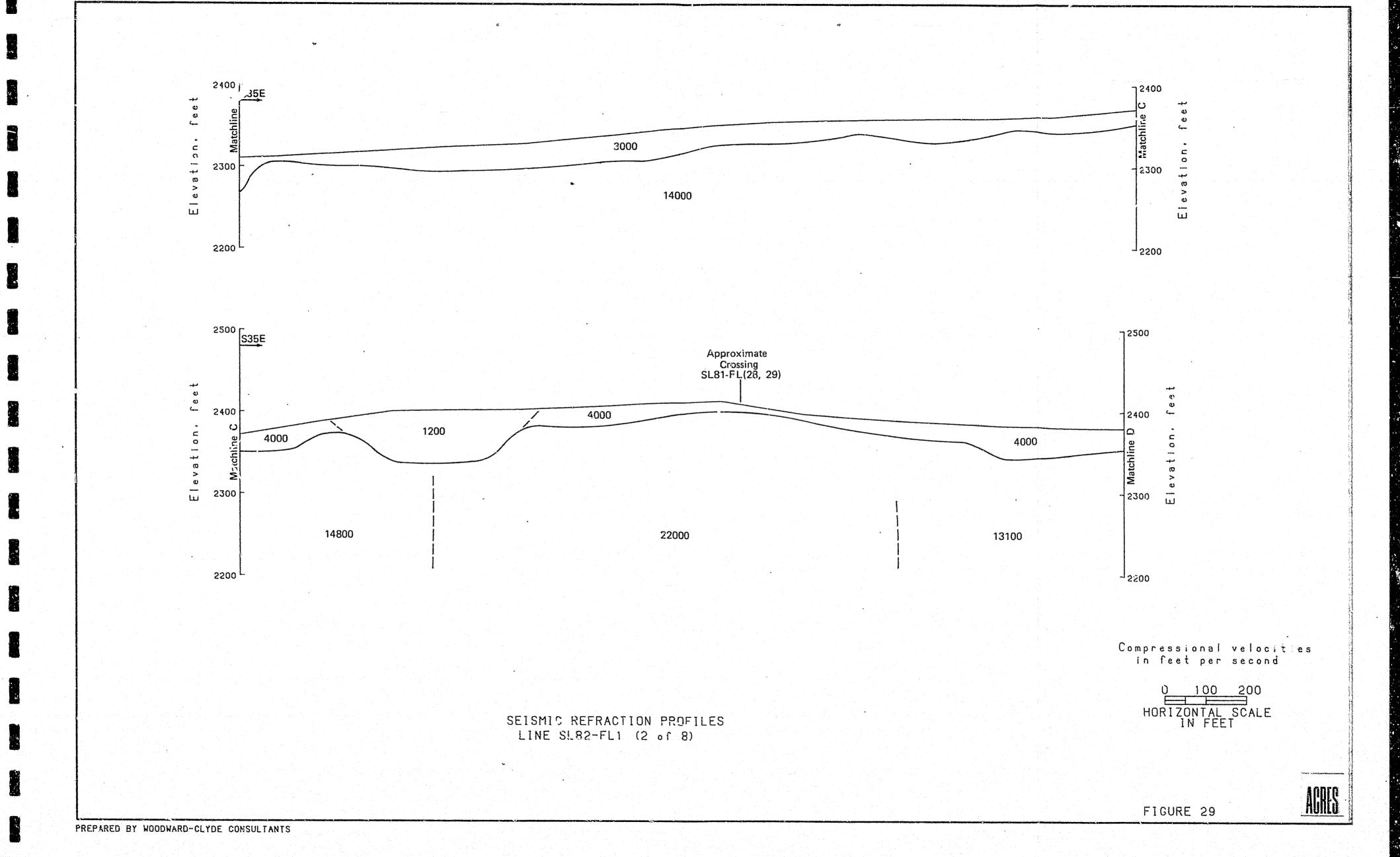
SEISMIC REFRICTION PROFILE LINE SL-22 (2 of 2)

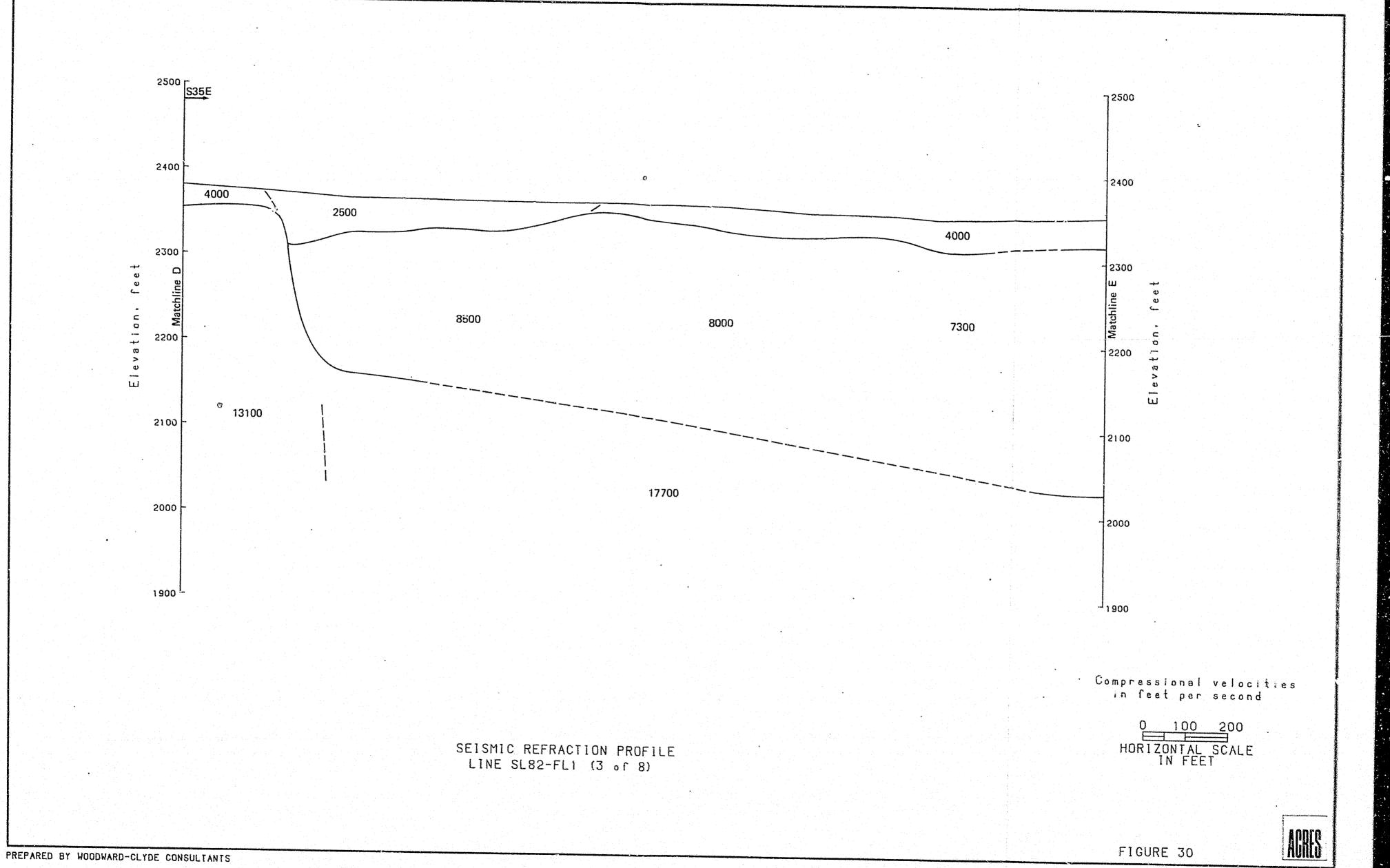
Compressional velocities in feet per second

