FIELD LOG OF BORING (CONTINUED)

SHEET 17 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE	Vis	Wt	pH	DEPTH	GRAPHIC LOG	
										311		Light Brown 5YR 6/4 Clayey Sand.
										2		fine to medium grained sand.
										3		a few coarse grains, subangular to
												subround, gap graded, manganese? oxide
												staining on quartz
										4		medium and coarse fraction 95% to less
												quartz, fine grains of biotite
										315		I don't see any feldspar grains
												40% medium 30% fine sand
										6		30% clay, clay decreasing w/depth
												(316 to 315 bgs)
										7		
												Some coarse
										8		mica feldspars, with silt.
												(315 to 320 bgs)
										9		
										320		
				Mud Engineer								Silty
						↳	41	8.4	8.0			
	CORE									1	SC	Light Brown 5YR 6/4 clay Sand.
											SM	fine to coarse grained sand, subround,
										2	SP/SM	gap graded, with gravel, Dg apperance
	321		6	6	G							layers with abundant gravel (Sand, gravel (SP)
			F	F	O					3	SP/GP	or gravelly (SP) sand) gravel is composed of
	TO		E	E	O							granitic fragments that are
			E	E	D					4		subangular to subround
	↓		T	T								quartz, biotite, feldspar, oxides?
										325		clay content decreasing w/depth
	↓											from 321 to 325 we have a silty
										6	GW/GP	clayey sand (SC) which grades into
	327											a silty Sand which is interbedded with
										7		and grades into a Sand w/gravel
												which is interbedded w/sandy gravel
										8		layers. At 327 we have a
												gravelly sand with minor clay/silt
										9		
												Light Brown 5YR 6/4 Sand (SP)
					17so		41	8.5		330	SP	(325 to 330 bgs)

FF8

HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 18 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										331		Light Brown 5Y 6/4 Sand (SP)		
										2		fine to coarse grained, subangular to		
												subround, well graded, with gravel		
										3		gravel composed of granitic fragments		
												coarse sand is mostly quartz and granitic		
										4		fragments.		
												quartz, biotite, feldspar (sericite)		
										335		10% gravel 85% sand 5% silt/clay.		
												(330 to 335)		
										6				
												same, minor gravel		
										7		5% gravel 85% sand 5 to 10% silt/clay		
												small biotite and feldspar grains		
										8		medium - feldspar and quartz		
												coarse - quartz granitic fragments		
										9		(335 to 340 bgs)		
										340				
												same, no gravel, app graded		
										1		95% sand, 5 silt/clay		
												(340 to 345 bgs)		
										2				
										3				
										4				
										345				
												same, mostly fine to medium grained		
										6		some coarse grained		
												80% fine and 15% coarse,		
										7		5% silt/clay		
												(345 to 350 bgs)		
										8				
												clay content increasing		
										9				
										350				

FF8

HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 19 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	
										35 1		
												Light Brown 5YR 6/4 Sand (SD) with clay
										2		fine to coarse grained, subangular to
											SD	subround, gap graded to well graded,
										3		quartz, feldspar, biotite,
												50% fine 30% med 15% coarse.
										4		5% silt/clay
												(350 to 355 bgs)
										355		grain size decreasing ↓
										6	SD SM	Same, fine to medium grained (SD-SM)
												90% sand 10% silt/clay
										7		(355 to 360 bgs)
										8		grain size decreasing.
										9		
										360		
					2000		42	8.5				Same (SD-SM) no clay
										1		(360 to 365 bgs)
										2		
										3		
										4		
										365		
										6		Same (SD-SM)
												90% sand 10% silt
										7		60% fine ↓
												30% med ↓
										8		(365 to 370 bgs)
												grading into fine grained
										9		material, clay content increasing
										370		

FF8

HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 20 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D	COND.	D.RATE	Vis	Wt	pff	DEPTH	GRAPHIC LOG	
										371		Pale yellowish brown 10YR 6/2
										2		Silty Clayey Sand (SC)
												fine to medium grained sand, subangular
										3		to subround grains, mostly poorly sorted
												quartz, biotite, feldspar?
										4		20% medium - 50% fine sand
												10% silt 20% clay
										375		(370 to 375 bgs)
										6		Same, Clay Sand (SC)
												10% med 60% fine sand/silt
										7		30% clay
												grain size decreasing.
										8		(375 to 390 bgs)
										9		Sand grain size decreasing.
										380		Same, Clay Sand. Sandy Clay
										1		mostly fine grained sand w/ some
												medium grains. grain composed mostly
										2		of quartz and some biotite.
												65% sand 35% clay
										3		(380 to 385 bgs)
										4		
										385		
												Same as indicated above
						26 ft/hr				6		60% sand/silt 40% clay
												(385 to 390 bgs)
										7		
												gradational interface btw. Clay Sand
										8		and Sand Clay
										9		
					2000		43	8.5	8.0	390		

FF8

HARDING-LAWSON ASSOCIATES

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FIELD LOG OF BORING (CONTINUED)

PROJECT:

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D	COND.	D.RATE	Vis	Wt	pH	DEPTH	GRAPHIC LOG	
										391		Dk Yellowish Brown 10YR 4/2 Sandy Clay
										2		fine grained sand, subround,
												30% sand/silt 70% clay
										3		(390 to 395 bgs)
										4		
										395		
												Sand,
										6		20% sand/silt 80% clay
												(395 to 400 bgs)
										7		gradational change from sandy clay
												to a clay w/sand
										8		
										9		
										400		
										1		Siltst., clay w/sand
												10 to 15% sand/silt 90% clay
										2		(400 to 405 bgs)
										3		
										4		
										405		
										6		
										7		Silt (ML)
	CORE											
			6	6						8		Soft, medium bedded,
												25% biotite, non plastic, slightly cohesive,
										9		slightly moist. When dry: Pinkish gray (5YR 8/1)
	407 to		FEET	FEET								Breaks @ 417.3, 418.3, 418.9, 419.1, 410.1,
										410		410.6, 411.0, 411.8, 412.3. Core from
												412.8 to 413.0 is broke to remove from bit.

FF8

HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 22 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D	COND.	D.RATE	V_{is}	Wt	pH	DEPTH	GRAPHIC LOG	
										41		Possible bedding partings dipping 10° (relative to horizontal)
	413											@ 407.5' (Broke during handling),
										2		408.1' (Broke while handling),
												410.6'
										3		
										4		
										415		Sandy Silt (ML)
												Moderate olive brown (5 Y 4/4)
										6		10% fine sand, non plastic.
												(sample bag 415-420')
										7		
										8		
										9		
										420		Sandy silt (ML)
					2000		40	8.5	8.5	1		Same as 415-420'
												(sample bag 420-425')
										2		
										3		
										4		
										425		Clayey Silt with sand (ML)
										6		Same as 415-420' except:
												less sand
										7		cuttings are balling slightly
												(sample 425-430')
										8		
										9		
										430		

FF8

HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 23 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D	COND.	D.RATE			pH	DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										431		Clayey Silt with ~~Sa~~ sand (ML)		
										2		same as 425-430'.		
										3		(sample 430-435')		
										4				
										435		Clayey Silt with sand (ML)		
										6		same as 425-430'		
										7		(sample bag 435-440')		
										8				
										9				
									8.5	440		Clayey silt with sand (ML)		
										1		same as 425-430'		
										2		(sample bag 440-445')		
										3				
										4				
										445		Clayey silt with sand (ML)		
										6		same as 425-430'		
										7		(sample bag 445-450')		
										8				
										9				
										450				

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HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED).

SHEET 24 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND. $\frac{in}{hr}$	D.RATE	Vis	Wt	pH	DEPTH	GRAPHIC LOG	
					2000		32	8.5		451		Clayey silt with sand (ML)
										2		
												same as 425-430' (sample bag 450-455')
										3		
										4		
										455		
												Clayey silt with sand (ML) same as 425-430' (sample bag 455-460')
										6		
										7		
										8		
						18 ft/hr				9		
										460		
												Clayey silt with sand (ML)
										1		
												same as 425-430' (sample bag 460-465')
										2		
										3		
										4		
										465		Clayey silt with sand (ML)
										6		same as 425-430' (sample bag 465-470')
										7		
										8		
										9		
										470		

FF8

HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED).

SHEET 25 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE	Vis	wt	pH	DEPTH	GRAPHIC LOG	
										471		Clayey silt with sand (ML)
										2		same as 425-430' (sample bag 470-475')
										3		
										4		
										475		
										6		Clayey silt with sand (ML) moderate olive brown (5Y 4/4) 10% sand, fine to medium grained (increasing sand content and grain size) (sample bag 475-480')
										7		
										8		
										9		
					2000		38	8.5		480		Clayey silt with sand (ML)
										1		same as 475-480' (sample bag 480-485')
										2		
										3		
										4		
										485		Silt with sand and clay (ML)
										6		same as 475-480' except less cohesion, balling (sample 485-490')
										7		
										8		
										9		
										490		

FF8

HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 26 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D	COND. (1)	D.RATE	V.e	Wt	pH	DEPTH	GRAPHIC LOG	
										491		Clayey Silt with sand (ml)
										2		same as 475-480' (sample bag 490-495')
										3		
										4		
										495		Clayey Silt with sand (ML)
										6		same as 475-480' (sample bag 495-500')
										7		
										8		
										9		
										500		clayey Silt with sand (ML)
										1		same as 475-480' (sample bag 500-505')
										2		
										3		
										4		
						18 ft/hr				505		Clayey silt with sand (ML)
										6		same as 475-480' (sample bag 505-510')
										7		
										8		
										9		
					2000		40	8.5		510		

FF8

HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 27 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										510		Clayey silt with sand (ML)		
										2		same as 475-480' except more sand (15% fine sand)		
										3		(sample bag 510-515)		
										4				
										515		Clayey, sandy silt (ML)		
										6		Moderate olive brown (5Y 4/4)		
										7		10-25% fine to coarse grained sand, angular to subrounded; qtz, hornblende, and granite grains.		
										8		(sample bag 515-520')		
										9				
										520		Clayey, sandy silt (ML)		
										1		same as 515-520'		
										2		(sample bag 520-525')		
										3				
										4				
										525		clayey, sandy silt (ML)		
										6		same as 515-520'		
										7		(sample bag 525-530')		
										8				
										9				
										530				

FIELD LOG OF BORING (CONTINUED)

SHEET 28 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE	Vis	Wt	pH	DEPTH	GRAPHIC LOG	
										531		Clayey, sandy Silt (ML)
										2		Same as 515-520' (sample bag 530-535')
										3		
										4		
										535		Clayey, sandy Silt (ML)
						23 ft/hr				6		same as 515-520' (sample bag 535-540')
										7		
										8		
										9		
					5000		41	8.6		540		Clayey silt w/ trace sand (ML) Moderate olive brown (5Y 4/4) Contains trace of fine sand. Cuttings are stiffer. (sample bag 540-545')
										1		
										2		
										3		
										4		
										545		clayey silt w/ trace sand (ML)
										6		same as 540-545' (sample bag 545-550')
										7		
										8		
										9		
										550		

FIELD LOG OF BORING (CONTINUED)

SHEET 29 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	EC COND.	D.RATE	Vis	LH	pH	DEPTH	GRAPHIC LOG	
	CORE 551 TO 552		100%	100%	P				8.0	550		Light olive gray 5Y 5/2 clayey Sand (SC) fine grained sand with some medium grains, subangular to round, poorly graded medium grains mostly quartz abundant biotite in the fine grain fraction w/silt at 552 ft some feldspar
										3		
										4		quartz, feldspar, biotite, amphibole? 3% medium - 62% fine sand & silt 30% clay. There are fine grains of some minerals that I cannot identify. They are a greenish mineral and a opaque white or rust (oxide?) mineral. The grains are most round and weathered for difficult ID. slight $CaCO_3$ cementation effervescence w/ addition of HCL
										555	SC	
										6		
										7		
										8		
										9		same, fine to medium grained occasional gravel gravel is same in composition (555 to 560 bgs)
										560		
										1		Light Olive Gray 5Y 5/2 Silty Clay (CL) w/Sand fine grained sand most recognizable grains are subround quartz, and biotite 5% sand 35% silt 60% clay (560 to 565 bgs)
										2	CL	
										3		
										4		
										565		
										6		same, some medium grains 5% sand 40% silt 55% clay (565 to 570 bgs)
										7		
										8	CL	zones are silty, appears to be interbedded clayey silt and silty clay, majority is silty clay.
										9		
					1900		42	8.5		570		

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HARDING LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED).

SHEET 30 OF ____

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										571	CL	Sand, fine grained sand.		
										2		10% sand 40% silt 50% clay		
												(570 to 575 bgs)		
										3				
										4				
										575		Sand, occasional mud grains		
										6		(575 to 580 bgs)		
										7				
										8				
						40 ft/hr				9				
										580		Sand, fine grained sand		
										1		quartz and biotite are the major		
												recognizable grains.		
										2		silt content fluctuates, interbedded		
												silty layers.		
										3		5 to 10% sand 45% silt 45% clay.		
												(590 to 595 bgs)		
										4				
										585		Sand, % of clay and silt		
										6		fluctuates.		
												(595 to 600 bgs)		
										7				
										8				
										9				
										590				

FIELD LOG OF BORING (CONTINUED)

SHEET 31 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE	V.S	Wt	pH	DEPTH	GRAPHIC LOG	
										591		Light olive gray 5Y5/2 silty clay.
										2		w/sand, round to subround lithic fragments
												composed of quartz, biotite, feldspar,
										3		and apatite (?)
												10% sand 40% silt 50% clay.
										4		(590 to 595 bgs)
										595		
												same,
										6		quartz, biotite, feldspar, apatite?
												(595 to 600 bgs)
										7		
										8		
										9		
					1900		42	8.5		600		
												same,
										1		(600 to 605 bgs)
										2		
										3		
										4		
										605		
												same,
										6		(605 to 610 bgs)
						40 cy/hr						
										7		
										8		
										9		
										610		

FF8

HARDING-LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 32 OF ____

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	Ec COND.	D.RATE	Vis	wt	pH	DEPTH	GRAPHIC LOG	
										611		Light olive gray 5Y5/2 Silty clay w/sand fine to coarse sand.
										2		sand composed of granitic fragments and lithic fragments.
										3		granitic's composed of quartz, amphibole feldspar
										4		lithic frags composed of quartz, feldspar, biotite, apatite, (glass?)
										615		15% sand 85% silt/clay
										6		(610 to 615 bgs)
										7		same,
												(615 to 620 bgs)
										8		
										9		
										620		
										1		same,
												(620 to 625 bgs)
										2		
										3		
										4		
										625		
												same,
										6		(625 to 630 bgs)
										7		
										8		
										9		
					1900		42	8.5		630		

FF8

FIELD LOG OF BORING (CONTINUED).

