GL01638

COMPLETION REPORT

GEOTHERMAL EXPLORATORY WELL S-89-4

Sulphurdale, Utah

For

Mother Earth Industries, Inc.
7350 E. Evans, Suite B
Scottsdale, Arizona 85260

GEOTHERMAL MANAGEMENT Co., Inc. P.O. Box 2980 Evergreen, CO. 80439-2980

GLO1638

COMPLETION REPORT

–

GEOTHERMAL EXPLORATORY WELL S-89-4

Sulphurdale, Utah

For

Mother Earth Industries, Inc.
7350 E. Evans, Suite B
Scottsdale, Arizona 85260

Prepared by
Geothermal Management Company, Inc.
P.O. Box 2980
Evergreen, Colorado 80439

July 1989

TABLE OF CONTENTS

FIGURES

APPENDICES

PLATE (in pocket)

COMPLETION REPORT FOR

S-89-4
Sulphurdale, Utah

I. ABSTRACT

A geothermal exploratory "slim hole" designated S-89-4 was drilled on Fee land controlled by Mother Earth Industries, Inc. between the dates of May 31 and June 5, 1989. The well is 3460 ft. south and 643 ft. east of the northwest corner of Section 7, T26S, R6W, SLB&M.

After penetrating approximately 120 feet of acid leached alluvial materials and bedrocks typical of the local Sulphur Pit the well encountered a landslide block containing highly altered and fractured rocks of the upper portion of the Three Creeks Tuff member of the Bullion Canyon Volcanic series (Moore and Samberg, 1979) and rocks thought to be the Wales Canyon Formation. A significant flow of steam was encountered at a depth of 615 feet within a white metasandstone or quartzite (Coconino Formation) and the well was drilled, in this formation, to a total depth of 628 feet KB.

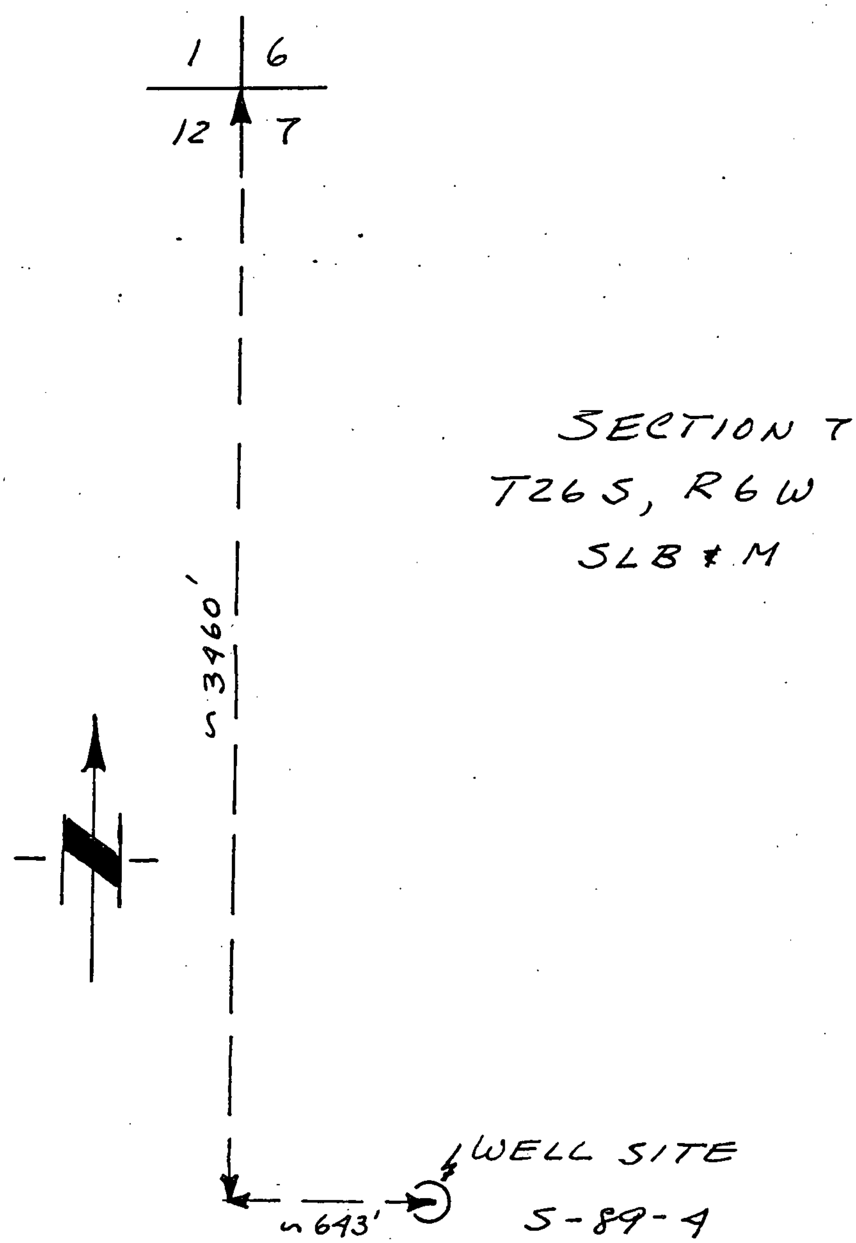
The prime contractor for the well was Grimshaw Drilling Inc.; surveys were done by Sunrise Engineering, Inc. of Fillmore, Utah; Safety Services were provided by Bell Safety of Evanston, Wyoming; wellsite geological supervision was by Geothermal Management Company, Inc. of Evergreen, Colorado; and petrographic examination of drill cuttings was done by Joseph Moore of Salt Lake City, Utah. All other activities were conducted by Mother Earth Industries, Inc.