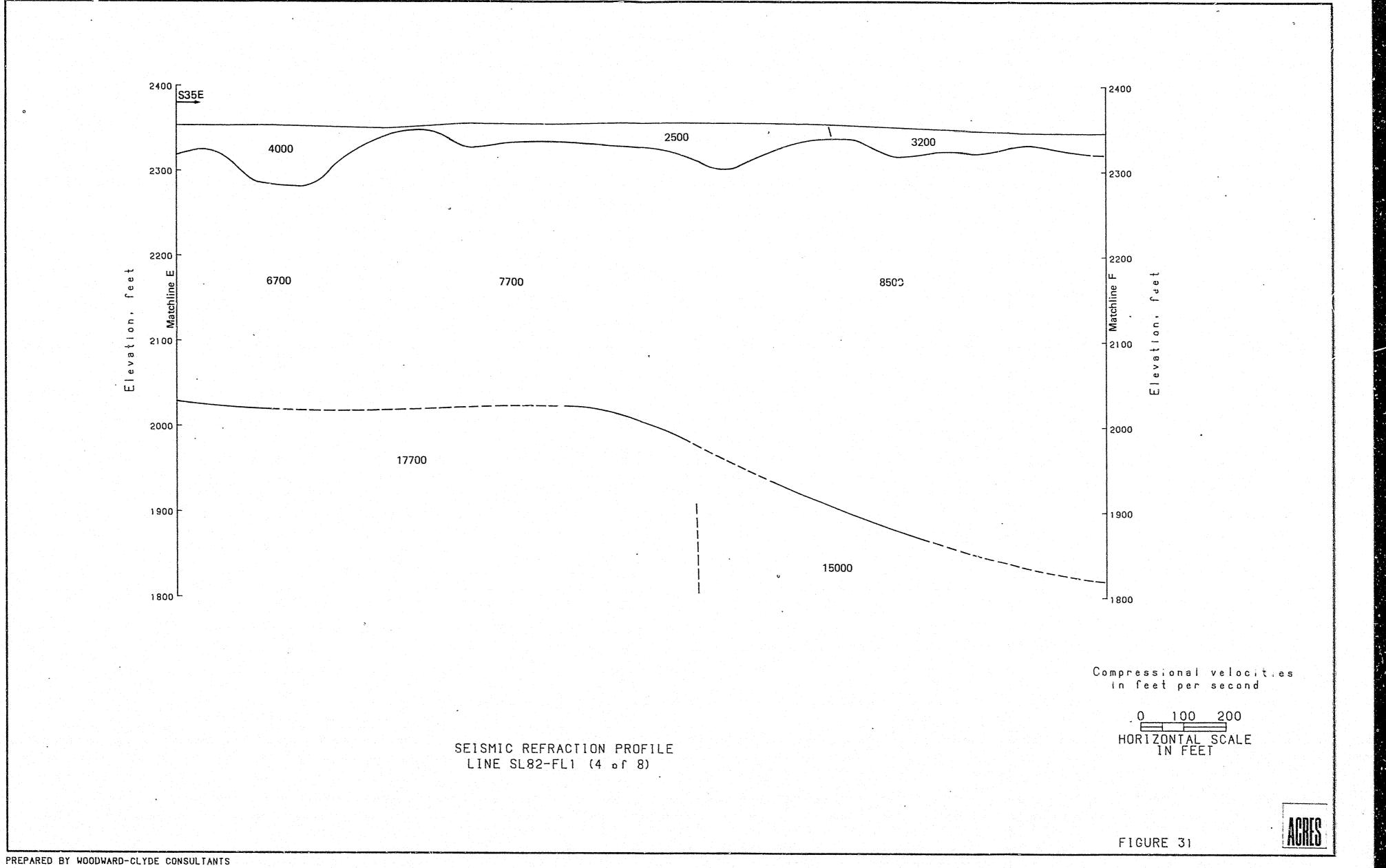
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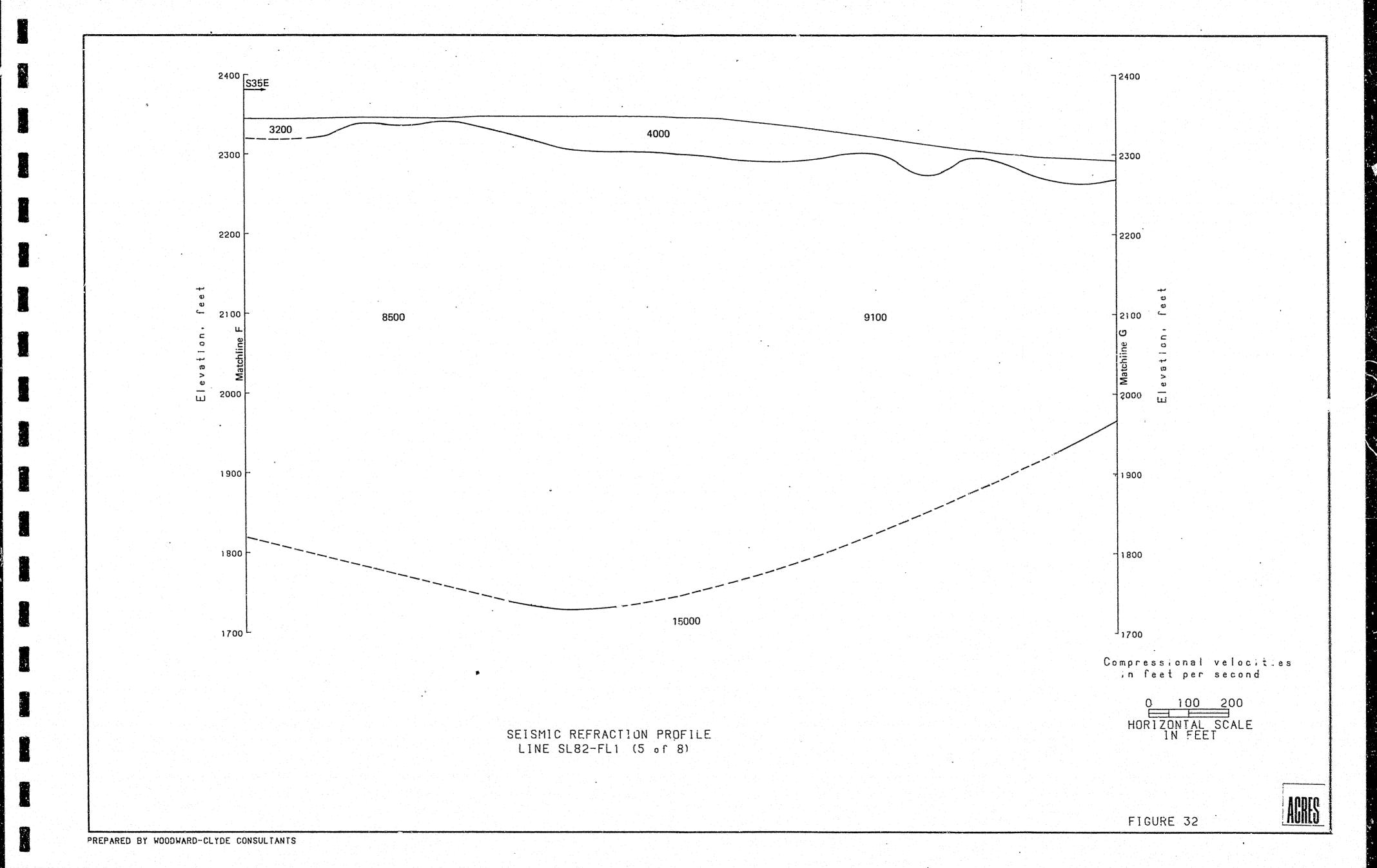