SHEET 33 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										631		Sand, light olive gray 5Y5/2 Silty Clay w/sand fine to medium grained lithic fragments composed of quartz, biotite feldspar, granitic fragments quartz and amphibole (630 to 635 bgs) silt content decreasing.		
										635		Moderate yellowish brown Clay (CL) w/fine grained sand, subangular to subround, poorly graded, quartz, biotite, granitic and lithic grains, feldspar 10% sand 90% silt/clay (635 to 640 bgs)		
						40 ft/hr				640		Sand, sand content decreasing. <10% sand 90% silt clay (640 to 645 bgs)		
										645		Sand, silt content increasing 5% sand 95% silt/clay (645 to 650 bgs)		
										650				

FIELD LOG OF BORING (CONTINUED)

SHEET 34 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	EC COND.	D.RATE	Vis	wt	pH	DEPTH	GRAPHIC LOG	
										651		10YR 5/4
												Moderate yellowish brown Clay(CL)
										2		w/fine and occasional medium grained
												sand, subround to subangular, poorly sorted
										3		graded,
												quartz, biotite, feldspar
										4		10% sand 90% silt/clay
												(650 to 655 bgs)
										655		
												Same, fine grained sand
										6		5 to 10% sand 90% silt/clay
												(655 to 660 bgs)
										7		some of the apparently medium grains
												are cemented little fragments composed
										8		of quartz, biotite and feldspar
												cemented with $CaCO_3$? effervesses
										9		with addition of HCl
												sand content increasing
										660		
												Same, possibly a sandy clay minor gravel
										1		(660 to 665 bgs)
										2		
										3		Moderate yellowish Brown 10YR 5/4
												at 666 we have a clay w/sand sand is
										4		fine to medium grained w/occasional
										665		coarse grains composed of quartz, biotite
									8.0			feldspar, w/ granitic fragments, minor gravel
	CORE									6		at 667 we see a sandy clay/clayey sand
										7		fine to medium grained sand, subangular to
												subround grains, poorly sorted, slightly
	6666		6	4						8		indurate, $CaCO_3$ cementation? effervesses with
	TO		TIME	TIME	G							at 668 we have a clay w/minor sand, the
										9		clay is shelly, thinny laminated biotite
			T	0-2								and quartz grains are visible, the long axis
										670		of the biotite grains is parallel to the
	↓											bedding, pebbles aligned due to compaction

FIELD LOG OF BORING (CONTINUED)

SHEET 35 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE	Vs	Wt	pH	DEPTH	GRAPHIC LOG	
	670									671		Here appear to be sand rich layers, (sand stringers) composed mostly of quartz and biotite, formation clays (breaks) along these stringers.
										2		
										3		stringers may be 2 grains in thickness. clay is very hard, moist it does not look saturated or even wet
										4		
										675		Sandy silt (ML) moderate yellowish brown (10 YR 5/4). 10% fine ~~[illegible]~~ sand. (Sample 675 to 680')
										6		
										7		
										8		
										9		
										680		Sandy silt (ML)
										1		Increasing sand content to 20%. Sand coarsens to fine to coarse grained. Coarse grains are subangular quartz and hornblende.
										2		
										3		(sample bag 680 to 685')
										4		
										685		Sandy silt (ML)
										6		same as 680-685' (sample bag 685-690')
										7		
										8		
										9		
					1900		40	8.7		690		

FF8

FIELD LOG OF BORING (CONTINUED)

SHEET 36 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										691		Sandy silt (ML)		
										2		same as 680-685' (sample bag 690-695')		
										3				
										4				
						34 cy/hr				695		Sandy silt (ML)		
										6		Moderate yellowish brown (10 YR 5/4) Sand content increasing to 25% mostly med to coarse grained. (Sample bag 695 to 700')		
										7				
										8				
										9				
									7.5	700		Sandy Silt (ML)		
										1		same as 695 to 700' (sample bag 700-705')		
										2				
										3				
										4				
										705		Sandy Silt (ML)		
										6		same as 695 to 700' (sample bag 705-710')		
										7				
										8				
										9				
										710				

FF8

FIELD LOG OF BORING (CONTINUED)

SHEET 37 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE	Vis	Wt	pH	DEPTH	GRAPHIC LOG	
										711		Sandy SiH (ML)
										2		same as 695-700' (Sample bag 710-715)
										3		
										4		
										715		Sandy silt (ML)
										6		Decreasing sand content (10%)
										7		Grain size fines to fine to medium grained sand (sample bag 715-720')
										8		
										9		
					2000		40	8.7		720		Sandy SiH (ML)
										1		same as 715-720' (sample bag 720-725)
										2		
										3		
										4		
										725		Sandy SiH (ML)
										6		Increasing sand content (to 15-20%)
										7		Sand coarsening slightly (sample bag 725-730')
										8		
										9		
										730		

FF8

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FIELD LOG OF BORING (CONTINUED)

SHEET 38 OF ____

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND. EC	D.RATE	Vis	Lt	pH	DEPTH	GRAPHIC LOG	
										731		Silt (ML)
												Moderate yellowish brown (10 YR 5/4)
										2		trace fine sand. Biotite
												(sample bag 730-735')
										3		
										4		
										735		Silt (ML)
										6		Same as 730-735'
						34						(sample bag 735-740)
						ft/hr				7		
										8		
										9		
										740		Silt (ML)
										1		Same as 730-735'
										2		(sample bag 740-745')
										3		
										4		
										745		Silt (ML)
										6		Same as 730-735'
										7		(sample bag 745-750')
										8		
										9		
					2000		42	8.7	7.5	750		

FIELD LOG OF BORING (CONTINUED)

SHEET 39 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										751		Silt with sand and gravel (ML)		
												Moderate yellowish brown (10 YR 5/4)		
										2		Contains angular fragments of brown,		
												moderately hard siltstone. 20%		
										3		sand and gravel. Sand is fine		
												to medium.		
										4		(sample bag 750-755)		
										755				
												Silt with sand (ML)		
										6		10% fine-grained sand.		
										7		(sample bag 755-760)		
										8				
										9				
										760		Silt with sand and gravel (ML)		
										1		Same as 750-755'		
										2		(sample bag 760-765)		
										3				
										4				
										765		Silt with sand and gravel (ML)		
										6		Same as 750-755'		
										7		(sample bag 765-770)		
										8				
										9				
						HARD DRILLING 770-771'				770				

FF8

HARDING LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 40 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										771		Sandy Silt (ML) Moderate yellowish brown (10 YR 5/4) angular to subangular grains, fine to coarse grained, qtz, hornblende, K spar, chert (?) → 30% sand (sample bag 770-775)		
										2				
										3				
										4				
										775		Sandy Silt (ML) same as 770-775' (sample bag 775-780')		
										6				
										7				
						34 ft/hr				8				
										9				
										780		Sandy Silt (ML) same as 770-775' except increase of mafic (black) minerals. (sample bag 780-785')		
										1				
										2				
										3				
										4				
										785		Sandy Silt (ML) same as 770-775' (sample bag 785-790')		
										6				
										7				
										8				
										9				
										790				

EES

FIELD LOG OF BORING (CONTINUED)

SHEET 41 OF ____

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE	V_{is}	wt	pH	DEPTH	GRAPHIC LOG	
										79.1		Sandy Silt (ML)
										2		same as 770-775'
										3		(sample bag 790-795')
										4		
										79.5		Sandy Silt (ML)
										6		same as 770-775'
										7		decrease of sand content (10-20%) decrease of mafic grains
										8		(sample bag 795-800')
										9		
									7.5	80.0		Sandy Silt (ML)
										1		Moderate yellowish brown (10 YR 5/4)
										2		10-20% subangular to subrounded, fine to medium grained sand.
										3		(sample bag 800-805')
										4		
										80.5		Sandy silt (ML)
										6		
										7		Coarse sand consisting of angular, black chert (10%)
										8		(sample bag 805-810')
										9		
					2000		42	8.7		81.0		

FF8

FIELD LOG OF BORING (CONTINUED)

SHEET 42 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										81 1		Sandy Silt		
										2		same as 800-805'		
										3		(sample bag 810-815')		
										4				
										815		Sandy Silt		
						34 cy/hr				6		same as 800-805'		
										7		(sample bag 815-820)		
										8				
										9				
										820				
										1		Sandy Silt		
										2		same as 800-805'		
										3		(Sample 820-825')		
										4				
										825				
										6		same as above		
										7		(sample bag 825-830')		
										8				
										9				
										830				

FF8

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FIELD LOG OF BORING (CONTINUED)

SHEET 43 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										830				
												Same as 800-805'		
										2				
												(sample bag 830-835)		
										3				
										4				
										835				
										6		Same as 800-805'		
										7		(sample bag 835-840)		
										8				
										9				
										840				
										1		Same as 800-805'		
										2		(sample bag 840-845)		
										3				
						34				4				
						54								
						1hr				845				
										6		Same as 800-805'		
										7		(sample bag 845-850')		
										8				
										9				
										850				

FF8

HARDING LAWSON ASSOCIATES

FIELD LOG OF BORING (CONTINUED)

SHEET 44 OF ____

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	
										851		Moderate yellowish brown (10 YR 5/4)
										2		Increase of sand.
												30%, med to coarse grained,
										3		subangular to subrounded
												Qtz, Kspar, hornblende.
										4		
												(Sample bag 850-855')
										855		
										6		Same as 850-855'
										7		(Sample bag 855-860')
										8		
										9		
										860		
										1		Same as 850-855'
												(Sample bag 860-865')
										2		
										3		
										4		
									7.5	865		
	CORE											865': Sand with gravel. (SW)
										6		Pale yellowish brown (10 YR 6/2),
												95%, fine to coarse grained sand, well-graded,
	865		6	6.4						7		Quartz, Kspar, hornblende, epidote, biotite
												fragments, 5% gravel, subangular qtz,
												largest diameter 20 mm. Sand is moist.
										8		
	6		FEET	FEET	GOOD							868.3': Coarse sand with gravel (SP)
												Pale yellowish brown (10 YR 6/2)
										9		80% med to coarse grained sand, 20% gravel
												868.7': Same as 865'
										870		870.5': Gravelly sand with silt matrix. (SM)

FF8

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FIELD LOG OF BORING (CONTINUED)

SHEET 44 OF

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	
										851		Moderate yellowish brown (10 YR 5/4)
										2		Increase of sand.
												30%, med to coarse grained,
										3		subangular to subrounded
												Qtz, Kspar, hornblende.
										4		
												(Sample bag 850-855')
										855		
										6		Same as 850-855'
										7		(Sample bag 855-860')
										8		
										9		
										860		
										1		Same as 850-855'
										2		(Sample bag 860-865')
										3		
										4		
									7.5	865		
	CORE									6		865': Sand with gravel. (SW)
												Pale yellowish brown (10 YR 6/2),
	865		6	6.4						7		95%, fine to coarse grained sand, well-graded,
												Quartz, Kspar, hornblende, epidote, lithic
												fragments, biotite 5% gravel, subrounded qtz,
										8		largest diameter 20 mm. Sand is moist. Massive
	6		FEET	FEET	GOOD							868.3': Coarse sand with gravel (SP)
										9		Pale yellowish brown (10 YR 6/2)
												80% med to coarse grained sand, 20% gravel
										870		868.8': Sand as 865'
												870.5': Gravelly sand with silt matrix. (SM)

FIELD LOG OF BORING (CONTINUED)

SHEET 45 OF ____

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	EC COND.	D.RATE	Vis	Wt	pH	DEPTH	GRAPHIC LOG	
	871									874		35% Gravel is composed of quartz and granite, 60 mm max size; 50% fine to coarse grained sand, same lithology as previous. Also moist. Moisin.
										2		
										3		— KR
										4		Serious rig chatter ± 874 boulders, cobbles stream ± 875
										875		bright olive gray 5Y5/2 Sandy (clay sand?)
										6		fine to coarse grained, round to subangular, well graded, with clay and silt
										7		rig chatter ± 877 at 877.5
										8		quartz, feldspar, biotite, opaque, amphibole? lithic & aquatic fragments. 90% sand 10% clay/silt
										9		(875 to 880 bgs)
										880		
										1		Same, slight CaCO3 cementation, effervesces w/ HCl
										2		(880 to 895 bgs)
										3		
										4		
										895		Same — fine grained fraction increased
										6		95% sand 5% silt clay
										7		(895 to 900 bgs)
										8		
										9		
					2000		41	85		900		

FIELD LOG OF BORING (CONTINUED)

SHEET 46 OF ____

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO. B-9
										891		Light Olive Gray 5Y5/2 Sand		
												fine to coarse grained, round to		
										2		subangular, well sorted, with silt and clay?		
												quartz, feldspar, biotite, hornblende, apatite,		
										3		granitic fragments.		
												90% sand 10% silt clay		
										4	SP	30% coarse 30% med 30% fine - sand		
												(890 to 895 bcg)		
										895				
										6		same,		
												coarse fraction - quartz and lithic fragments		
										7		fine and med - quartz, biotite, feldspar, hornblende		
										8		(895 to 900 bcg) rig chatter at 898		
										9		ok at 899		
									7.5	900		Moderate Yellowish Brown 10YR5/4 Clayey Sand	SC	
												~~or Sandy Clay~~ rig chatter at 900.5		
										1	SC	fine to coarse grained, round to subangular		
												ok at 901.5		
										2		rapgraded		
												65% sand 35% silt clay		
										3		10% coarse 25% med 30% fine - sand		
												(900 to 905 bcg)		
										4				
										905				
												same, subangular feldspar		
										6		round to subround rig chatter 905		
												quartz, apatite, ok at 906		
										7		granitic fragments, some CaCO3		
												concretions of fine grained material		
										8		70% sand 30% silt/clay		
												15% coarse 25% med 30% fine - sand		
										9				
												silt/clay content decreasing.		
										910				

FIELD LOG OF BORING (CONTINUED)

SHEET 47 OF ____

PROJECT: | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.(ft)	D.RATE	Vis	Wt	pH	DEPTH	GRAPHIC LOG	
										911		Moderate Yellowish Brown 10YR 5/4 Sand
												fine to coarse grained, round to
										2		subangular, well sorted, w/silt
												quartz, feldspar, biotite, epidote,
										3		hornblende, granitic & lithic fragments
												some $CaCO_3$ cementation of fine grains
										4		60% sand 10% silt/clay
												20% coarse 35% med 35% fine sand
										915		(910 to 915 bgs)
										6		Same grain size decreasing slightly
												not as much coarse grained
										7		material.
												(915 to 920 bgs)
										8		fine grained fraction increasing
										9		grading into a clay sand
										920		same color, clayey sand
												fine to coarse sand, round to subangular
										1		poorly graded, many of the coarse grains
												are actually cemented fine grains
										2		that does not effervesce w/HCL
												same mineralogy as above silt/clay
										3		20 to 25% sand 15 to 20% rig chatter
												as
										4		(920 to 925 bgs)
										925		
												same as above
										6		(925 to 930 bgs)
										7		
										8		clay content decreasing
										9		
										930		

FIELD LOG OF BORING (CONTINUED)

SHEET 48 OF ____

PROJECT: ENSCO | NO. | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	EC COND.	D.RATE	Vis	Wt	pH	DEPTH	GRAPHIC LOG	
									7.5	931		Moderate Yellowish Brown 10YR5/4 Sand Silt/or Clay Sand, fine to medium
										2		grained w/occasional coarse material
												some of granular material
										3		is cemented fine grained material w/
												quartz, biotite, feldspar crystals in
										4		a clay or silt matrix, some balling
												of the sample. (I think it is a
										935		Clayey Silty Sand)
												(930 to 935 bgs)
										6		
												Grayish Red Purple 5RP4/2 Rhyolite
										7		effervesces w/HCl there are also
												fragments of Medium bluish gray 5B5/1
										8		Rhyolite, several of the blue gray
												cuttings show flow structure,
										9		mineralization along elongated
												vesicles (very thin 1mm),
										940		flow banding
												(935 to 940 bgs)
										1		
												Some
												(940 to 945)
										2		blue gray rhyolite is very
										3		
										4		
												Moderate reddish brown 10R4/6 Rhyolite
										945		horizontal and vertical fractures.
												filled with secondary mineralization
							43	8.5	7.0			some quartz (cristobalite), vesicules appear to be
	CO									6		elongated in the direction of flow.
										7		they also are fill with secondary minerals
	RE 946		4 FT	3.5 FT	G							at 947.5 granitic phenocrysts are
										8		observed they are subangular to
	TO		FT	FT	OOD							angular, looking at a cross section
										9		euhedral to subhedral quartz can be
	↓ 950		T	T	D							seen lining a fracture/vesicle,
										950		vugs