II. LOCATION

This report pertains to MEI exploratory slim hole S-89-4 located near Sulphurdale, in Beaver County, Utah within the Cove Fort-Sulphurdale KGRA.

Specifically, the well is on MEI controlled fee land approximately 3460 feet south and 643 feet east of the northwest corner of Section 7, T26S, R6W, SLB&M. It is about 1480 feet from well 34-7A (Linda), about 595 feet from the nearest previously drilled production well P-88-2 (Loretta), and about 230 feet southeast of exploration well S-89-1.

Figure 1 depicts the location of the well relative to the section corner; Plate I (in the pocket) is a survey plat of the entire MEI production area.



REVISIONS		
No.	Date	By
1		
2		
3		
4		
5		

GEOTHERMAL MANAGEMENT Co.

P.O. Box 2980 Evergreen, CO. 80439-2980 (303) 670-3454

LOCATION MAP S-89-4

SULPHURDALE, UTAH

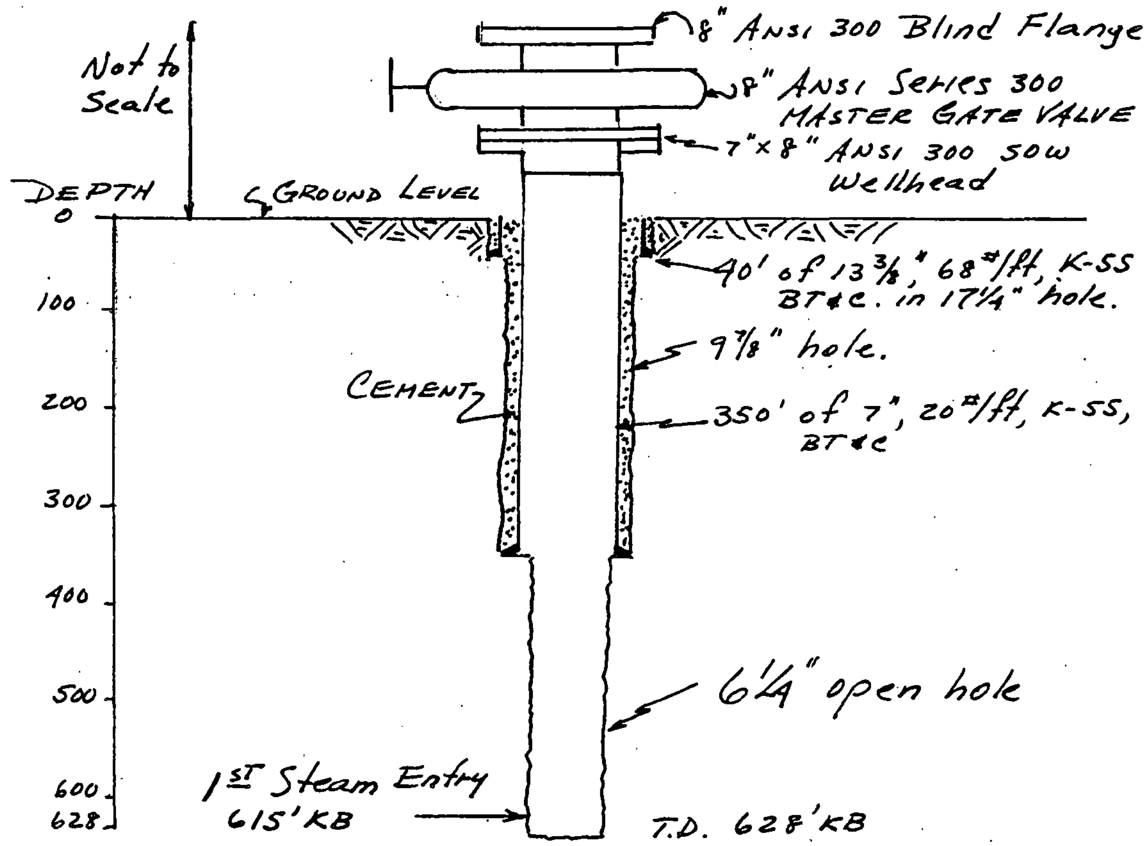
By: GWH	Ckd: GWH
Date: 6-23-89	
Scale: 1" = 600'	
Dwng. No: ME1894-1	
Figure 1	