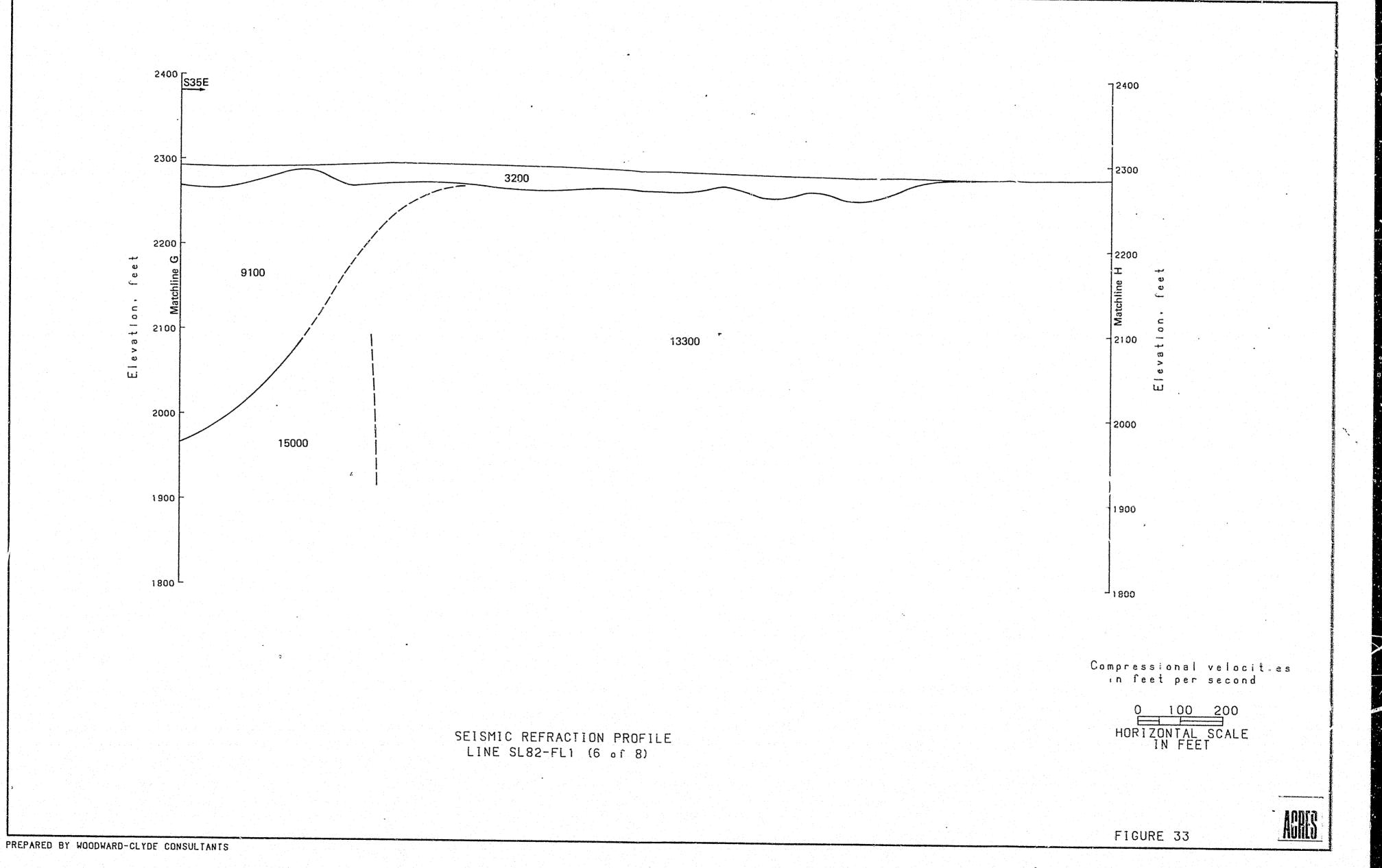


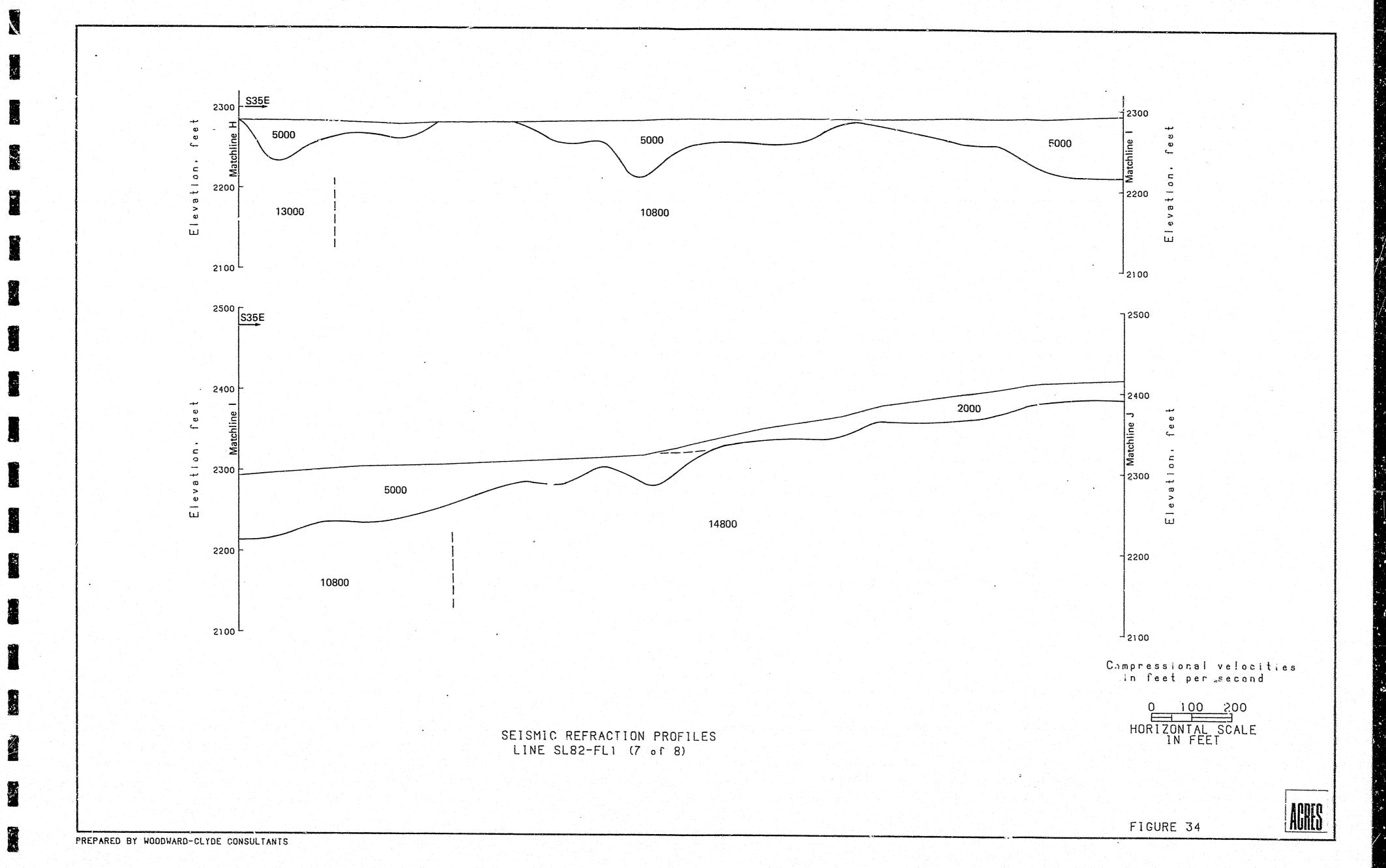