FIELD LOG OF BORING (CONTINUED)

SHEET 49 OF

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE	VIS	wt	pH	DEPTH	GRAPHIC LOG	PROJECT: ENSCO	NO. 18396	BORING NO. B-9
												Rhyolite		
										951		porphyritic (with med. grained phenocrysts)		
												aphanitic groundmass, flow structures		
										2		(poss flattened lapilli?), granite inclusions		
												sanidine, quartz, biotite - total 10-15%?)		
										953		Lost circulation - no returns.		
										4				
												drilling w/o circulation		
										955				
										6				
										7		(drilling to generate cuttings		
												to help clog downhole		
										8		openings and stem circulation		
												loss)		
										9				
										960				
										1				
										2				
										3				
										4				
										965				
										6				
										7				
										8				
										9				
										970				

FIELD LOG OF BORING (CONTINUED)

SHEET 50 OF

PROJECT: ENSCO | NO. 15396,00 | BORING NO. B-9

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D.	COND.	D.RATE	Vis	wt	pit	DEPTH	GRAPHIC LOG	
							~60			971		No circulation
										2		↓ no returns
										3		
										4		
										975		
										6		
										7		
										8		
										9		
										980		End drilling. 23:00 11/16/87 (end of effort to restore lost circulation)
										1		
										2		
										3		
										4		
										5		
										6		
										7		
										8		
										9		
										0		

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LOG OF BORING B-10

SHEET 1 OF 13

PROJECT	LOCATION	ELEVATION	PROJECT NO.
ENSCO	C(4-1)32abd	1405	08701260
DRILLING AGENCY: Stewart Bros.	FOREMAN: Randy Stewart	DATE STARTED: 10/30/87	DATE FINISHED: 11/4/87
DRILLING EQUIPMENT: Failing 2500		BEDROCK DEPTH: 1000 FT.	COMPLETION DEPTH: Abandoned
CASING: NONE	SCREEN: NONE	BORING ANGLE: Vertical	INSPECTOR: MFG

SAMPLES: Cuttings > 5-FT. intervals; core > Various intervals, As Noted

WATER LEVEL	FIRST	COMP.	24 HR.
	N/A	N/A	N/A

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SANDY CLAY - 70% Lt Brown clay, 30% v. coarse sub-angle to subrnd felsic sand		0				Drilling mud-rotary with 6¼-inch mill tooth bit, No surface casing
		5				
CLAYEY SAND - SAME AS Above, except 80% v. coarse sand, 20% clay		10				
SANDY clay - SAME AS 0-10 Ft., except 90% clay, 10% sand		15				
CLAYEY SAND - SAME AS 10-15 FT		20				
SANDY CLAY - SAME AS 15-20 FT Except 35% sand, 65% clay		25				
SANDY Gravel - poorly sorted, angular felsic sand and gravel		30				
		35				
		40				
SANDY clay - 40% very coarse, angular felsic sand. 60% lt. Brn clay		45				Decrease in sand grain size downward (45-55 Ft.)
		50				
CLAYEY Sand - 75 to 80% v. coarse, subangular felsic sand, 25% lt. Brn clay		55				Decrease in sand grain size downward (55-65 Ft)
		60				
90% sand		65				

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LOG OF BORING B-10

SHEET 2 OF 13

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SAND - SAME AS Above, except 90% SAND, 10% CLAY		65				Drilling fluid visc. = 33 sec/qt
CLAYEY Gravel - 65% Felsic angular gravel. 35% Brn. clay		70				Resistivity = 230 ohms
		75				
SANDY CLAY 10% coarse felsic sand 90% lt. Brn silty clay		80				
CLAYEY SAND - 70-80% v. coarse felsic sand. 20-30% Light tan clay		85			120 FT/HR	Clay does not react to HCl
		90				
		95				
		100				
some optical Qtz. XL's						
CLAYEY SAND - SAME AS Above, except clay is darker, and contains 10% gravel		105				
		110			100 FT/HR	5/3
		115				
		120				
		125			80 FT/HR	Drilling fluid resistance = 45 ohms
		130				
		135				
		140				
		145				

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LOG OF BORING B-10

SHEET 3 OF 13

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SAND med to coarse, well sorted, sub rnd., felsic sand, 5% clay		145				
SAND - SAME AS Above, except coarser		150				
CLAYEY Gravel - Felsic, angular gravel (5-10 mm) and 10% clay		155				
20% clay		160				
Gravelly clay - As Above, except 70% clay		165				
SANDY Gravel - v. coarse angular sand and gravel, Felsic w/ Lithic fragments of meta Rx (epidote, chlorite) some clasts of Jasper and yellow chert		170				
		175				
		180			80 FT/HR	
		185				
lithic frags of weathered brick-red rhyolite		190				
		195				
		200				
		205				
CLAYEY SAND SAME As Above, except 50% clay, 50% SAND		210				
SANDY Gravel - SAME AS 170 - 210		215				
		220				Drilling fluid pH = 9.0 visc. = 33 sec/qt.
		225				

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LOG OF BORING B-10

SHEET 4 OF 13

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SANDY Gravel - SAME AS Above		225			80 FT/HR	
		230				
SANDY Gravel - SAME AS Above w/ only Trace of clay		235				
		240				
SANDY Gravel - SAME AS Above except increased clay (~5%)		245				
		250				
		255				
		260				@ 260 FT. Drilling fluid conductivity = 1634
		265				
CLAYEY SAND - SAME AS Above except 45% clay, 55% sand & gravel		270			60 FT/HR	@ 270 FT., Drlg mud cond. = 1653
CLAYEY SAND - SAME AS Above except 25% clay		275				
		280				@ 280 FT., Drlg. mud cond. = 1656
CLAYEY Gravel - SAME AS Above, except grains larger, 40% clay and more lithic frags of rhyolite		285				
SANDY CLAY - SAME AS 275-285, except 70% pink clay		290				@ 290 FT., Drlg. mud cond. = 1646
		295				
		300				@ 300 FT., Drlg. mud cond. = 1671
		305				
		310				

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LOG OF BORING B-10

SHEET 5 OF 13

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
		310				@ 310 Ft., mud Cond. = 1671
Clayey Gravel + Sand - Felsic, angular, very poorly sorted, gravel in horoz beds. clasts of granite, jasper, chloritic schist, epidote, Qtz.		315	Run R-1			Core drilled from 313.20 to 325.20. Had 7.20 FT recovery from 313.2 to 320.2
LOSS		320				
CLAYEY SAND - felsic, v. coarse sand (0.5 - 2 mm), sub round to sub angular, contains granite, lithic frags of Meta RX, epidote. 35-40% pinch silty clay		325				Core drilled 325 to 335. Had No recovery, core bit worn out. Rotary drilled from 325 w/ 6¼" Tricone bit
		330			60 FT/HR	
		335				
		340				Drilling fluid (@ 340 Ft.) visc. = 34 sec/qt. conductivity = 1410 µmho/cm
CLAYEY SAND - SAME As Above, except finer grains, and 50% clay		345				@ 350 Ft. mud conductivity = 1421
SAND - SAME As above, Except 10-15% clay		350				
		355				
SAND - SAME As Above w/ < 5% clay		360				@ 360 Ft. mud cond. = 1403
SAND - SAME As above w/ 30% clay		365				
		370				@ 370 Ft. mud cond. = 1414 visc. = 32
CLAY - Blue-gray sticky (bentonitic) clay w/ 10% angular coarse sand		375				geolograph drum stuck (didn't rotate) from 374-382
		380				@ 380 Ft. mud. cond. = 1414
		385				
CLAYEY SAND - Interbedded blue-gray gravelly sand; blue-gray, fine, silty sand; lt. tan clay.		390	Run R-2		8 min/FT.	core Run-#2 @ 387.0 FT. Drilling mud visc. = 55 cond. = 1471 Cored 387.0 TO 392.1 FT. 2.45 Ft Recovery (

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LOG OF BORING B-10

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
CLAYEY SAND - SAME AS Above ~ 40% clay		390				mud-rotary drilling. Drilling mud visc. = 36 sec/qt.
CLAYEY SAND - SAME AS Above, except slight increase in % clay		395			34 FT/HR	
		400				
MFG		405				color of samples changed from tan-gray to more blue-gray @ 405'.
SAND~~y clay~~ - Blue gray clay, contains 40-60% v. fine felsic micaceous sand. Also <5% v. coarse, angular, felsic sand grains		410				
		415			30 FT/HR	
some lumps of med. brown clay in cuttings		420				Added bentonite to Drlg. mud @ 437. for coring
		425			45 FT/HR	
		430				PH = 9.0 Drilling mud visc. = 40
		435				
SAND - v. fine grained, massive, Blue-gray, angular, well sorted felsic sand. ¼" Blue-gray clay lenses @ 441-442. granite cobble (2") @ 438.3 ft. ~ 40% clay		440	Run R-3			Run-R3 at 437 Ft. cored to 442 FT. w/ 40 RPM, and 3000 lb. on bit. 4.70 FT Recovered (437-441.7)
		445				
		450			38 FT/HR	Reamed to 442, & Drilling w/ mud-rotary @ 450 FT., Mud cond. = 2080
		455				@ 460 Ft. " " = 2070
		460				
		465				
		470				@ 470 Ft. cond. = 2060 visc. = 36

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LOG OF BORING B-10

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
V. fine Sand - SAME As Above		470				
		475			52 FT/HR	
		480				@ 480 FT., mud cond. = 2070
		485				
		490				@ 490 FT., mud cond. = 2060
Gravely SAND - SAME As Above, except 20% 1-inch granite cuttings, from cobble @ 494.5 - 495.5 Ft.		495				- Greatly increased rig chatter @ 494.
V. fine clayey SAND - SAME As 470-495 FT., except 5-10% Brown silty clay cuttings		500			11 FT/HR	@ 500 FT., mud cond. = 2040 visc = 36
		505				Tripped for bit @ 496 FT. changed to 6¼" button bit. drilled through granite @ 495.5
		510			60 FT/HR	AT 511 FT., Tripped for tooth bit
		515				@ 511 FT., Mud visc = 37 cond = 2000
		520				@ 520 FT, mud cond. = 1990
		525				
< 5% Brown silty clay		530				@ 530 FT., mud cond. = 1970
		535				
		540			120 FT/HR	@ 540 FT., mud cond. = 1960 visc. = 36
		545				
		550				@ 550 FT., mud cond. = 1970

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LOG OF BORING 13-10

SHEET 8 OF 13

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
V. fine clayey sand - SAME AS Above w/ < 5% brown clay		550			70 FT/HR	
		555				
		560				@ 560' mud cond. = 1980
		565				@ 510', mud cond. = 1980 visc. = 37
sandy, silty clay - SAME As Above except finer sand (30%), and Lt. Brn-gray color,		570				570 FT. - slight color change downward, more brownish
		575				
		580				@ 580 FT. mud. cond. = 1970
		585				
		590				@ 590 Ft. mud cond. = 1960
		595				
		600				@ 600 Ft. mud cond. = 1950 visc. = 35
		605				
		610				@ 610 Ft. mud cond. = 1950
		615				
SANDY, Silty Brown Clay - SAME As above, w/ 5-10% coarse angular sand, silty clay (80%) ← orange-brn color 10% Blue-gray clay		620				@ 620 Ft. mud. cond. = 1940
		625				
		630				

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LOG OF BORING B-10

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
sandy, silty Brown clay - SAME As ABOVE		630				
		635				
638-640.3 = Horizlamela of green gray & Brn clay (1-2 mm) 640.3-642.3 = Massive brn. silty clay w/ sand lenses (lenticular) 642.3-644.7 = massive brn silty clay w/ Trace of coarse sand		640 645	Run R-4			-Core Run R-4 @ 638 FT. To 645, 6.7 FT. Recovery (638 - 644.7 FT.)
		650				
		655				
		660				
silty CLAY - SAME As Above, except 15% v.coarse, Angular, felsic sand		665				
		670				drilling mud pH = 9.0 visc = 37 cond. = 1908
SANDY CLAY - SAME As Above, except 35% sand (coarse, angular, felsic)		675				
45% sand		680				
50% sand		685				
SAND AND GRAVEL SUBROUNDED V.FINE - COARSE SAND MATRIX W/ FINE - COARSE PEBBLE GRAVEL (SUB-ROUND SUB ANGULAR) (25%) AND ANGULAR GRANITE CLASTS 5-20mm (2%). ALTERNATING SANDY & GRAVEL W/ ZONES - CLASTS THROUGHOUT (ONE 0.2 FT LONG)		690	Run R-5			core Run R-5 @ 687 FT. - 693.5 ft 6.5/6.5 = 100% recovery 6.45/6.5 = 99% RQD SLIGHT REACTION TO HCL IN LOWER FOOT ONLY VIS = 37 sec/qt.
		695				
NO SAMPLE						
SILTY CLAY, BRN 50% AND SAND, FN - V.COARSE SUB-ROUNDED FELSIC (40%) W/ 10% FN. SUBROUNDED GRAVEL		700				VIS = 50
		705				
AS ABOVE BUT W/ 35% CLAY 50% SAND AND 15% GRAVEL (SOME SUBANGULAR)						
AS ABOVE BUT slightly MORE COARSER MATERIAL		710				

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LOG OF BORING B-10

SHEET 10 OF 13

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SANDY CLAY AS ABOVE BUT LESS CLAY 35% sand, 65% clay		715				
		720				ROUGH DRILLING
AS ABOVE BUT 80% silty CLAY		725				
		730				VIS = 42
		735				
		740				
		745				ROUGH DRILLING
AS ABOVE BUT w/ "DRY" CLAY AGGREGATES, 90% CLAY 10% v. coarse, angular, felsic sand		750				VIS = 36
AS ABOVE BUT FEWER AGGREGATES		755				
AS ABOVE 745-755 BUT MORE AGGREGATES		760				VIS = 40
		765				
		770				VIS = 40
AS ABOVE BUT INCREASING COARSE SAND & FN GRAVEL, ~10% (SUBROUNDED - SUBANGULAR GRAVEL)		775				
		780				VIS = 41
AS ABOVE BUT w/ SAND & GRAVEL trace		785				ROUGH DRILLING
AS ABOVE 775-785		790				VIS = 38
Gravelly SAND - SAME AS ABOVE, except increased gr. size in sand		795				
		800				

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LOG OF BORING B-10

SHEET 11 OF 13

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SANDY SILTY CLAY, AS ABOVE W/ 15% SAND, TR GRAVEL		800				VIS = 39
sand is v. coarse, felsic, angular		805				
BECOMING MORE GRAY DOWN HOLE		810				VIS = 43
		815				slight color change to lighter brown silty clay @ 810 FT.
SANDY CLAY. SAME AS ABOVE, except sand grains coarser (5-10 mm)		820				
sandy clay - SAME AS 800-820 FT.		825				
AS ABOVE BUT very SMALL GRAVEL		830				
GRAVELLY CLAY, AS ABOVE BUT w/ 40% FINE SUBROUNDED GRAVEL		835				
AS ABOVE 820-835		840				
		845				
		850				
		855				
AS ABOVE BUT w/ [illegible] SAND & GRAVEL, felsic, Angular, Gravel is 3-8mm		860				VIS = 43
AS ABOVE BUT 30% COARSE FRACTION		865				
COARSE FRACTION DECREASING, DOWNHOLE ~ 20% sand		870				
		875				
		880				VIS = 39
<5% sand		885				

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LOG OF BORING R-10

SHEET 12 OF 13

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SANDY SILTY CLAY, AS ABOVE		885				
SANDY CLAY - v. coarse, subangular, felsic sand, (40%), silty Brn. clay (60%)		890				VIS = 41
SANDY CLAY - SAME AS ABOVE, except 10% sand + gravel		895				
		900				
SANDY CLAY w/ 15% LITHIC FRAGMENTS (GRANITE) TO 30 mm AND 40% MED-COARSE SAND & FN GRAVEL (FELSIC) SUBROUNDED - SUB-ANGULAR		905				
ALTERNATING [redacted] MFG CLAY AND GRAVEL		910				color Δ from med. Brown to Light Tan @ 910 to 940 FT.
TR. ANGULAR [illegible] RED GRANS W/ CRYSTAL-LINE INCLUSIONS (RHYOLITE ?)		915				HARD SPOT - PENETRATION RATE DECREASE
		920				
		925				
		930				VIS: 40
		935				HARD SPOT VIS: 30
color becomes more brownish, similar to 900 FT.		940				
		945				
		950				
RHYOLITE, PURPLE-gray APHANITIC ~~LITHIC FRAGMENTS~~ (cuttings) IN CLAY MATRIX		955				HARD SPOT
RHYOLITE, AS ABOVE BUT w/o CLAY		960			30 FT/HR	DRILLING RATE DECREASE
Rhyolite - Purple-gray, Aphanitic, some subhedral Qtz. phenocrysts, Granitic inclusions (~1-2cm) + granitic intrusive veins		965	R-6			VIS = 43 967 ft - 969.5 FT. core Recovered 1.5 FT.