III. WELL DRILLING AND CONSTRUCTION HISTORY

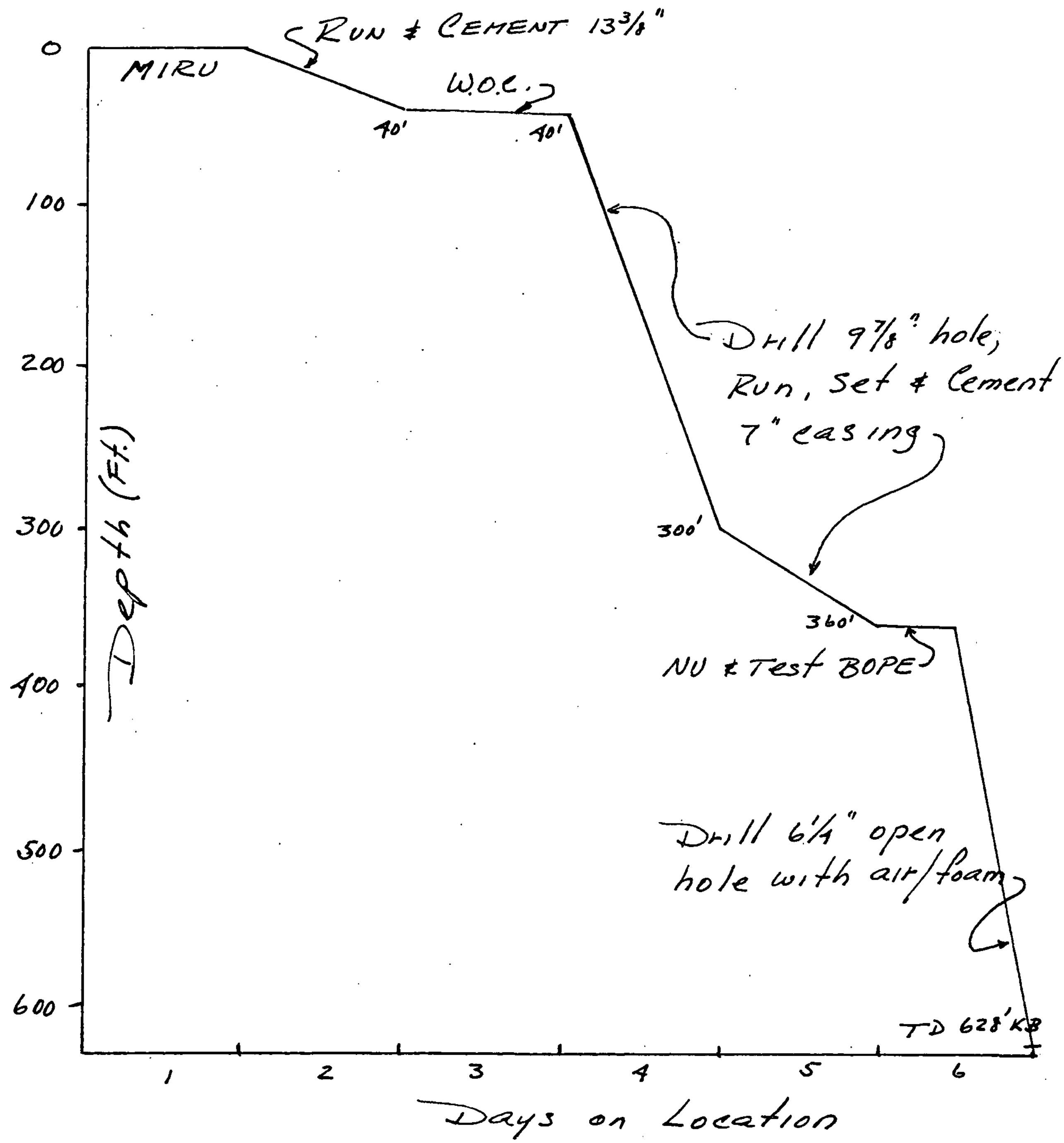
In order to cost-effectively search for extensions of the dry steam geothermal resource discovered to date, exploratory well S-89-4 was drilled in a "slim hole" configuration as follows:

On May 31, 1989, Grimshaw Drilling, Inc. equipment was moved from the site of S-89-1 to the S-89-4 location and rig-up was begun. By 1800 hrs on June 1 a 17.5" hole had been drilled to 50'KB and by 2300 hrs, 40' of 13.375", 61 lb./ft., K-55, BT&C surface casing was set and cemented by Dowell/Schlumberger. On June 3 and 4, following miscellaneous repairs and further rig-up, an 8.625" hole was drilled to 360'KB. Three hundred fifty (350) feet of 7", 26 lb./ft., K-55, BT&C casing was run and cemented by Dowell using high temperature cement plus 40% silica flour. On June 5, after nippling up a double ram BOP stack, the well was drilled to a total depth of 628'KB in only 5 hours. The first steam entry was logged at 615'KB. Note that KB is equal to Ground Level plus 10 feet.

A drilling history, describing daily events between May 31 and June 5, 1989, drilling activity sheets, and tour reports accompany this document as Appendix A. Figure 2 is a profile of the well as completed; Figure 3 is a drilling curve showing the rate of drilling progress, and Figure 4 shows the Blowout Preventer stack used on the 7" casing. Appendix B, attached, is MEI's basic drilling procedure developed for slim exploratory wells. Appendix F comprises the geolograph charts that document the drilling rate from 379'KB to 628'KB.