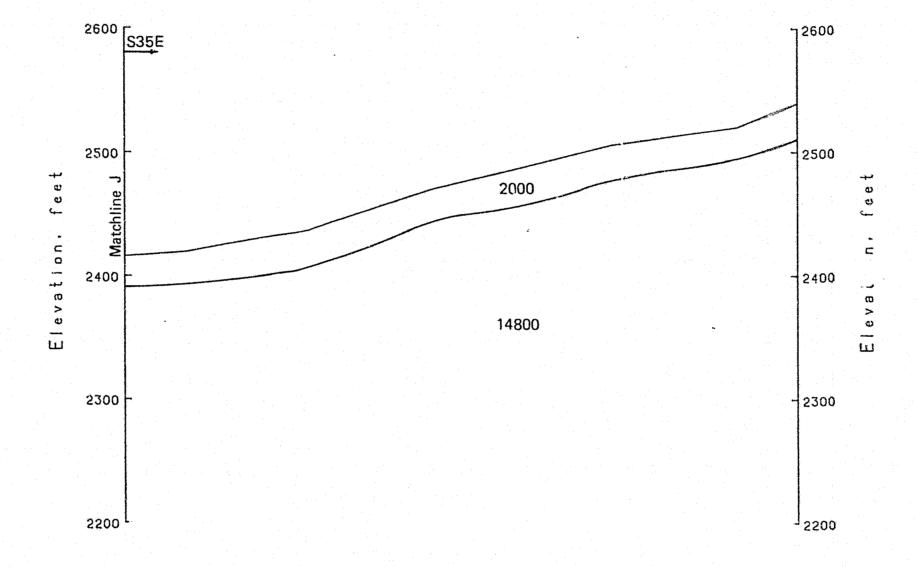










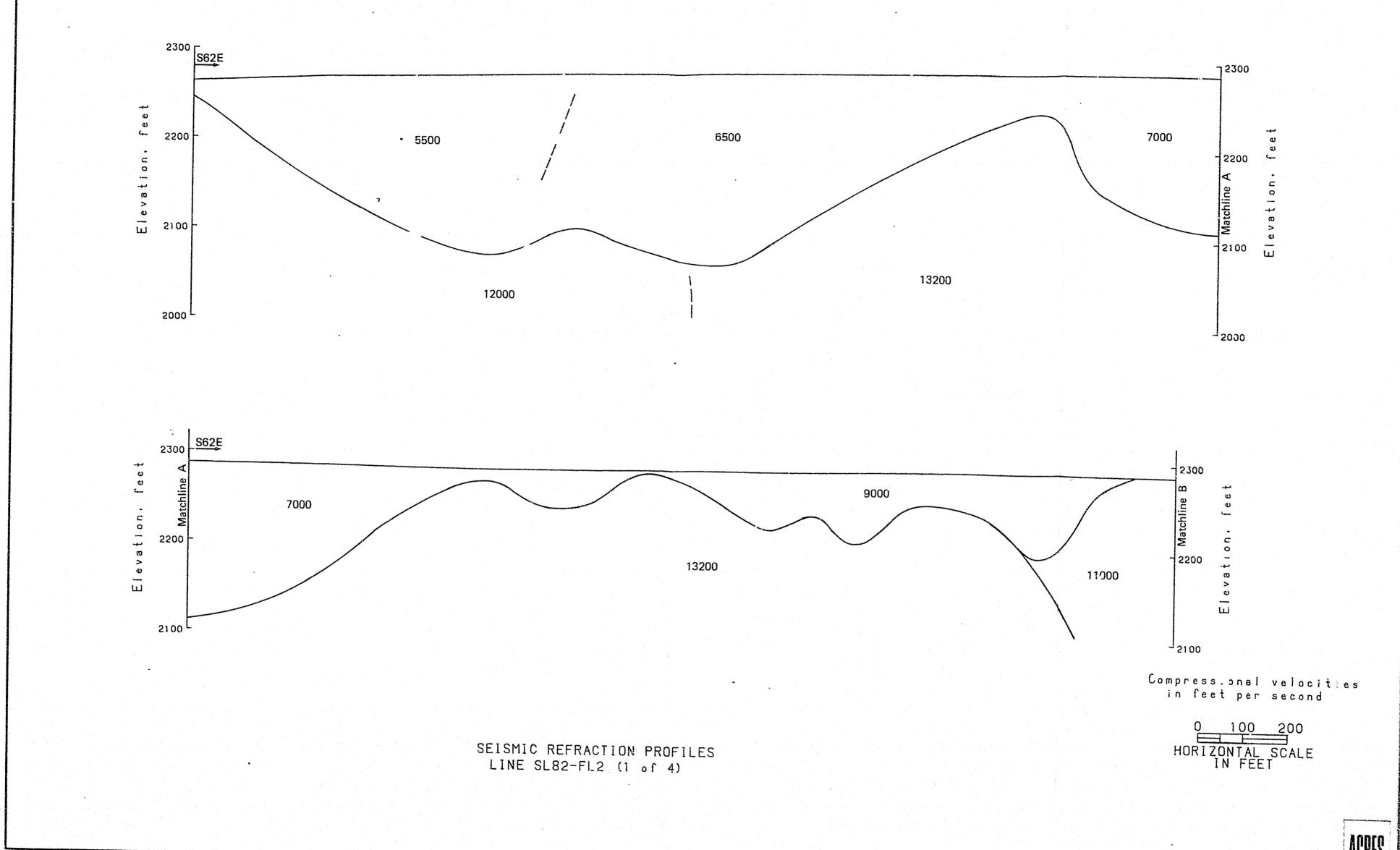