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LOG OF BORING R-10

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
Rhyolite - purple-gray, aphanetic cuttings (75%), Brick-red aphanetic cuttings (25%) Tr. of Qtz. grains		970			25 FT/HR	core drilling rate = 27 min/FT (1st FT.) = 48 min/FT (2nd FT.)
Rhyolite - SAME As Above, except 90% Brick red, 10% purple		975				@975' mud visc. = 49 cond. = 1740
		980				
Rhyolite - SAME As above w/ optical, euhedral Qtz XL's (~1%)		985				@985' mud cond. = 1732
		990				
Rhyolite w/ clay - 35% black volcanic cuttings (obsidean). 65% med. Brown Silty Clay (from 998-1000 Ft.)		995				@995' mud cond. = 1732 visc. = 47 - obsidean @ 998 FT. Also some "pumpkin" orange clay
SANDY BRECCIA: FN - V. COARSE PEBBLE BRECCIA w/ 65-70% ANGULAR GRANITE CLASTS IN ORANGE SAND MATRIX (.05-2mm SIZE FELSIC SAND, TR. FN. MAFIC GRAINS)		1000	R-7 Loss			core At 1000 FT. To 1003 FT. cored ~20 min/FT. 1.5 ft recovery / 3 ft cored RQD .71/1.5 = 47%
TD = 1001.5 FT. (recovered) 1003 FT. (cored)		1005				
		1010				
		1015				
		1020				
		1025				
		1030				
		1035				
		1040				
		1045				
		1050				

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LOG OF BORING P2

SHEET 1 OF 8

PROJECT: ENSCO	LOCATION: C(4-1)32	ELEVATION: 1407.2	PROJECT NO.: 08701260
DRILLING AGENCY: STEWART BROS	FOREMAN: R. STEWART	DATE STARTED: 10-3-87	DATE FINISHED: 10/4/87
DRILLING EQUIPMENT: FAILING 2500		BEDROCK DEPTH: Not encountered	COMPLETION DEPTH: 585
CASING: 4-inch low-carbon steel	SCREEN: vertical slotted 4-inch steel casing	BORING ANGLE: VERTICAL	INSPECTOR: PJW/EDR/MFG
SAMPLES: 5 FT INTERVALS - CUTTINGS		WATER LEVEL: FIRST	COMP. / 24 HR. 522.4 FT.

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
TOPSOIL, SILTY w/ CLAY AGGREGATES LT BRN	6 5/8 - INCH SURF. CASING	0				drilled w/ 15 inch solid stem auger bit to 20 ft
SAND & GRAVEL 60% FN-COARSE SAND, 40% SUBROUNDED - SUB ANGULAR FN-COARSE GRAVEL, MED BRN		5				
SILTY SAND w/ 10% CLAY AGGREGATES LT BRN		10				Set 9 7/8-inch OD casing to 20 ft.
SILTY SAND & GRAVEL SIMILAR TO 5-10 FT w/ TR PEBBLE SIZE CLASTS		15			2'/min	
		20				drill out w/ 8 3/4-inch roller bit (rock bit)
SILTY SAND & GRAVEL 40% GRAVEL - LARGEST ARE 0.5 x 1 in.		25				
SIMILAR TO ABOVE - HIGHER SAND %, 10% SILT, 50% SAND, 40% GR		30'				
↓		35'				
		40'				waiting on Mud Man for Mud Assessment
↓		45'			2'/min	
SILTY SAND & GRAVEL - 30% GR., 10% SILT, 60% SAND		50'				
SILTY, GRAVELLY SAND - SIGNIF. LESS GRAVEL		55'				
SILTY SAND & GRAVEL - SIMILAR TO 50' → 55' INTERVAL		60'				MUD WEIGHT = 8.4 VISC = 42 PH = 9.0 Ca = 40 Cl = 350
↓ LARGEST SIZES ARE 1/4" x 1/4"		65'				
SOME 1/2" x 1/2"		70'				PLASTIC VISC. = 7 YIELD POINT = 4 GEL STRENGTH = 1 & 3

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LOG OF BORING P2

SHEET 2 OF 8

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SAME AS ABOVE - 30-40% GRAVEL, 60% SAND, 20-20 SILT.		70				
		75'			2'/MIN	DRILLING RATE ABOUT 2-FEET / MINUTE
		80'				
		85'				
SANDY GRAVEL - SAME AS ABOVE - SAND SIZE BECOMING LARGER INCREASE IN SMALLER SIZED GRAVELS subangular to angular, v. poorly sorted, some Qtz is pale amythest, composition is felsic, w/some meta lithic frags.		90'				
		95'				
		100'				Lithologic descriptions made by MFG after 100 FT.
		105'				
coarse SAND - SAME AS ABOVE, except <1% gravel		110'				
		115'				
		120'				
Dirty Coarse SAND - SAME AS Above, except sub-angle to sub-Rnd. and 35-45% brown silty clay		125'			90 FT/HR	
		130'				
		135'				
		140'				
coarse SAND - SAME AS 110-125 FT.		145'				
		150'				

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LOG OF BORING P2

SHEET 3 OF 8

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
Dirty Coarse SAND - SAME As Above except 35% silty brown clay, 15% fine sand.		150				
		155				
		160				
		165				
		170				
Dirty Coarse Sand - SAME as above, except slight decrease in grain. size, + 45-50% clay		175				
		180				
coarse SAND - Angular, coarse-med., felsic sand. 10-15% pink silty clay		185			90 FT/1HR	
		190				
		195				
Coarse SAND - SAME As Above, except angular-subround, + 20% clay		200				
Coarse SAND - SAME As 185-200 FT.		205				
		210				
		215				
		220				
		225				
		230				

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LOG OF BORING P2

SHEET 4 OF 8

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
		230				
SANDY clay - Med. Brown silty clay w/25-35% felsic, coarse, subangle, sand		235				
SAND - SAME AS 205-235 FT		240				
SAND - SAME AS Above, except coarse to v. coarse, and 15-20% clay		245				
		250				
		255				
		260				
V. coarse SAND 5% pink clay; 10% Lithic Frags; 85% v. coarse Felsic angular sand.		265			%	mud visc. = 32 sec/qt.
Coarse SAND - SAME AS above, except coarse, subangular sand, & 35% clay		270			FT/HR	
		275				
		280				
45% clay		285				- Driller increased drill pipe rotation speed @ 287 FT.
55% clay		290				
SANDY CLAY - 60% Pink-Brn, silty clay, 40% sub-Rnd, well sorted, felsic, coarse, sand		295				
		300				
		305				
		310				

4+8 = Hard
-4:13

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LOG OF BORING P2

SHEET 5 OF 8

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
		310				
		315				
		320			92 FT/min	
		325				
SANDY clay - SAME As Above, except 70% silty clay		330				
		335				
		340				
SANDY clay - SAME As Above except clay Not silty, and less cohesive. decrease in sand size.		345				
		350				
		355				
CLAYEY SAND 70% subround, mod. sorted, felsic, med., sand. 30% Blue-gray clay		360				
SANDY CLAY - SAME As Above, except 70% blue clay, 30% sand		365				
		370				
CLAY - SAME As Above, except 5-15% SAND		375				
		380				
		385				
		390				

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LOG OF BORING P2

SHEET 6 OF 8

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
		390				
		395			90 FT/HR	
SANDY CLAY - SAME AS Above, except 20% sand		400				
		405				
SAND 70% sand, med., felsic, subround, 30% blue-clay		410				
		415				
		420				
SANDY Clay - SAME AS 400-410 FT.		425				
		430				
Clay SAME As 375-400 FT		435				
		440				
		445				
		450				
		455				Driller Reports Hard spot 454-456, 457-460, 464-465
		460				Prob. Represents sand lenses
		465				
		470				

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LOG OF BORING P2

SHEET 2 OF 8

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
CLAY SAME AS Above		470				
		475				Driller reports Hard spot @ 473-477 FT, 478-481 FT, 482-483 FT (sand lenses?)
		480			90 FT/HR	
		485				
		490				Mud visc. = 38 sec/qt.
		495				
		500				Driller Reports Hard spot @ 499-507 FT
		505				
		510				Driller Reports very rough drilling (hard spot) @ 508-515 FT.
		515				
		520				
		525				
		530				
		535				
		540				
		545				hard spot @ 546 FT
		550				

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LOG OF BORING P2

SHEET 8 OF 8

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
CLAY SAME AS Above		550				
		555			90 FT/HR	
		560				
		565				Driller Reports Hard spot @ 565 - 567 FT.
		570				
		575				
		580				
		585				
TOTAL DEPTH = 590 FT		590				

454 – 456 Rough

456 – 457 smooth

457 – 460 Rough

460 – 464 smooth

464 – 465 Rough

465 – 473 smooth

473 – 477 Rough

477 – 478 smooth

478 – 481 Rough

481 – 482 smooth

482 – [illegible] Rough

@ 490'

Vol = 38

NOTE: driller's report of rough & smooth drilling to correlate with boring log

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LOG OF BORING B-11

SHEET 1 OF 18

PROJECT	LOCATION	ELEVATION	PROJECT NO.
ENSCO	C(4-1)32	1411.82	08701261
DRILLING AGENCY: Stewart Bros.	FOREMAN: Randy Stewart	DATE STARTED: 12/19/87	DATE FINISHED: 12/22/87
DRILLING EQUIPMENT: Failing 2500		BEDROCK DEPTH: ~1050'	COMPLETION DEPTH: 1055.5
CASING: N/A	SCREEN: N/A	BORING ANGLE: Vertical	INSPECTOR: KBD, MFG, DLR

SAMPLES: Cuttings every 5 feet

WATER LEVEL	FIRST	COMP.	24 HR.
	NA	NA	NA

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS (SPUD IN 2245)
TOPSOIL - Clayey SILT - red brown - w/ coarse grained GRAVEL Angular to subrounded		0			2ft/hr	SPUD in w/ 6 3/4-inch mill tooth bit. Drilling mud-rotary w/ No. surface csg.
GRAVEL - ~20% fines, up to 10mm, granitic frags, qtz, feldsp, schist		5				
CLAYEY GRAVEL - SAB w/ ~30% clay & silt - light red-brown color		10				
GRAVELLY SAND - v. fine to v. coarse gr. quartz, feldspar some dark min., angular to subrounded light red brown color granite & schist grains.		15				
SAB w/ ~10% clay/silt		20				
SAB w/ increase in GRAVEL (~40%)		25				
SANDY GRAVELLY CLAY ~50% clay 10% gravel 40% sand as above		30				
Increase in sand to 30%		35			2ft/hr	Mud Visc = 40
SAME AS ABOVE Decrease in clay		40				
SANDY GRAVELLY CLAY ~40% sand, 10% gravel		45				
		50				
		55				
		60				cuttings w/ sandy silt
CLAYEY GRAVELLY SAND - SAB w/ ~20% clay		65				
		70				

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LOG OF BORING B-11

SHEET 2 OF 18

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SANDY GRAVEL 45% clay		70			120 FT/HR	
		75				Moderate Rig chatter
		80				
Clayey Gravel - v. coarse angular sand - gravel up to 25 cm Brown clay		85			100 FT/HR	
		90				
		95				
		100				
Clayey SAND - Angular v. coarse, angular sand - some (5-20%) gravel. 40-50% Brown clay		105			86 FT/HR	Drilling Fluid visc = 40
		110				
		115				
		120				
Clayey Gravel - SAME AS 85-105 FT.		125			80 FT/HR	
		130				
		135				
Clayey Gravel - SAME AS ABOVE, except 35% clay		140				
Gravelly clay - SAME AS ABOVE, except 65% clay		145			72 FT/HR	
Clayey Gravel - SAME AS 140-145'		150				
		155				

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LOG OF BORING B-11

SHEET 3 OF 18

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SANDY GRAVEL - SAME AS ABOVE w/ < 5% clay		155			92 Ft/HR	
		160				
		165				
		170			133 Ft/HR	
		175				Drilling Fluid
		180				visc = 40
		185				
		190			80 Ft/HR	
		195				
		200				
		205				
		210				
		215				
		220				
		225				
(c) see pg. 4 for description		230		Core Run #1	18.2 min/Ft.	Begin Core #1 @ 0443 cored from 229-239 Ft. Added DrillPac to Orig. Mud for less filtrate, more visc. Rotate @ 70 RPM removed 2 mud pump valves
		235				
		240				

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FIELD LOG OF BORING NO. _____

SHEET 4 OF 18

DEPTH FEET	DESCRIPTION	ROCK CORE: Sketch	Run No.	Recov. ft	RQD	Piezometer Data	SAMPLES: Type Number	Recov. ft	Penetra Resist. Blows/6in	REMARKS: CORE RUN #1
229	Fine-med. felsic sand + .25-1 cm gravel. < 20% clay		CORE RUN #1 9.0 ft/10.0 Ft = 90% Recovery							Begin coring @ 0443
230	Med-v. course felsic angular sand (25%). 0.25-1.5 cm felsic, angular gravel (20%). red-brown silty clay matrix (55%)								18.2 Min./Ft	Drilling Fluid viscosity = 49
	Med-v. coarse angular felsic sand-gravel									
231	SAME As 229.5-230.6 Ft.									Cored from 229-239 Ft.
232	SAME As Above, except fine to v. fine sand replaces clay matrix									
	SAME As 229.5-230.6 Ft.									
233	V. coarse (1-4 mm) angular, felsic sand (75%). v. fine felsic sand Matrix									could not core to Ft w/out stopping to make drill pipe connection, so only cored 6.8 Ft.
	SAME As 229.5-230.6 Ft.									
	SAME As 232.6-233.3									
234	SAME As 231.3-232.3 Ft.									
	SAME As 232.6-233.3, except 40% coarse, 60% fine									
235	SAME As 231.3-232.3 Ft									made drill pipe connection @ 0647
236	LOSS	LOSS								Finish coring @ 0728
237	SAME As 232.6-233.3 Ft.									made connection @ 235.8 Ft., and cored additional 3.2 Ft. to 239.0 Ft.
	SAME As 229.5-230.6 Ft.									
238	SAME As 231.3-232.3 Ft.									
	SAME As 229.5-230.6 Ft.									sedimentary sequence quite cyclic
239										