REVISIONS			GEOTHERMAL MANAGEMENT Co. P.O. Box 2980 Evergreen, CO. 80439-2980 (303) 670-3454	By: GWH	Ckd: GWH
No.	Date	By		Date: 6-23-89	
1				Scale: 1"=200' Vert.	
2				Dwng. No: ME1894-2	
3			WELL PROFILE S-89-4	Figure 2	
4					
5			SULPHURDALE, UTAH		



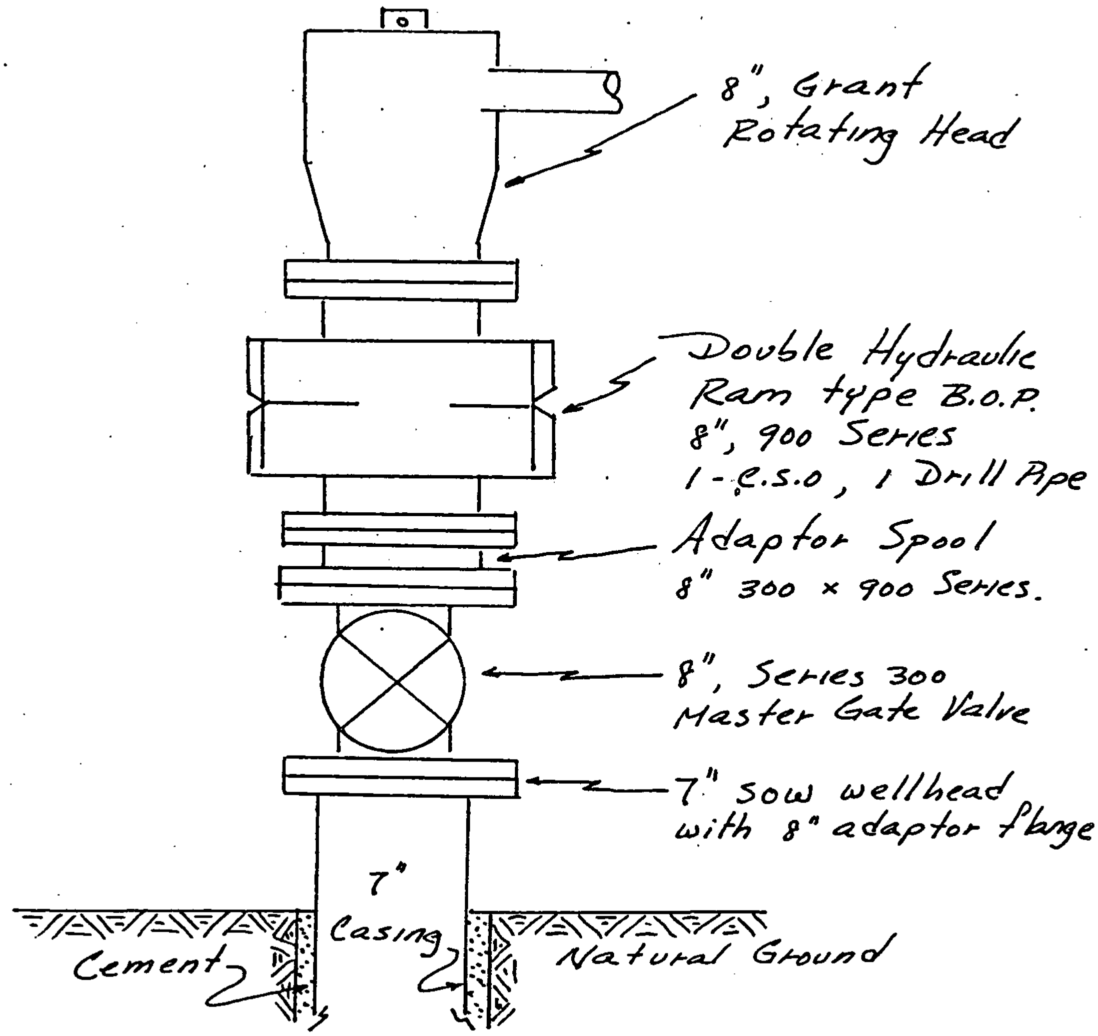
REVISIONS		
No.	Date	By
1		
2		
3		
4		
5		

GEOTHERMAL MANAGEMENT Co.
P.O. Box 2980 Evergreen, CO. 80439-2980 (303) 670-3454

DRILLING CURVE S-89-4

SULPHURDALE, UTAH

By: GWH	Ckd: GWH
Date: 6-23-89	
Scale: 1" = 100' Vert.	
Dwng. No: HE1894-3	
Figure 3	



REVISIONS		
No.	Date	By
1		
2		
3		
4		
5		

GEOTHERMAL MANAGEMENT Co.
P.O. Box 2980 Evergreen, CO. 80439-2980 (303) 670-3454

7" B.O.P.E. STACK S-89-4

SULPHURDALE, UTAH

By: GWH	Ckd: GWH
Date: 6-23-1989	
Scale: None	
Dwng. No: ME1894-4	
Figure 4	

IV. GEOLOGY

The Cove Fort-Sulphurdale region, in southwestern Utah, comprises folded and faulted sedimentary and metasedimentary rocks of Paleozoic to Mesozoic age that are overlain, sequentially, by Oligocene to Miocene age ash-flow tuffs and Quaternary basalts. All of the rocks except the basalts have been intruded locally by Miocene quartz - monzonite and/or latite porphyry stocks, sills, and dikes.