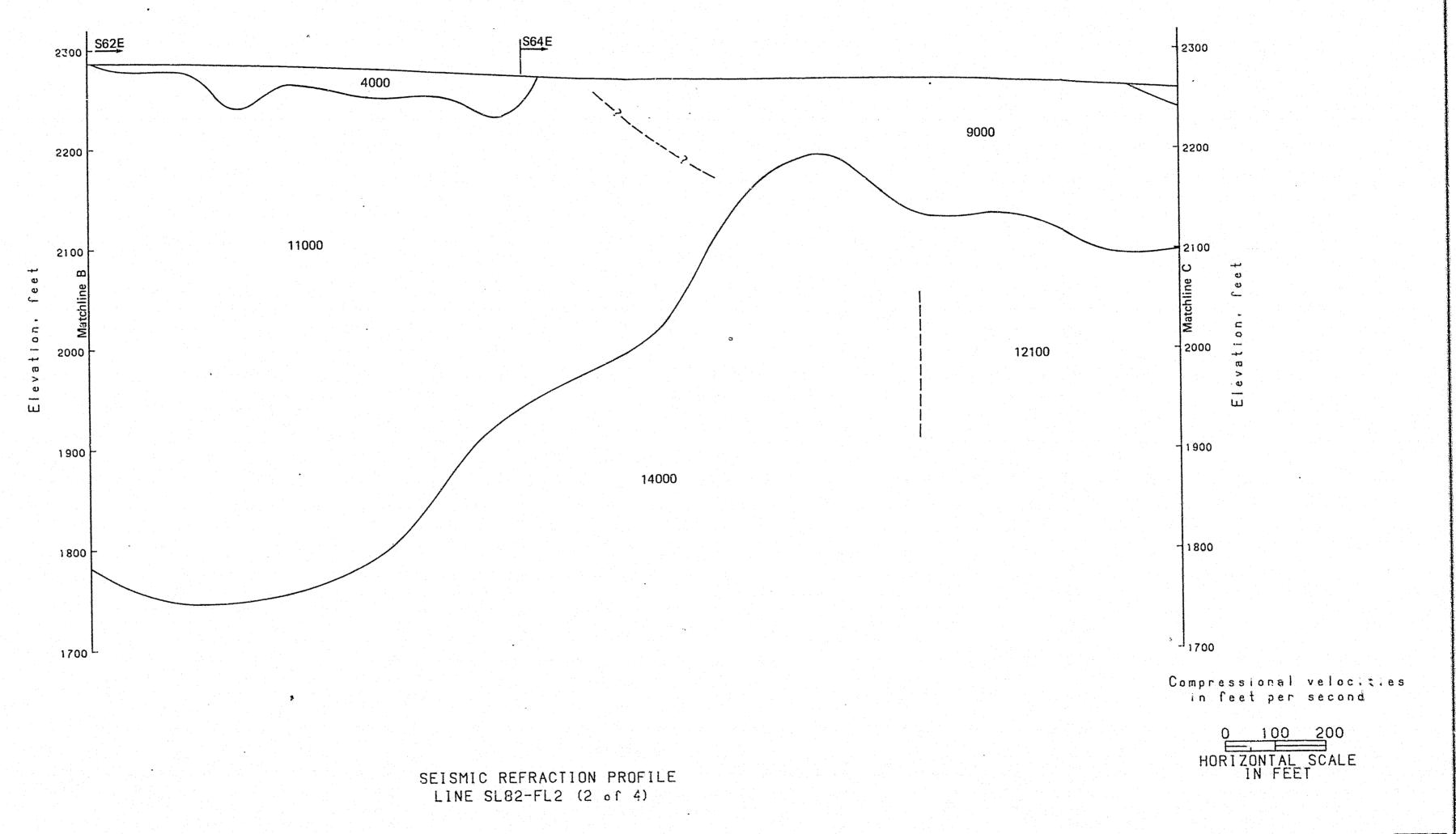
SEISMIC REFRACTION PROFILE LINE SL82-FL1 (8 of 8)