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LOG OF BORING B-11

SHEET 5 OF 18

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
GRAVELLY SAND - v. coarse gr. felsic sand angular to subrounded ~10% silt. see core for detailed description - same ... rad for - silt ~45% gravel		239			25ft/hr	
		245				
SAB w/ 15-20% silt/clay						
		250				
		255			20ft/hr	
SAME as 239-245						
		260				
		265				
		270				
30% silt 20% gravel 50% coarse SAND gravel size increasing to 10mm						
		275			100ft/hr	
20% silt 15% gravel 65% coarse SAND						
		280				
15% silt 15% gravel 70% v. coarse sand finer gravel						
		285				
		290				
30% silt w/clay SAB						
		295				
20% silt w/clay SAB						
		300			80ft/hr	
10% silt w/clay SAB gravel coarsening						
		305				
30% silt w/clay						
		310				drilling fluid visc = 56
20% silt w/clay						
		315				
SAB					60ft/hr	
		320				
SAB						
		325				

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LOG OF BORING B-11

SHEET 6 OF 18

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
~~[illegible]~~ SAB		325				
		330			55ft/hr	
		335				
		340				
		345				
		350				
silt/clay is gray brown color						color change gradual reddbrown to gray brown
SILTY, CLAYEY SAND ~5% gravel - reddish gray color, sand - v.f. to coarse sub-angular quartz, feldspar, granitic frags, epidote, biotite, jasper - ~20% clay		355				
		360			46ft/hr	
25% med-coarse SAND 5% gravel 30% clay, 40% silt/v.f.g. sand		365				
		370				
SILTY CLAYEY SAND - large (20 mm) schist frags. ~20% med-coarse gr. felsic sand, 2% gravel - 78% silt/v.f.g. sand & clay light gray brown		375				
45% silt/v.f.g. sand 40% coarse sand ~15% gravel angular to subangular schist & granite fragments		380			24ft/hr	
CLAYEY SILTY SAND - v.f.g. to med gr. ~5% coarse sand w/ trace gravel - clumps of red brown f. sand ~20% clay		385				
		390				
trace rounded gravel (Fe oxide stained quartz(?) (10 mm)						
SILTY CLAYEY SAND - v.f. to med gr. w/ trace gravel & coarse sand, red-brown color ~20% clay		395				
		400			60ft/hr	
		405				
		410				

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LOG OF BORING B-11

SHEET 7 OF 18

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SAB w/ ~5% coarse gr SAND		415				VOC = 42 Stringers of red brown silt
SILTY GRAVELLY SAND 20% coarse sand 50% gravel ½ fill-rock, quartz, granite trace ~30% clay		420				lots of silty cuttings
(C)		425				
		430				Tripping out to core - can't get above ~240' CORE RUN #2 BEGAN @ 1115
		435				core time
(C)		440				CORE RUN #3 END @ 1855
SILTY SAND and CLAYEY SAND and SILT Light brown to grayish-brown Very fine to medium-grained with pebble gravel [SEE CORE LOG DETAILS ON Pg. 8]		445				
(C)		450	LOSS			LOSS @ 448.3 to 450
Continues, as above, until 505ft		455				
		460				
		465				Drilling rods rattling
		470				
		475				
		480				
		485				
		490				
		495				

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FIELD LOG OF BORING NO. U-11

SHEET 8 OF 18

DEPTH, FEET	DESCRIPTION	ROCK CORE: Sketch	Run No.	Recov. ft	RQD	Piezometer Data	SAMPLES: Type Number	Recov. ft	Penetro Resist. Blows/6in	REMARKS
										CORE RUN # 2 #3
430	SILTY SAND - v.f. to coarse felsic sand, subangular to subrounded, muscovite, biotite, schist, chaotic, dry, not well indurate trace clay, [illegible] color									Began coring 1715
431										reads moderately to dilute HCL
432										
433	SANDY SILT - no coarse grains w/ trace clay TRACE GRAVEL (FINE)									
434			CORE RUN #2	3.3ft/10ft = 33%	3.3/3.3ft = 100%					
435										Began tripping in @ 1645 Finished tripping out @ 1930
436	LOSS	LOSS								
437										
438										
439										
440										END CORE RUN @ 1855
441	SILTY SAND and CLAYEY SAND and SILT w/ trace of GRAVEL, Light brown to grayish-brown with occasional reddish-brown pockets of CLAY. Dry. Very fine to medium-grained SAND, poor to moderately sorted with 5-10%									Begin tripping 2135 Cored with 4 7/8-inch diamond-insert bit 10 ft inner core barrell D. Kirchner logging core from 440 ft 12-21-87
442										
443	Coarse to very coarse SAND and pebble gravels to 1/2-inch. SAND is subangular to subrounded.									Begin tripping in @ 2120 Finished tripping out @ 2400
444	Mostly quartz (70%) and 30% mafic minerals, including biotite and muscovite & schistose material		CORE RUN #3	8.3ft/10ft = 83%	8.3/8.3ft = 100%					
445	Core is very loosely cemented, friable, coarsens downward									Coring rate 10 min/ft.
446	No obvious bedding planes or structures can be identified becomes coarse-grained, gravelly SAND									
447	mottled white Moderately high permeability									
448										END CORE RUN @ 2215

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FIELD LOG OF BORING NO. D-11

SHEET 9 OF 18

DEPTH, FEET	DESCRIPTION	ROCK CORE: Sketch	ROCK CORE: Run No.	ROCK CORE: Recov. ft	ROCK CORE: RQD	Piezometer Data	SAMPLES: Type Number	SAMPLES: Recov. ft	SAMPLES: Penetra Resist., Blows/6in	REMARKS
44.8										CORE RUN #3 (CONT)
44.9		LOSS	M #							
45.0										END AT 2315 Hrs

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LOG OF BORING B-11

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
		495				
		500				Rock bit diameter = 6 3/4 inches
↓ Becomes coarser-grained sand with reddish-brown silty clay. Sand to very coarse-subangular weathered granite? pebbles to 1/8-inch. Clay is hard-stiff-claystone (CL)		505				
		510				After drilling to 520, inspected rock bit (Tricone, ~~carbide teeth~~)
grades to SILTY CLAYEY SAND and CLAYEY SAND, greyish-brown w/ red mottled clay		515				
C		520				Reached 520ft @ 0310 hrs.
		525	CORE RUN #4			Core run # 4 Begin coring @ 0425 Hrs. Mud viscosity – Marsh Funnel 60 sec
C CLAYEY, SILTY SAND light brown to olive greyish-brown Poorly sorted v. fine to pebbles (fragments to 5/8-inch-quartz and granitic) Subangular to angular quartz (60-70%) biotite and muscovite and mafics (30-40%) Fragments are friable to soft. Color change @ 535' to reddish-brown and yellowish-brown. Becomes SANDY SILTY CLAY with occasional pebbles of quartz and granite. Some clay fragments are hard, reddish-brown to dark brown mixed with grey silty sand as above. CLAY is (CL). Moderate to low permeability		530				END CORE RUN @ 0615 Hrs. Resume rock-bit drilling @ 0730 Hrs 532 ft @ 0745 hrs.
		535				0800 hrs
		540			↑	
		545			70 ft/hr	
		550			↓	
SILTY CLAY (CL) with SAND – reddish-brown to brown, soft with 10-15% very fine sand and silt. Sand is micaceous with minor amts of quartz. Moderately low to low permeability		555				0817 hrs
		560			↑	
↓ becomes slightly more sandy and coarser-grained with minor quartz frags. to 1/8-inch.		565			66 ft/hr	
Same as @ 555 (ie Sand content only ≤ 10%)		570			↓	
		575				
		580				0837 hrs

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FIELD LOG OF BORING NO. 15-11

SHEET 11 OF 18

DEPTH, FEET	DESCRIPTION	ROCK CORE: Sketch	Run No.	Recov. ft	RQD	Piezometer Data	SAMPLES: Type Number	Recov. ft	Penetra Resist. Blows/6in	REMARKS
520	SANDY CLAY and SANDY SILT, light grayish-brown interbedded, with SILTY CLAY and CLAY, reddish-brown mottling and thin stringers. (1/8 inch to 2 inches) SAND is very fine-grained to coarse, poorly sorted, moderately well-indurated and CLAY is stiff to very stiff (CL). SAND is subangular to subrounded, mostly quartz (70-80%) and mafic minerals.		RUN # 4	Recovered 7.8 ft of 9.8 ft = 80 %						CORE #4
521										Begin Coring @ 0425 Hrs.
										0428 Marsh Funnel = 60 secs.
										0434 Hrs. } 1 ft/12 mins. ≈ 5 ft/Hr
522										0446 Hrs.
										} 1 ft/15 mins.
523										0459 Hrs.
										} 1 ft/13 mins.
524										0512 Hrs.
	grades to CLAYEY SAND and SANDY SILTY CLAY with coarse SAND - moderately well-indurated to hard									} 1 ft/13 mins
525										0525 Hrs.
										} 1 ft/12 mins
										0537 Hrs.
526	grades to coarse to very coarse CLAYEY, SILTY SAND light grayish brown to gray with 10-15% v. fine gravel. Becomes more friable, but moderately indurated. [Coarsens to end of core where we lost core from 527.8 to 529.8]									Marsh Funnel = 57 secs. @ 0540 Hrs.
527										} 1 ft/10 mins
										0547 Hrs.
										} 1 ft/11 mins
528	(Reddish brown clay seam oriented at ~45° from vertical located at ~526.8 ft)			← LOST →						0558 Hrs
										} 1 ft/11 mins
529										0609 Hrs
										0614 Hrs. - Marsh Funnel = 55 sec.
530										529.8' End Run #4 @ 0615 Hrs.
										TRIP OUT CORE 0616 to 0650 Hrs.
										Core run from 520.0 to 529.8 ft (Two feet lost in bottom of run)

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LOG OF BORING B-11

SHEET 12 OF 19

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SILTY CLAY with SAND reddish-brown to brown...(continues)		580				
↓ becomes darker brown and the SAND and fine pebble content increases to 15%. Pebbles are quartz and heavily weathered & friable granitic material Qtz frags to 1/8-inch, angular, opaque to translucent. Mafic minerals increase to 20% of SAND content, very friable & weakly cemented		585 590 595				
CLAYEY SAND and SANDY CLAY reddish-brown		600				0900 hrs.
↓ CLAYEY SILTY SAND - reddish-brown to yellowish-brown SAND is fine to med. grained with scattered pebbles to 1/8 inch subangular, friable - soft Pockets of tan to white very fine sand and silt. Interbedded with SANDY SILT and CLAYEY SAND becomining gray-brown		605 610 615 620			42ft/hr	0930 hrs
↓ SILTY SAND AND CLAYEY SAND - dark gray to grayish-brown Poorly sorted very fine to very coarse, angular to subangular quartz and mafics, pebbles of weathered granite to 1/4-inch, Friable to weak - moderate to high permeability. Interbedded at 630-635 with reddish-brown clay.		625 630 635			55ft/hr	
} fragments of siltstone - reddish brown, very hard - up to 3/4-inches		640				0953 hrs
↓ As above at 625 with interbeds of light-brown and reddish brown silty clay.		645 650			42ft/hr	
		655				1020 hrs. Mud-Marsh Funnel = 49 secs.
(C)		660 665	SEE BOX #5			660-670 Core run #5 (optional) Begin Coring @ 1155 hrs 12-21-87 @ 660 ft.

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FIELD LOG OF BORING NO. B-11

SHEET 13 OF 18

DEPTH, FEET	DESCRIPTION	ROCK CORE: Sketch	Run No.	Recov. ft	RQD	Piezometer Data	SAMPLES: Type Number Recov. ft	Penetro Resist. Blows/6in	REMARKS
660	SILTY CLAYEY SAND - vfs to coarse grained rusic sand, silica, quartz, epidote, mafic min. ~10% clay red brown color not inundated at 0.25' 3-4cm granitic fragment along dueces ~15% coarse grains, light brown								Began coring @ 1155
661									good core!
662	2-1cm patches of white clay(?) on surface not continuous clay as 661.9' lense of rust red silty clay 1" wide 662.2' coarsening of sand & more indurated to 662.6'								core is "swollen" in alternating "beds" from top to bottom due to clay(?) in silty sand
663	662.75 v.f.g SAND w/ silt ~5- Med-coarse g								slight reaction to HCL at various core locations
664									
665			CORE RUN #5	9.3ft/10.3ft = 93%	9.3ft/9.3ft = 100%				Core rate ave ~9 min/ft
666	~20% coarse sand								Tripped in to core @ ~1115 Tripped out complete @ 1400
667									
668	Fe oxide stained quartz grains (med size) med to								
669	SAND - COARSE grained w/ tr granitic gravel - indurated. granitic cobble 1" diam - sub-rounded								No reaction to HCL slight reaction to HCL
670	LOSS	Loss							Finished coring @ 1315
	Shoe has coarser gr. sand w/ trace of gravel. - cemented								

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LOG OF BORING B-11

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
LOSS of 0.7'		665	CORE BW #5		9min/1ft	Began tripping in ~1130 Tripping out complete 1400 End core run @
NOTE: SILTY CLAYEY SAND (C) vf to med sand subangular - trace gravel (chert) claystone stringers & silty - SAME as core in undisturbed cuttings light yellow brown		670				Began drilling @ 1440
		675				Rough drilling
pieces of reddish-brown silty clay - interbedded w/ silty sand. percentage of med to coarse grains increases w/ depth gradually SAME AS 670		680		20 gpm/hr		add rod @ 1540 NOTE: 670 - appears to be very clayey ~680 but some undisturbed cuttings are very similar to silty sand in core #5 ∴ SILTY CLAYEY SAND
		685				
trace of chert fragments - gravel size (~5-7mm)		690				
		695				
SAME AS 670'		700				
SAB w/ red brown sandy clay bed		705				
SAB w/ 5% very coarse sand		710		15 gpm/hr		
SAME AS ABOVE 670'		715				
		720				
small piece of white silt/clay		725				VISC = 40 sec/qt.
TR. coarse noncrystalline sand & silt.		730				rough drilling
increasing clay		735				
SILTY SANDY CLAY - vf to med sand & silt ~50% clay - some areas more silty (~30%) & less clay - some min as above ~15% sand. 740-745' - chips of red-brown claystone.		740				Add rod @ 1950 - pretreat mud -
		745				Pretreating mud - visc = 45 added 7 bags mud seal & 3 bags of cedar fiber Resumed drilling @ 2030
		750				