The rocks penetrated in S-89-4 comprise breccias and ash-flow tuffs, reworked and hydrothermally altered to varying extents, that have been designated as the Three Creeks Tuff Member of the Bullion Canyon Volcanics (one of the oldest of the local volcanic units). The Three Creeks Tuff has three distinct zones: an upper and a lower zone of red to grey densely welded tuff and a middle zone of poorly welded white tuff. Only the lower zone of the Three Creeks Tuff has been mapped in the Cove Fort area of interest.

This lowermost zone of the Three Creeks Tuff has been further subdivided into two cooling units. The upper unit is characterized by euhedral plates of biotite up to several millimeters wide and euhedral (beta morphology) quartz crystals while the rocks of the lower cooling unit are mineralogically the same but much finer grained. The lower unit (tentatively correllated with the Wales Canyon Formation) is found in S-89-4 at a depth of about 370 feet.

S-89-4 initially penetrated approximately 120'KB of alluvium, colluvium, leached, silicified, and variably pyritized Three Creeks Tuff (Tbt) that is typical of the materials found in the main Sulphur Pit. From 120 to 220'KB, a zone of reworked Tbt, possibly created along a landslide movement plane, was penetrated. This zone was characterized by accumulations of Tbt phenocrysts without the normal rock matrix.

Below 220'KB, S-89-4 transected variably fractured, brecciated, pyritic and altered (argillic and silicic) light grey to medium grey to green-grey Tbt. The mineralogically similiar, but argillically altered, smectitic Wales Canyon Fm. was found at 370'KB. Commonly, the textures of the Tbt and of the Wales Canyon rocks were 80-100% obliterated by alteration to calcite, sericite, clay, quartz, and pyrite.

At 610'KB, the well encountered a white, vitreous, fractured, pyritic pre-Tertiary age metasandstone or quartzite thought to be the Coconino Fm. Steam was first noticed near the contact, but the first significant entry was at 615'KB.

Attached, as Appendix C, is a petrographic description of drill cuttings from this well together with some interpretive comments.

V. PERMITS

Because well S-89-4 was drilled on privately owned land and not on Federal property, the permitting required was minimal. Attached as Appendix D is a copy of the relevant permit from the Utah Division of Water Resources (UDWR). Archeological clearance for the well was given as a result of studies encompassing the whole prospect area that were previously accomplished and documented. When the BOP stack on S-89-4 was pressure tested in accordance with State regulations, the test was witnessed and approved by UDWR representitive John Solum.

VI. SUMMARY COST ESTIMATE

Attached to this report as Appendix E is a "Field Cost Estimate" for the drilling of S-89-4. The costs are lower than those for some of the other slim holes previously drilled by MEI because: 1) The hole was rapidly and efficiently drilled, and 2) the depth to steam was significantly less than in any other well drilled in the field to date. These changes resulted in decreased rig time and consultant/service company utilization, so that the approximate cost per foot of S-89-4 was $62.37.

APPENDIX A

S-89-4 DRILLING HISTORY

5-31-89	
0800 - 1830	RDMO from S-89-1, MIRU on S-89-4 site.
6-1-89	
0700 - 1800	Continued MIRU.
1800 - 2000	Drill 50'KB of 17.5" hole for surface pipe.
2000 - 2200	Run and cement (Dowell/Schlumberger) 40 ft. of 13.375", 61#/ft, K-55, BT&C casing.
2200 - 2400	WOC.
6-2-89	
0000 - 0730	WOC, RU mud and light systems.
0730 - 0900	Cut off 13.375" casing, further rig up.
0900 - 1200	Repair mud tanks.
1200 - 2400	Miscellaneous rig-up and repairs.
6-3-89	
0000 - 0200	MU flow line and weld in place.
0200 - 0600	Break subs off 17.5" bit.
0600 - 0800	DA to 76'KB using mud. Hole sloughing.
0800 - 1000	Build up mud viscosity and weight.
1000 - 1110	DA 76-100'KB.
1110 - 1200	Welding and repairs.
1200 - 1425	DA 100-169'KB.
1425 - 1855	Repair pump, refill mud tank.
1855 - 2400	DA 169-300'KB.
6-4-89	
0000 - 0340	DA 300-360'KB., setting depth for 7" casing.
0340 - 0445	Circulate and condition hole.
0445 - 0530	Short trip, RIH, tag bottom, no fill.
0530 - 0730	Circulate and condition hole. Survey at 360'KB. Deviation = .75 degree.
0730 - 1000	POOH, LD collars.
1000 - 1300	RU to run 8 joints of 7", 26#/ft, K-55, BT&C casing.
1300 - 1330	Cementing by Dowell. CIP at 1330 hrs.
1330 - 2130	WOC.
2130 - 2400	Cut off casings, MU 6" SOW flange and begin to NU BOP stack.

6-5-89

0000 - 1200	NU BOP stack, MU blooie line, Test BOP. Test witnessed and approved by J. Solum. (750 psi to 740 psi in 15 minutes.)
1200 - 1745	Drill cement from 341'KB to 360'KB.
1745 - 1925	DA 360-628'KB with air/foam. First steam entry at 615'KB.
1925 - 2300	Condition hole.
2300 - 2400	POOH, LD DP. Crew released except for one watchman while well was flowed.