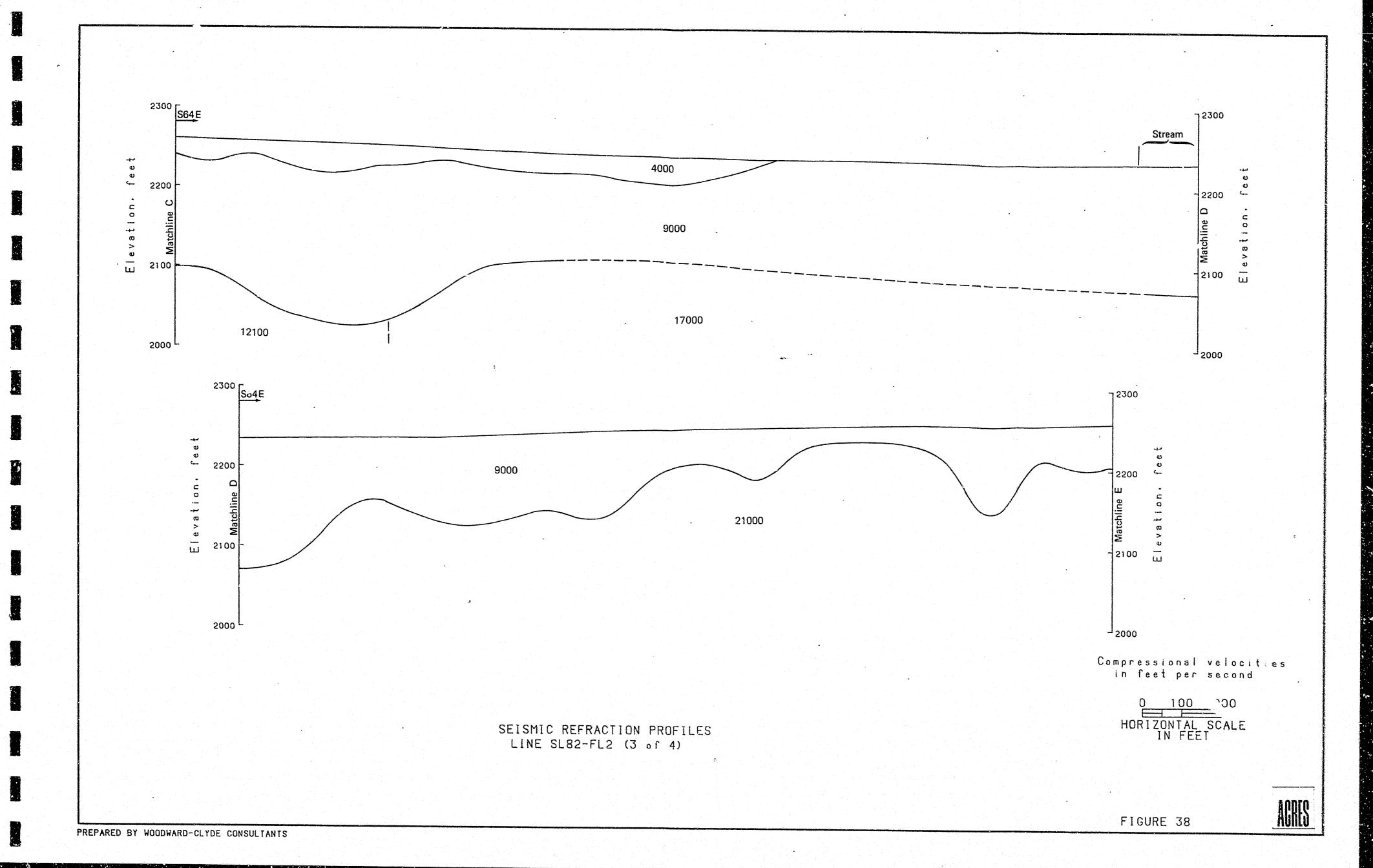
Compressional velocities in feet per second