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LOG OF BORING B-11

SHEET 15 OF 18

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SANDY SILTY CLAY / SILTY CLAY/SAND w/ TRACE OF GRAVEL (Granitic origin) - Subangular to subrounded, med. brown, changing silt layers.		750			17 Ft/Hr	tripping out to change bits @ 2220 @ 7316 6 1/4" button bit shown. Drilling @ 2240
		755				
		762				color is med. brown
		765		20/68	17 Ft/HR	Increased drill stem rotation to ~100 rpm from 75 rpm @ 765
		770				
		775				
SANDY silty CLAY - SAME as above, except ~10% coarse sand + gravel		780				very slow drilling 783-784'
		785			31 Ft/HR	
Gravelly silty clay - SAME AS above, except 20% to 25% felsic angular gravel (0.1 - 1.0 cm)		790		20/39		
		795				
		800				
		805			9 Ft/HR	Drilling fluid visc. = 41 sec/qt.
65% Gravelly silty CLAY - SAME AS ABOVE 35% Rhyolite - Purple-gray aphanetic cuttings		810				@ 813 Ft., increased drlg rate prob. represents top of rhyolite, No change in rig chatter.
Rhyolite - Aphanetic Purple-gray (30%) and red-brown (70%) cuttings. cuttings are 1-5 mm		815			12 Ft/HR	
5% Purple-gray cuttings		820			60 Ft/HR	increased drilling rate @ 819 Ft.
		825				
		830			12 Ft/HR	
		835				

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DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
Rhyolite - SAME As Above		835			12 Ft/HR	
		840				
25% Rhyolite - SAME As Above 75% SANDY silty CLAY - Brown silty clay w/ 15% coarse sand - Dark, Micaceous, lithic frags + felsic mtl		845				bottom of rhyolite seems to be @ 847 Ft., based on drlg rate + rig chatter
		850			20 Ft/HR	
SANDY silty CLAY - 45% Med. angular sand, composition = Meta. frags. + granitic frags 55% Brn. silty clay		855				
		860			60 Ft/HR	
SANDY CLAY - very cohesive, brown silty clay w/ 10-20% sand + gravel coarse mtl. comositisn = Same as above		865				
		870			27 Ft/HR	
SANDY CLAY - SAME As Above, except clay less cohesive + plastic, w/ 20% med. sand		875				
		880				
		885				
CLAYEY SAND - SAME As Above, except 55-60% med. sand.		890				
		895			24 Ft/HR	
		900				
		905				
		910				
		915			28 Ft/HR	
		920				

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DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
CLAYEY SAND - SAME AS ABOVE		920			28 Ft/HR	Drilling mud visc = 41 pH = 8.0
		925				
SAND - Med. to coarse, Meta. + felsic, angular well sorted sand, similar to above, except <5% silt + clay		930			24 Ft/HR	
CLAYEY SAND - SAME AS ABOVE, except 25% silty clay		935				
SAND - SAME AS 930-935 Ft.		940				
CLAYEY SAND - SAME AS 935-940 Ft.		945				
		950			29 Ft/HR	
CLAYEY SAND - SAME AS 935-940'		955				
		960				
SANDY CLAY - SAME AS ABOVE, except 60% clay - clay more cohesive 40% sand		965				
Gravelly CLAY Brown silty clay w/35% v.coarse sand + gravel. - Felsic, angular.		970			26 Ft/HR	Decreased drilling rate @ 971 Ft.
SAND - SAME AS 930-935 Ft.		975				
CLAYEY SAND - SAME AS 935-940 Ft.		980				
		985				
SANDY CLAY - 65% brown clay. 35% med.-fine sand; 70% of sand is dark lithic frags, 30% of sand is coarser felsic mtl		990				
CLAYEY SAND - SAME AS 935-940', except 60% sand, 40% clay		995			8 Ft/hr.	Drilling rate decreasing gradually
SILTY CLAYEY SAND clay is red-brown to light pinkish brown color in good cuttings also silty sand. composition is same as above		1000				
		1005				

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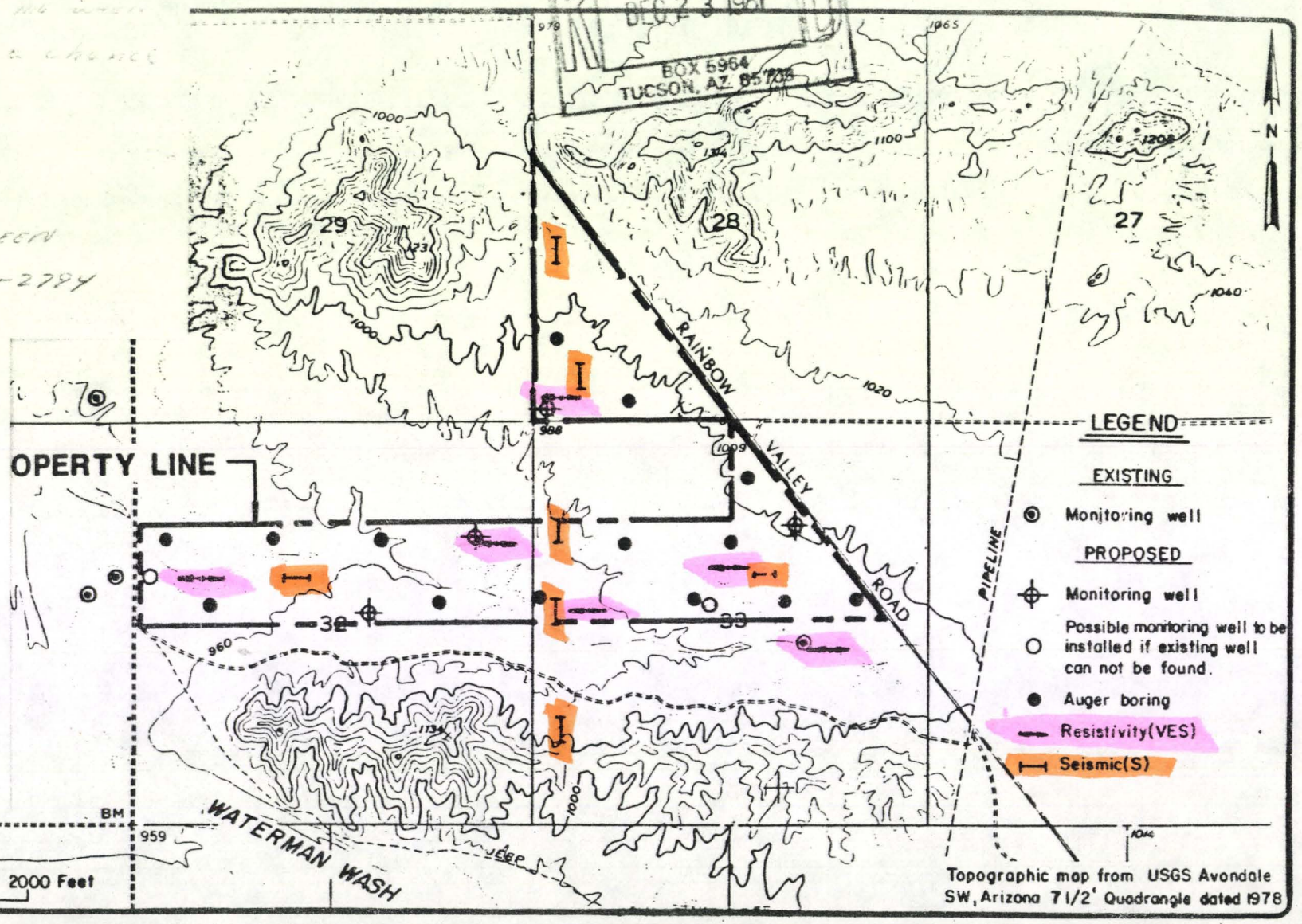
LOG OF BORING B-11

DESCRIPTION	WELL	DEPTH FEET	SAMPLE	WATER GPM	DRILL RATE	REMARKS
SILTY CLAYEY SAND SAB w/ tr. gravel subangular feldspar 8/10mm		1005				
undisturbed cuttings have a reddish brown silty clay matrix ~30% SAND ~35% coarse TR GRAVEL AS ABOVE 1/4-1/2in.		1010			13ft/hr	Add rod @ 1310 resume drilling 1315
		1015				
		1020				
TRACE FINE GRAVEL						rough spots - not too bad
		1025				visc ≅ 47 closed funnel & started while we were unclogging
		1030				rough drilling ~5min
regular sample - SAB						
~1034' - grab sample - very coarse granitic sand w/ 15% clay/silt probably a granitic cobble		1035				very rough 1034-1035 @ 1455 Paul grabbed a sample
SAME AS 1020		1040				
		1045			15ft/hr	visc = 48 (Frank K.) wt = 8.7 pH = 8 (L)
SAB w/ ~20% gravel size granitic fragments (from cobbles possibly) & increase in coarse gr. size - fine 1-inch chip of granite						
		1050				1046-1047 very rough 1048-1049 drilling @ 1605 1050 very rough
GRAVEL SIZE GRANITE FRAGMENTS, angular, lots of fe oxide stained granite (weathered granite)		1051				lots of chatter, quiet, chatter, quiet ...
SAB - w/ cutting of silty, clayey sand as above (1005)						- Got cuttings at 1 foot intervals
		1052				
SAB w/ less clayey clumps.		1053				
SAB		1054				
		1055				- Rough 1054.5'
		1056				- 1055.5 TD - paul calculated Geologyapt showed 1057. Geophysical log says 1057
		1057				
		10				TD 1057

Jim Beck
Is this what you
asked for? Can no when
you have had a chance
to look at.

M. Green
(602) 894-2794

RECEIVED
DEC 23 1987
BOX 5964
TUCSON, AZ. 85703



Topographic map from USGS Avondale SW, Arizona 7 1/2' Quadrangle dated 1978

EMCON ASSOCIATES
Consultants in Wastes Management and Environmental Control

Michael H. Green, C.P.G.
Project Manager

4636 East Elwood St., Suite 8
Phoenix, AZ 85040
(602) 894-2794
San Jose, CA 95131
(408) 275-1444

EMCON Associates

SOUTHWEST RESOURCE MANAGEMENT, INC.
SOUTHWEST VALLEY LANDFILL
SITE NO. 1
GOODYEAR, ARIZONA

GEOLOGIC/HYDROGEOLOGIC INVESTIGATION

FIGURE 1

PROJECT NO. A 01-01.01

110169

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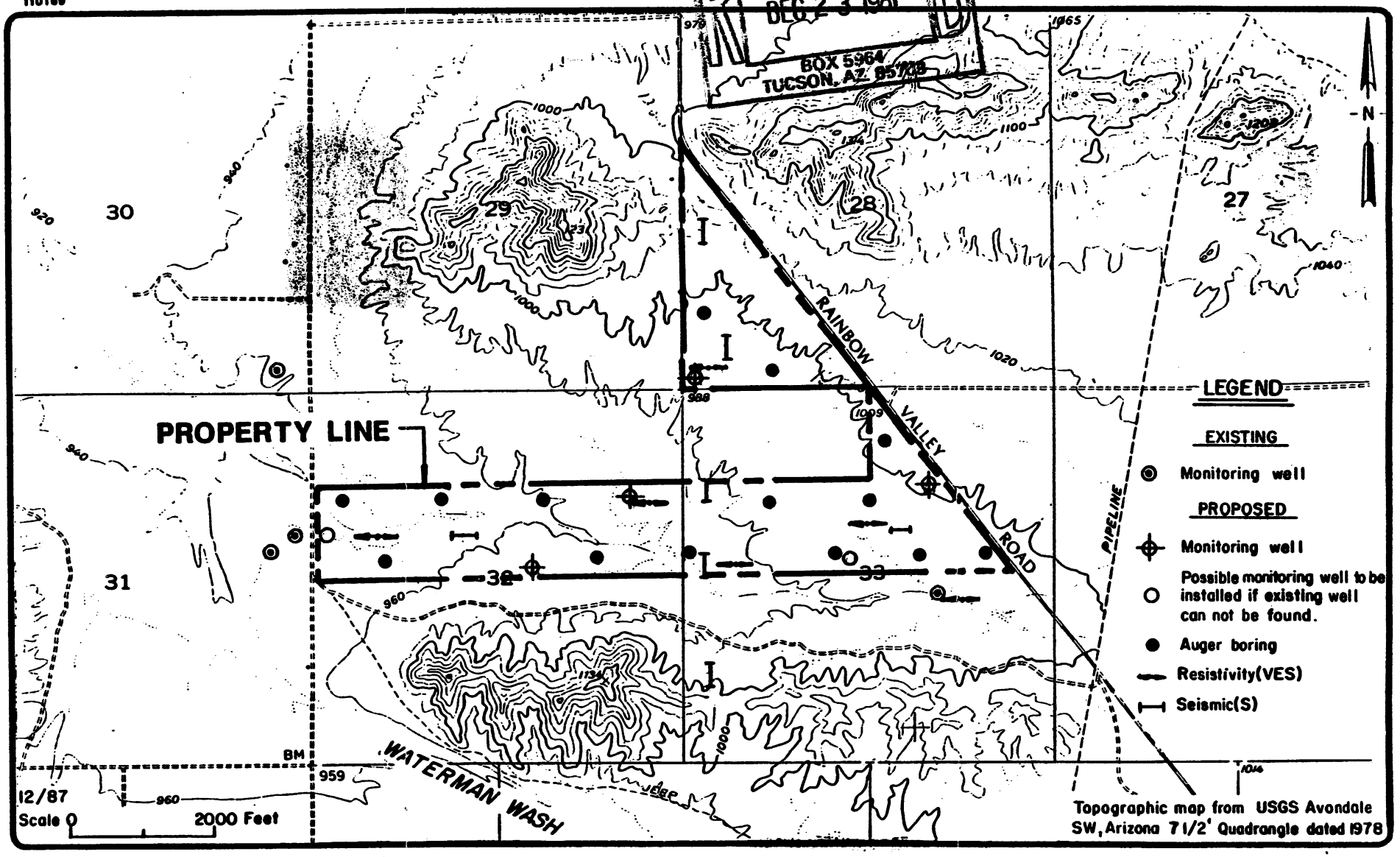

EMCON Associates

SOUTHWEST RESOURCE MANAGEMENT, INC.
SOUTHWEST VALLEY LANDFILL
SITE NO. 1
GOODYEAR, ARIZONA

GEOLOGIC/HYDROGEOLOGIC INVESTIGATION

FIGURE 1

PROJECT NO. A 01-01.01

WALTER:

HERE IS THE PLAT WE DISCUSSED - CALL ME WHEN YOU have had a chance to look at.

M. GREEN
(602) 894-2794

EMCON
ASSOCIATES
Consultants in Wastes
Management and
Environmental Control

Michael H. Green, C.P.G.
Project Manager

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San Jose, CA 95131
(408) 275-1444

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MANUSCRIPTS FOR MARCH 1988

SEISMIC INTERPRETATION

Seismic Expression of the Upper Morrow Sands, Western Anadarko Basin
Jens R. Halverson

SEISMIC THEORY

Reflection Seismology Over Azimuthally Anisotropic Media
Leon Thomsen

An Analytic Generalized Inverse for Common-Depth-Point and Vertical Seismic Profile Traveltime Equations
Gerard T. Schuster

Numerical Verification and Extension of an Analytic Generalized Inverse for Common-Depth-Point and Vertical Seismic Profile Traveltime Equations
Gerard T. Schuster, Daniel P. Johnson and Dan J. Trentman

SEISMIC SIGNAL PROCESSING

Imaging Discountinuities on Seismic Sections
E. R. Kanasewich

Dispersive Noise Removal in T-X Space: Application to Arctic Data
Greg Beresford-Smith and Rolf N. Rango

VERTICAL SEISMIC PROFILING

Removal of the Detector-Ground Coupling Effect in the Vertical Seismic Profiling Environment
Paul C. Wuenschel

POTENTIAL FIELDS

Simplified Frequency-Domain Expressions for Potential Fields of Arbitrary Three-Dimensional Bodies
R. O. Hansen and Xiaomu Wang

Improved Inversion of Geopotential Field Anomalies for Lithospheric Investigations
R. R. B. von Frese, D. N. Ravat, W. J. Hinze and C. A. McGue

ELECTRICAL AND MINING

Titanium Geophysics: The Application of Induced Polarization to Sea-Floor Mineral Exploration
Jeffrey C. Wynn

Three Dimensional Modeling of a Hole-To-Hole Electrical Method; Application to the Interpretation of a Field Survey
C. Poirmeur and G. Vasseur

Mike Green
894-2794

Fencon
Job #1832

4/8

Surely (complete) planned w/ various colors. etc. - all out & done this week
Meet their office w/ surveyor next monday - tentative plans.