DRILLING ACTIVITY LOG WELL # [5 89-?] DATE [5-31]89

TIME	DEPTH	NAME	COMMENTS
08:00		M Harris	Start Riging down off Hole # 589-1
		R Agular	get all Lines disconected off of Rig
		D Talbut	tip over, Build new drill pad.
			Move equment out of in front of drill
		K Richins	get mud system unhooked. get Electrical
		L Hawkins	Systey disconeeted Start picking up all
			the little missi equment get the Rig
		B Larsen	moved off substructer. pulled sub over to
		J Grimshaw	New Location and get it Leveled and moved
			end pice of sub over with forklift and get
			it bolted on & Leveled up. Move Rig on
			Substructer & get it Leveled up get derick
			in air. get the B.O.P. Nippled Down
			and stacked out on cement pad. get
			plate & Bleeder valve Nippled on well.
			Blow well & then put it on Bleed. move stairs over
6:30			to New site & Start to Rig up

tot 10½

2

DRILLING ACTIVITY LOG WELL #: [S-89-2] DATE: [6-1-]89

TIME	DEPTH	NAME	COMMENTS
07:00		M Harris	Get pad Flatero out for dog house
		R Augler	get dog hous moved in get all Rental
		D Talbot	tools Rounded up and stacked out on Cement
			pad get Air Compresser moved on location
			move mister pump by Aair copresser Chang out
			Bolts on valve well # S-89-1 get moved
			off old Loaction start + get dog house
			Riged up move Water tank onto drill
			pad get Big Light plant + Little Light
			plant move in get air compresser plumbed in
			+ mistpump plumed in drag dow Fule tank
			and get it plumbed in to the air Compresser
			and mist pump get Light plant Wired in
			and all the Light we Could find that
			Would work get 40 ft of 13 3/8 Conductor
12hrs 7:00	1900		Casing moved on to pipe Racks

Jan 09 '09 11:34 P.05

MEI DRILLING ACTIVITY LOG WELL # [S-89-2] DATE: [6-1-89]

TIME	DEPTH	NAME	COMMENTS
~~19:00~~ 0700		RH	Get location ready move air Compersson
		"	+ Mist tank to location and Set Same
		"	unhook light plants and move to location
		"	and Set up take Blewe line apart
		"	and move to location Clean 17" Bit up
		"	to drill with take Rotating head off
		"	take Spool off B.O.P.S move Cat walk and
		"	Beaver side To Rig and Rig up move 6¼ Callar
		"	and Subs move 13⅜ Cassing to Cat walk
		"	Rig up fuel line and water tank Pick up
		"	17in Bit Bit Sub 4 Crossover Subs make up
1800	44	"	on Kelly and Drill Kelly Down Clean Hole
		"	pick up Callar and Drill to 50" KB
		"	Stand Callar Bit and Subs Back and
2000	-2200	"	Run Cassing 50" KB and Cement
2200-2400	"	"	try to fix Lights wait on Cement Randy Harvey 17 hours
12:00	50"		Larry Wall 17 Hours
1200	[illegible]		Dale Hunt 17 hours

MEI DRILLING ACTIVITY LOG WELL #: [S-89-] DATE: [6-2-89]

TIME	DEPTH	NAME	COMMENTS
02:30	M	Harris	got to work Casing was Cemented
	R	augilair	while waiting on it was geting mud system
	D	talbot	moved moved the mud pump and got it out of
			the way while we was doing that Rick worked on
			Lights after we moved mud pump out tryed to move
			mud pit couldn't get enough traction on that end
			to get it up out of the hole it is in (tank is still
			got a lot of Solids in it.) had to go out the other
			end. drill pipe + pipe Racks in the way had Rick
			move them while he is moving had Dave get torch over
			to Rig + I cut of 13 3/8 Casing 6" Below table. Belt
			came off on fork Lift had to put it Back on it came
			off agin and we put it back on about the 5th or 6th time
			it wouldn't stay on long enoug to mess with finish
			moving drill pipe + pipe Rack with back hoe. pull out
			mud tank + pulled it over to the Rig pushed it into
			place. pushed in mud pump. Started to weld
12:[illegible]			up hole [illegible] of mud tank. Dave clean up dog house
			put [illegible] that we could find.

MEI DRILLING ACTIVITY LOG WELL #: [S-89-2] DATE: [6-2-89]

TIME	DEPTH	NAME	COMMENTS
12:00		RH	Make Cut + Weld Suction line Between
			pump and tank make Cut and weld
			mud Line to Rig 3" & Rig up lights
			Clear off floor fill mud tank with H_2O
			make and weld Flow line
			Rig up air lines to pump from Rig
			Etend Charge pump Cord to Reach
			light plant
			put Geolograph line on
~~12:00~~ 24:00		RH	
			Randy Harvey ✓
			Larry Wall
			Dale Hunt

Randy Harvey 12:00
Larry Wall 12
Dale Hunt 12

Mike 12 hrs
Rick
Dave

MEI DRILLING ACTIVITY LOG WELL #: [5 89-] DATE: [6-3-89]