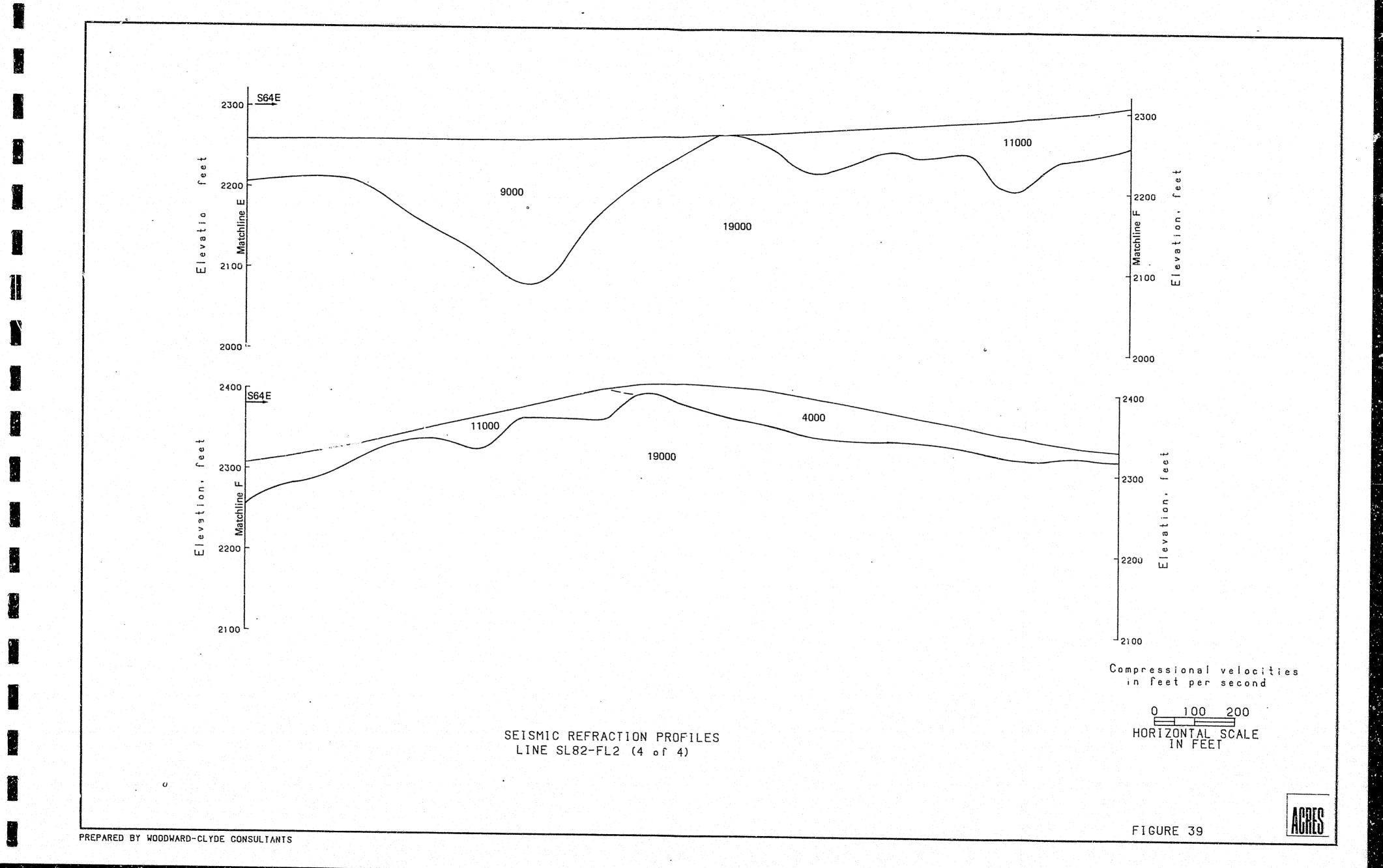
0 100 200 HORIZONTAL SCALE IN FEET

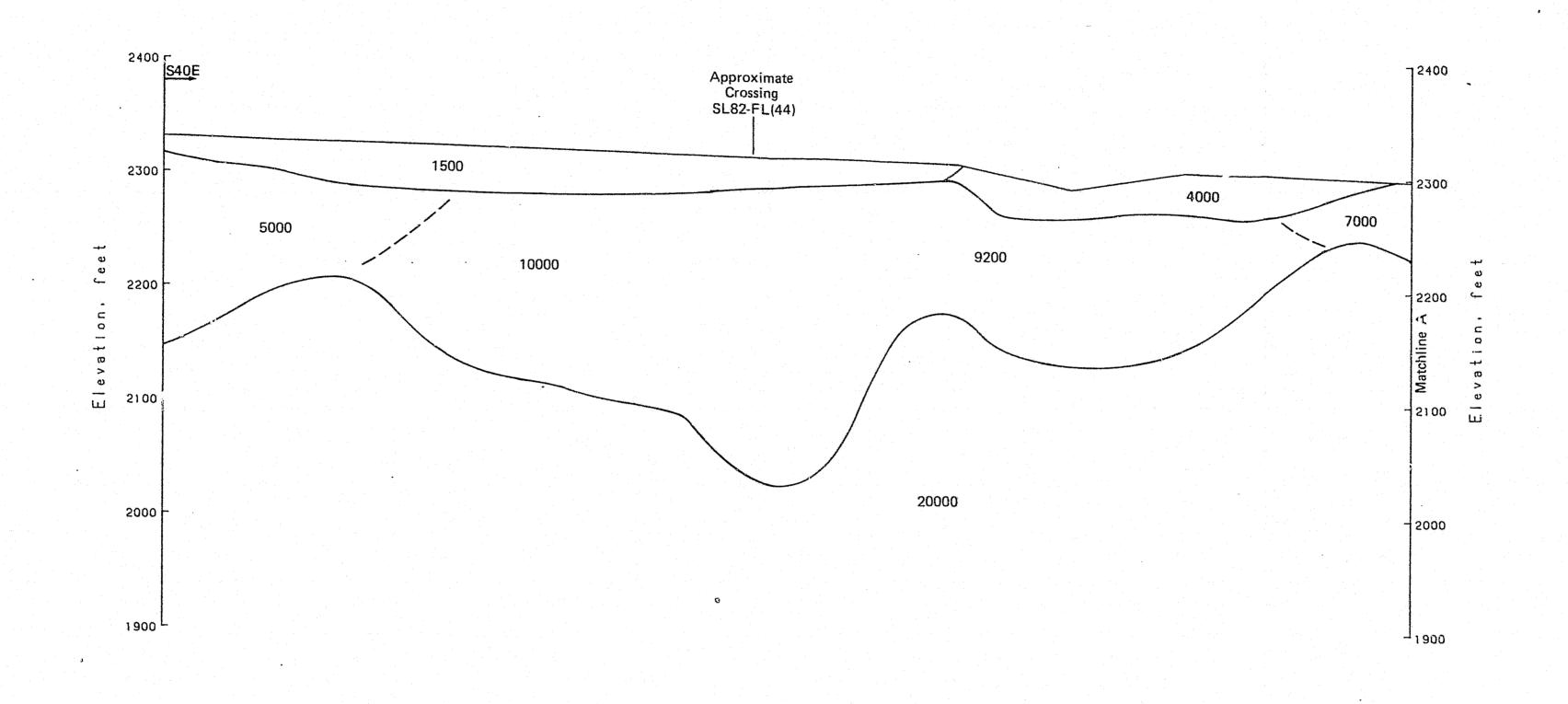
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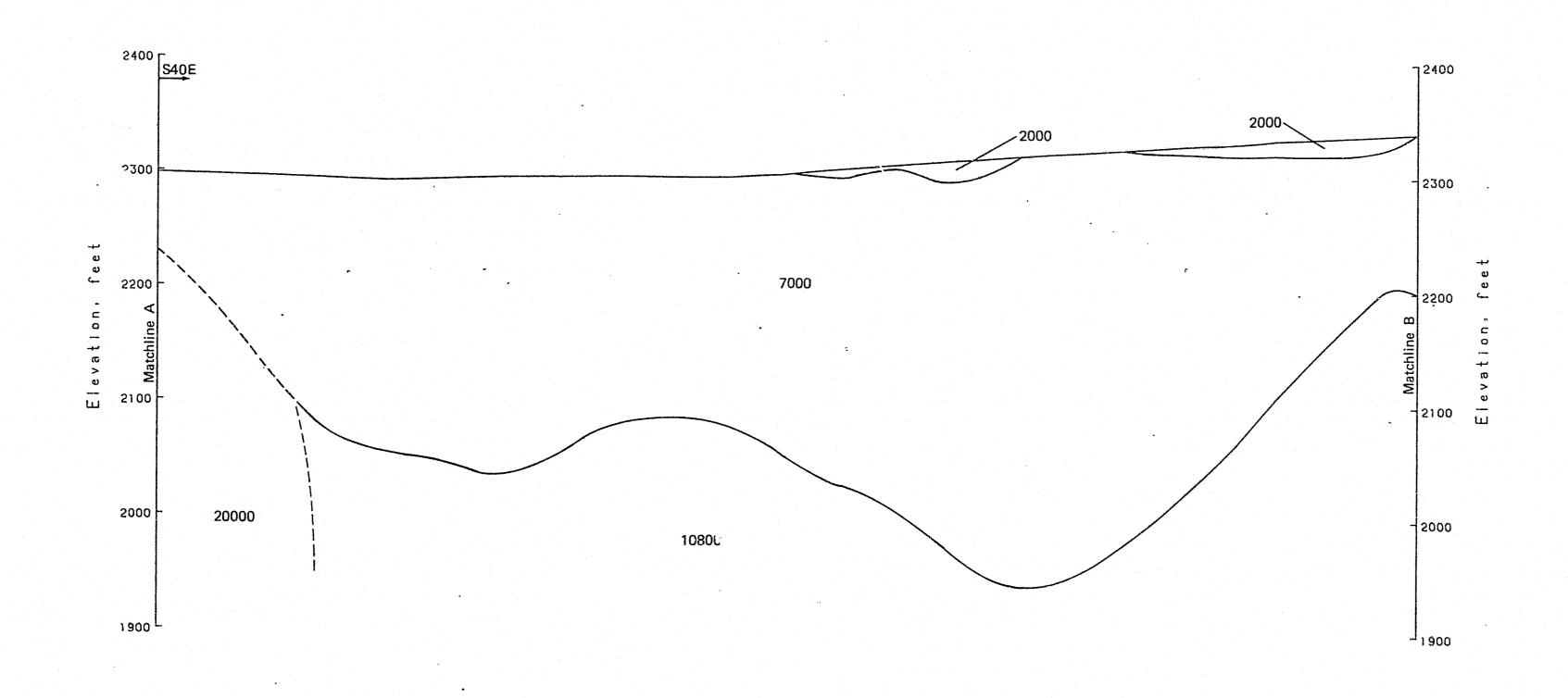


SEISMIC REFRACTION PROFILE LINE SL82-FL3 (1 of 3)

Compressional velocities in feet per second

0 100 200
HORIZONTAL SCALE
IN FEET

4 1 N 1 Junton 1



0 100 200
HORIZONTAL SCALE
IN FEET

SEISMIC REFRACTION PROFILE LINE SL82-FL3 (2 of 3)