12/30/87

Registrar
Egypt
Sent

Mike Green called.

1/4/88

Walt. called
Mike Green re egypt.
on hand etc.

W.

Respectfully submitted,
Terrametrics Associates

Walter E. Heinrichs. Jr, Principal

WEH:jh

P. O. Box 5964
Tucson, AZ 85703

REFERENCES

Hawkins, L. V., 1961, The reciprocal method of routine shallow seismic refraction investigations: Geophysics, v. 26, p. 806-819

Palmer, Derecke, 1981, An introduction to the generalized reciprocal method of seismic refraction integration: Geophysics, v. 46, p. 1508-1518.

EMCON.

12/23/87

Dick Davis Called

Paper records

Sledge hammer.

Noon 11th.

3 Stack – 500'

60' Spacing

Sunday evening

Dick

Cont 1191

Impact switch

Tues. AM.

7:48

27th

Blaster. No

Phx.

Betsy Seisgun

Terramitre Assoc.
(GTEX) Proposal 1832 12/3/87

1. Neither seismic or electrical work are guaranteed to detect water table. Refraction data could be limited by depth down to any higher velocity interbeds, ie volcanics, caliche etc.

2. Hammer energy may be feasible for seismic. If not, Betsy seisgun (shot gun) shells would be need.

3. Propose Jackrabbit Trail for minimizing surveying & inaccessibility on one line.
" N-S lines to minimize brushing on southern E-W strip of land.

4. If mostly accessible, ie few or no portable spreads, & no brushing or surveying, probably will average 6 to 7 660' spreads, with 60' geophone spacing, per day, equals minimum 7 to 8 field days for estimated minimum recommendation of 47 spreads

5. Seis refraction work may provide usable reflection data as well.

6. Battery powered Electrical equipment Geoweslern X-1 definitely depth limited ie prob. less than 100' and maybe less than 50'? Training to collect data charged at professional fee rates. Depending on scope, depth and personnel qualifications, this would probably require a minimum of 3 professional man days and cost a minimum of $2500.00. Personnel should ideally

be somewhat proficient in geometry and trigonometry or at least rote-trainable in these areas along the lines of ohms law: $I = \frac{E}{R}$, etc. As far as interpretational training goes, a minimum exposure to the elements of resistivity interpretation, would cost about the same ie $2500.00.

Turn key

Seismic estimates are a minimum of $23,750 for a four man crew, seven days of field operations in job, complete, this is just under $4000 per day and just over $4000 per profile mile. If Betsy were required, add $275 per operating field day. Minimum contract would be for 2 field operating days at $10,000, and half of that in advance. Any other subcontracted personnel or supplies etc., would be at our cost plus 15%. Additional operating days over and above the two day minimum, if done consecutively, will be $2750.00 per operating day.

2-3 weeks notice

$5000.00 advance.

cross spreads vs 2 ll lines etc.

EMCON

ASSOCIATES

Consultants in Wastes
Management and
Environmental Control

Dennis McElrath

4636 East Elwood #8
Phoenix, Arizona
(602) 894-2794

San Jose, CA 95131
(408) 275-1444

Dr. Walter Heinrichs
810 W. Grant Road
Tuscon, AZ 85703

RECEIVED
DEC 3 - 1987
10:20 AM
BOX 5584
TUCSON, AZ 85703

December 2, 1987

Re: Proposal for Services

Dear Mr. Heinrichs:

Per your conversation with Mr. Lee Dooley, I have enclosed the maps of the proposed landfill area.

To re-state what Lee mentioned, EMCON Associates is looking for a registered geophysicist to:

1) Assist EMCON personnel with performing and interpreting resistivity tests and data.

2) Perform a seismic refraction survey in the chosen areas and interpret the data.

3) Please include an up-to-date resume and professional qualifications of your company.

4) Provide a cost estimate for the above services.

I will call you in the late afternoon tomorrow (Thursday Dec. 3rd) to confirm rough estimates.

If any questions arise, please feel free in calling 1-602-894-2794.

Sincerely,

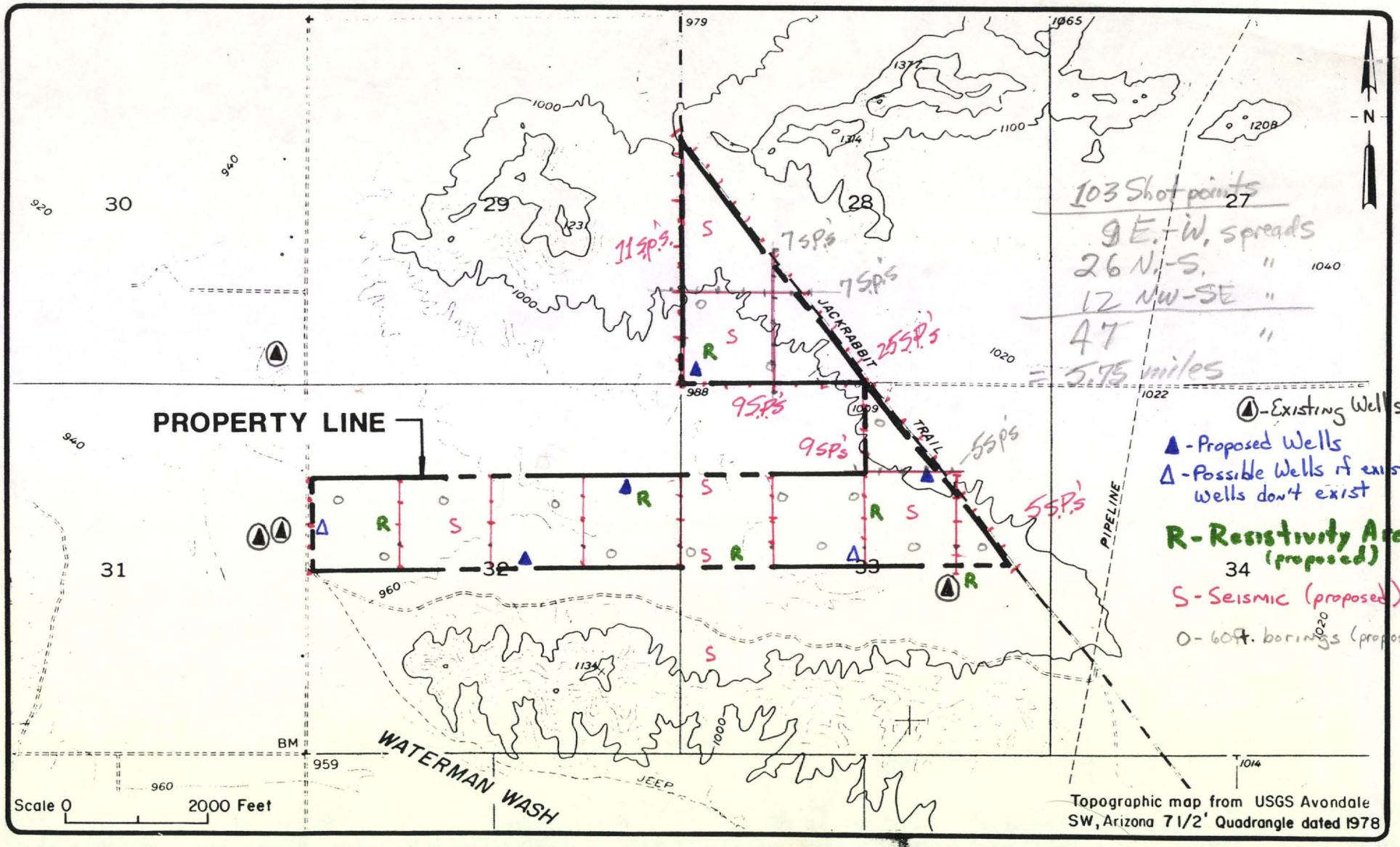
Dennis C. McElrath

Dennis C. McElrath

enclosures

P.S.
EMCON's resistivity equipment is a Geowestern X-1 direct current apparatus with a Schlumberger electrode spacing array. EMCON has sufficient cord

110169



EMCON Associates

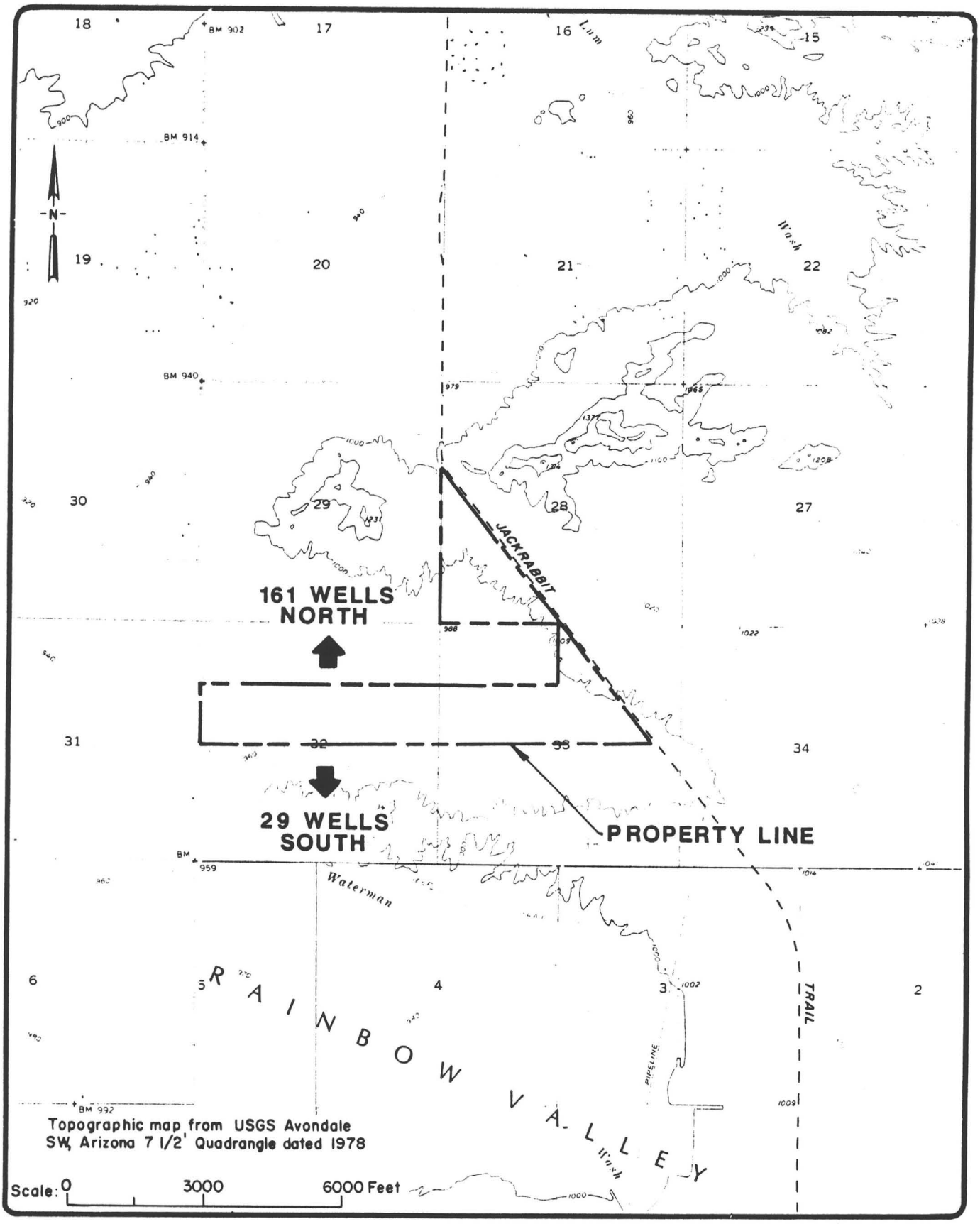
AMERICAN CONTINENTAL CORPORATION
REAL ESTATE DIVISION
ESTRELLA LANDFILL
GOODYEAR, ARIZONA

EXISTING TOPOGRAPHIC MAP

FIGURE 2-2

PROJECT NO. A01-01.01

110169



Topographic map from USGS Avondale SW, Arizona 7 1/2' Quadrangle dated 1978

EMCON Associates

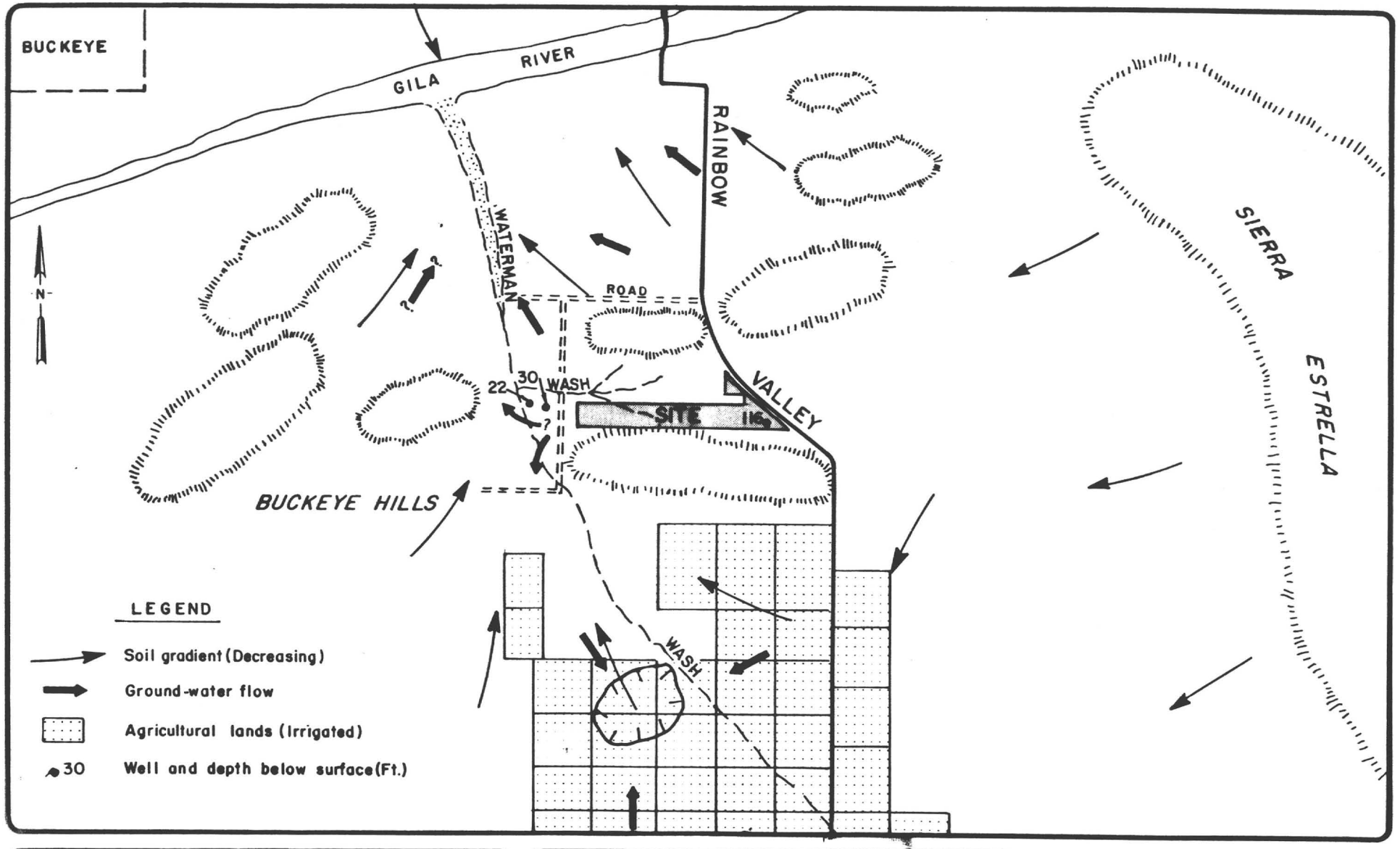
AMERICAN CONTINENTAL CORPORATION
REAL ESTATE DIVISION
ESTRELLA LANDFILL
GOODYEAR, ARIZONA