TIME	DEPTH	NAME	COMMENTS
2400	0000		weld nipple on Casing for flow Line went
			+ got a pice of 8" casing 22ft Long made folow Line
			and got it welded on halled mud over to Rig
			Started taking apart 17in Bit + Subs Chand Bit to
			derick Leg + Brok it Loose Could find onley one tong
			parts Large enough for Big bit subs Look all over couldn't
			find others any palce went + got one off floor from
			M.E.I. Rig got Big Bit sub broke Loose. mix mud
			put on Bit Sub + 8 3/4 Bit. Started drilling @ 40 ft. drilled
0600	40		Kelley down when went to Rod up hole had slufed in
			put Kelley Back on & cleaned out hole mix mud while
			circulating hole try to Rod up agin Still wouldn't go
			had to get mud Real heavy had a Lot of Loose
			Formation Comming in on us circulate with heavy
			mud clean out hole mud wouldn't goo through Flow Line
			had to get hole in casing cut Larger when mud
			[illegible]
1200	[illegible]		[illegible]

6

MEI DRILLING ACTIVITY LOG WELL #: [5-89-4] DATE: [6-3-89]

TIME	DEPTH	NAME	COMMENTS
12:00	100"	RH	Drill 7 ft take goose neck off and turn
12:55	107"	RH	make Conection Collar 6 1/4
2:05	138"	RH	make Conection Collar 6 1/4
2:50	169"	RH	make Conection Drill pipe 3 1/2
3:30			lose pump presure check and take apart
7:00	169	RH	pump Replaced 2-6" Swabs fix wench
7:45	198	RH	Conection D P.
8:20	230	RH	Conection + Shut down to ADJ Clutch
10:00	261	RH	Conection + Condition Hole fix Light plant
11:25	291	RH	Conection
			Randy Harvey
			4 Gal oil in Pump Motor — Larry Wall
			3 Gal 90 in Rotary — Dale Hunt

DRILLING ACTIVITY LOG WELL # [S 89] DATE: [6-4-89]

TIME	DEPTH	NAME	COMMENTS
2400	300	mike	drilling going Fair drilling in Solid [illegible]
			Flow Line temp 107° 344 ft from G.L. drilling has
			Slowdown Hitting Some small Fract[illegible]. Flow Line temp
340	360 KB		110 350 Ft. from Ground Level 360 K.B. T.D. for 7"
340	4:45		Circulating hole + conditiong it. Get Caseing Ready
			& straped
445	5:30		Short Trip Trip Back To Bottom no
			fill -
5:30	7:00		Circ & Cond Hole sTrap (9) Joints
			of 7" @ 396.30
7:00	7:30		Survey @ 350 3/4 %
7:30	1		Trip out Hole to Run Caseing & Lay Down
	10:00		D.C 4 of them.
10:00	12:00		Rig up to Run Caseing Run 8 Joints

Jan 05 '89 11:34 P.05

MEI DRILLING ACTIVITY LOG WELL # [5-89-4] DATE: [6-4-89]

TIME	DEPTH	NAME	COMMENTS
	1:00		1 JTS of 7" Cassing and Rig up to Cement
1:00	1:30	RH	pump Cement - modirate Return
1:30	9:30	RH	wait on Cement
9:30	12:00	RH	Cut Conductor and 7" off and weld Cassing flangeon
		RH	Drag acumulator over to location. Drag B.O.P.S. over.
		6"	Valve. well Head Valve. find Bolts to Everything
			Rig up water wash Down line to Rig. wire up water
			pump. Drain and Clean mud pit and fill with
			water. Serviced all Equipment on location
			fix Derrick lights. fixed Sling to pick up BOPS
			hauled trash off. Dug Dirt out of Cellar
			filled all Gear Box's on Rig
			Every thing is Ready to nipple
			up
			Randy Harvey 12
			Larry Wall 12
			Dale Hunt 12

Mike Ho[illegible]rs
Ric Augilar
Dave Tebot

DRILLING ACTIVITY LOG WELL # [S 89-4] DATE: [6-5-89]

TIME	DEPTH	NAME	COMMENTS
2400 – 12:00			Nipple up B.o.p.'s hang Bloie Line test Bop it had a Leak at the door on pipe Rams tightein it waigh for State man test Bop's agin have a verry small Leak on Door still tighter it agin test Bob agin this time we got a good test get Bottom hole assbley Ready + trip in hole tag Cement.

MEI DRILLING ACTIVITY LOG WELL # [S-89-4] DATE [6-5-89]

TIME	DEPTH	NAME	COMMENTS
12:00		341	tag Cement @ 341 Drill out Cement + shoe
			trip out with 6 Bit pick up hammer trip in
	348	RH	hole tag formation @ 348 Drilling @ 5:30
5:45	379	RH	Connection Drilling Sand and Shale
6:25	410	RH	Connection
6:55	442	RH	Connection
7:20	473	RH	Connection
7:50	504	RH	Connection
8:15	535	RH	Connection
8:40	565	RH	Conection Drill Break 565 to
9:05	597	RH	Conection Hit Steam @ 615 ft
9:25	628	RH	~~Conection~~ formation falling in work and
			Condition Hole
11:00	628	RH	trip out of Hole with 16 JTS Drill pipe
	12:30	RH	4 Collars 1 Sub 4ft Hamer
			Drilled 320 ft in 5½ hours Randy Harvey 12 ½
			Larry wall 12 ½
			Dale Hunt 12 ½

1/5

CONTRACTOR | RIG NO.