REGIONAL WELL LOCATION MAP

FIGURE 2-5

PROJECT NO. A01-01.01

110169



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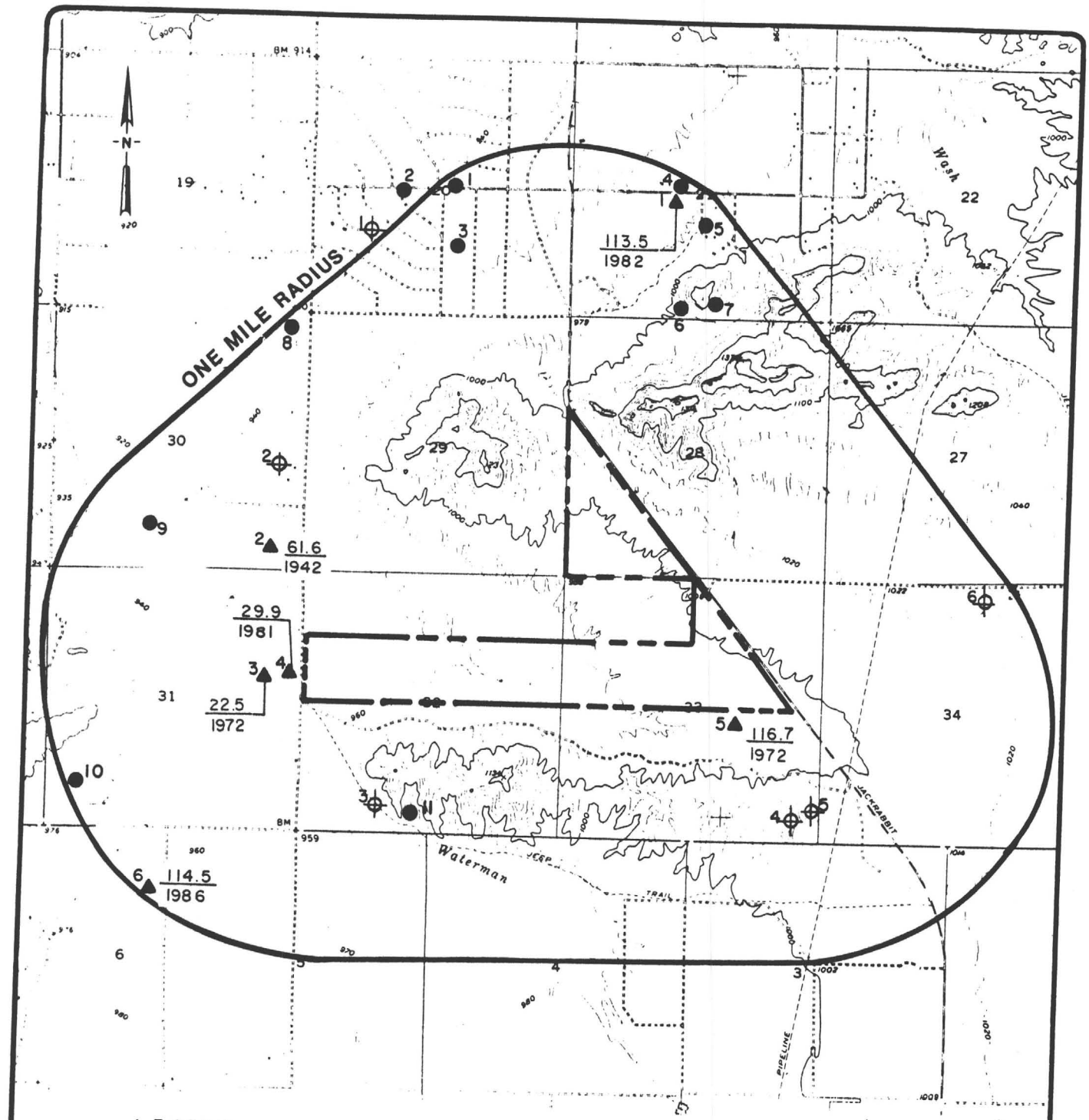
AMERICAN CONTINENTAL CORPORATION
REAL ESTATE DIVISION
ESTRELLA LANDFILL
GOODYEAR, ARIZONA

REGIONAL HYDROGEOLOGY

FIGURE 2-3

PROJECT NO. A01.01-01

110169



LEGEND

1 ● New wells post 1981

2 ⌖ Old wells pre 1981

3 ▼ 225/1972 Water level data location showing depth of water below surface (Ft.) and date measured.

Scale: 0 — 3000 Feet

NOTE:

Topographic base map from USGS Avondale SW, Arizona 7 1/2' quadrangle date 1978

Well information from Arizona Department of Water Resources Well Registry.

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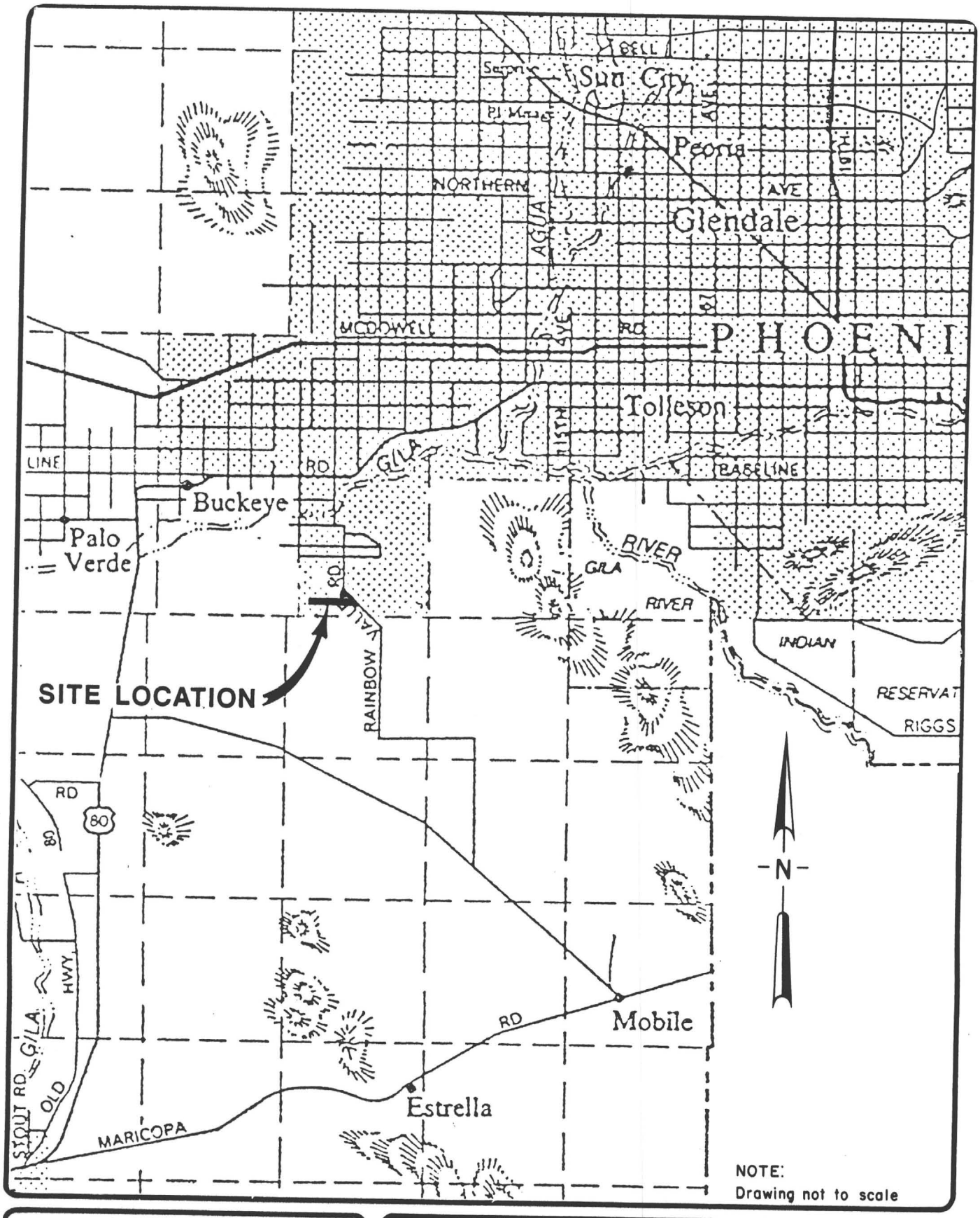
AMERICAN CONTINENTAL CORPORATION
REAL ESTATE DIVISION
ESTRELLA LANDFILL
GOODYEAR, ARIZONA

WELL LOCATION MAP

FIGURE 2-4

PROJECT NO. A01-01.01

110169



EMCON Associates

AMERICAN CONTINENTAL CORPORATION
REAL ESTATE DIVISION
ESTRELLA LANDFILL
GOODYEAR, ARIZONA

LOCATION MAP

FIGURE 2-1

PROJECT NO. A01-01.01

CONFIDENTIAL

TERRAMETRICS ASSOCIATES

GEOLOGY • HYDROLOGY • GEOPHYSICS

TELEX: 364412 INTR ID894

1472 NORTH FIFTH • P.O. BOX 1292 • LARAMIE, WYOMING 82070 • (307) 742-8366

810 WEST GRANT ROAD • P.O. BOX 5964 • TUCSON, ARIZONA 85703-0964 • (602) 623-0578

December 10, 1987

EMCON Associates
4636 E. Elwood, #8
Phoenix, AZ 85040

Re: Proposed geophysical work:
Secs. 28, 29, 32 & 33 T. 1 S.,
R. 2 W. Maricopa County, AZ
Terrametrics #AZ 1832-'87

Attn: Mr. Dennis Mc Elrath

Dear Mr. Mc Elrath:

This is in reference to several phone conversations I have had with you and your colleagues, Lee Dooley and Mike Green, beginning with your initial call on 1 December 1987. It is also in reference to your written communication of 2 December 1987 and six accompanying illustrations.

It is understood that you seek to acquire an on going relationship with appropriate geophysical expertise to work with you on a contracting and/or consulting basis. In addition, you are presently involved with a proposed waste site located within the above captioned area as indicated on the U.S.G.S. Avondale SW, 7½ minute Quadrangle map, and that some shallow geophysical asistance is being considered as a supplement or complement to a planned drilling program as indicated on your Project No. A01-01.01 Figure 2-2, which shows the property line and your proposed well and geophysical annotations.

Initially, I had the impression that six to eight miles of seismic traverse was desired but now I understand the thinking is more like seven areas or spots where seismic might be run along with six similar locations for some resistivity coverage. These proposed seismic and resistivity locations are indicated in red "S's" and green "R's" respectively on your Figure 2-2 mentioned above.

The objectives will be to acquire whatever useful subsurface information that can be obtained by the routine application of the two methods down to a depth of fifty feet below surface. It is also desired that we assist EMCON personnel with performing and interpreting the resistivity tests and data. The reason for the fifty foot criterion, is that this is the maximum depth of cut below the surface which is planned to be made to accommodate the intended waste fill material.

Although neither the seismic or electrical methods can be guaranteed to always detect the water table, it is hoped that this will be done and especially so if the water table depth should be near fifty feet or less below surface. The same would also apply to bedrock or any existing hard interbeds.

Reportedly, the area is very open, with little or no brush, completely drivable, no portable spreads will be needed and, surveying references will be provided or, little or none will be necessary to locate the spreads on the ground. Brunton compass orientation of spreads will be adequate. Personnel and equipment are allowed to stray outside of property lines if necessary and beneficial to over all objectives.

Reported water table depths range from 22.5 feet deep measured in 1972 and 22.9 feet deep measured in 1981 in two wells just west of the western property line, and up to 116.7 feet deep in a well near the southeast corner of the property. One immediate alternative recommendation to consider here would be to run some seismic and electrical work near the eastern most well and one of the two westernmost wells for initial interpretation correlation purposes.

We propose that a portable twelve trace digital recording seismograph be used with twelve geophones, spaced from 10 ft. to 60 ft. apart. Emphasis will be on vertical sounding as opposed to profiling. The same would apply to the resistivity work with similar depth criterion. "Cross" spreads may be used if deemed necessary. Hammer energy may or may not be entirely adequate for the seismic work. If not, we propose using a patented Betsy Seisgun Sources system utilizing safe and environmentally inoffensive shot gun shells. It is understood that you have and will furnish the necessary resistivity equipment but, we can probably supplement it if not and such is needed.

Based on your descriptions of conditions we estimate two days for the seismic field work and two field days for the resistivity work, at a minimum charge of $10,000.00 turn key for the seismic work and $5,000.00 for the resistivity work. I get the feeling that you would like to hold total charges to these two figures and, if so, we can work within those constraints. At this point, one unknown is how many cross spreads, if any, may be desirable and that really depends on how clean and crisp the results are, which wont begin to be determined until some are obtained. The above time estimates are based on the need for two or three cross spreads per method, three to four men including at least one professional on each crew and that you would be supplying at least two men for the resistivity crew and we would be supplying at least one man plus one vehicle, thus, one vehicle from each of us on the resistivity. Betsy charges, if needed are $275.00 per seismic operating day extra.

Turn key rates are as follows for Seismic:

Mobilization and demobilization	$3,500.00
Two days field operations @ $2,000 per day	4,000.00
Report and interpretation $1,000.00 (base)	1,000.00
Plus two field operating days @ $750.00/day	1,500.00
	$10,000.00

Resistivity training, operations and interpretation.
Base, two field days @ $2,500.00/day----------$5,000.00

Billings are based on charges acrued at the conclusion of field work, with a final billing accompanying the report and interpretation about three weeks later. Statements are due on presentation and, if unpaid after 30 days, will acrue added interest at 1.5% per month beginning on date of unpaid statement.

Depending on our work load, we may require from one to three weeks or more notice to proceed. At present, nothing is firmly scheduled for mid January. Naturally, preparation is best with most notice.

Two of our current brochures are enclosed. These include resumes as requested.

If you need further information please do not hesitate to call.

Sincerely,
Terrametrics Associates

Walter E. Heinrichs, Jr., Principal

WEH:jh

Encl: 2

cc: R. W. Davis
w/o enclosures.