SIGNATURE OF CONTRACTOR'S TOOL PUSHER

PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH

FIELD OR DIST. | COUNTY | STATE

LAST CASING TUBING OR LINER	SIZE	MAKE	WT. & GR.	NO. JOINTS	FEET	RKB. TO CSG. HD.	SET AT

WIRE LINE RECORD | REEL NO.

SIZE | NO. LINES | FT. SLIPPED

FT. CUT OFF | PRESENT LENGTH

TON MI. OR TRIPS SINCE LAST CUT

CUMULATIVE TON MI. OR TRIPS

MORNING TOUR

BIT RECORD

BIT NO.	
SIZE	17
IADC CODE	
MFG.	[illegible]
TYPE	
SER. NO.	
JETS 1/32" /TFA in²	
DEPTH OUT	
DEPTH IN	
TOTAL FTG.	
TOTAL HRS.	2
DULL CUT. STRUC. I O D L B G O R	
GPM/PUMP-PSI	

MUD RECORD: TIME | WEIGHT | PRESSURE GRADIENT | VISC.-SEC. | PV/YP | GELS | WL.-CC'S | pH | SOLIDS %

MUD & CHEMICALS ADDED: TYPE | AMT. | TYPE | AMT.

FOOTAGE (FROM, TO) | DR.-D RM.-R CORE-C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY RPM | WT. ON BIT 1000# | PUMP PRESS | PUMP NO. (LINER SIZE, S.P.M.) | PUMP NO. (LINER SIZE, S.P.M.) | METHOD RUN

DEVIATION RECORD: DEPTH | DEV. | DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
7:00	6:00		1	[illegible]
6:00	8:00		2	Drill Surface
8:00	10:00		12	Run Casing and Cement
10:00	[illegible]		13	wait on Cement

DRILLER

DAY TOUR

BIT RECORD: BIT NO. | SIZE | IADC CODE | MFG. | TYPE | SER. NO. | JETS 1/32" /TFA in² | DEPTH OUT | DEPTH IN | TOTAL FTG. | TOTAL HRS. | DULL CUT. STRUC. I O D L B G O R | GPM/PUMP-PSI

MUD RECORD: TIME | WEIGHT | PRESSURE GRADIENT | VISC.-SEC. | PV/YP | GELS | WL.-CC'S | pH | SOLIDS %

MUD & CHEMICALS ADDED: TYPE | AMT. | TYPE | AMT.

FOOTAGE (FROM, TO) | DR.-D RM.-R CORE-C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY RPM | WT. ON BIT 1000# | PUMP PRESS | PUMP NO. | PUMP NO. | METHOD RUN

DEVIATION RECORD: DEPTH | DEV. | DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
7:00	7:00		1	

DRILLER [illegible]

EVENING TOUR

BIT RECORD: BIT NO. | SIZE | IADC CODE | MFG. | TYPE | SER. NO. | JETS 1/32" /TFA in²

MUD RECORD: TIME | WEIGHT | PRESSURE GRADIENT | VISC.-SEC. | PV/YP | GELS | WL.-CC'S | pH

FOOTAGE (FROM, TO) | DR.-D RM.-R CORE-C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY RPM | WT. ON BIT 1000# | PUMP PRESS | PUMP NO. | PUMP NO. | METHOD RUN

DEVIATION RECORD: DEPTH | DEV. | DIRECTION

TIME LOG FROM | TO | ELAPSED TIME | CODE NO. | DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS

2/5

API WELL NUMBER	DATE
5 89-	6-8-89

CONTRACTOR	RIG NO.
Grimshaw Drilling inc.	2

SIGNATURE OF CONTRACTOR'S TOOL PUSHER

PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
1			10"

FIELD OR DIST.	COUNTY	STATE
Beaver		Ut

LAST CASING TUBING OR LINER	SIZE	MAKE	WT. & GR.	NO. JOINTS	FEET	BKB. TO CSG. HD.	SET AT
	13 3/8		K 55	2	41	10	50

WIRE LINE RECORD	REEL NO.	
SIZE	NO. LINES	FT. SLIPPED
FT. CUT OFF	PRESENT LENGTH	
TON MI. OR TRIPS SINCE LAST CUT		
CUMULATIVE TON MI. OR TRIPS		

MORNING TOUR

BIT RECORD				MUD RECORD			
BIT NO.				TIME			
SIZE				WEIGHT			
IADC CODE				PRESSURE GRADIENT			
MFG.				VISC.-SEC.			
TYPE				PV/YP	/	/	/
SER. NO.				GELS	/	/	/
JETS 1/32" /TFA in²				WL.-CC'S			
				pH			
DEPTH OUT				SOLIDS %			
DEPTH IN				MUD & CHEMICALS ADDED: TYPE / AMT. / TYPE / AMT.			
TOTAL FTG.							
TOTAL HRS.							
DULL CUT. STRUC. I O D L B G O R							
GPM/PUMP-PSI							

FOOTAGE FROM	TO	DR.-D RM.-R CORE.-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY RPM	WT. ON BIT 1000#	PUMP PRESS	PUMP NO. LINER SIZE	S.P.M.	PUMP NO. LINER SIZE	S.P.M.	METHOD RUN

DEVIATION RECORD	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
0230	0730	5	13	W.O.C. Rig up light's & mud sys.
0730	[illegible]	[illegible]		Cut off Casing & [illegible]
[illegible]				[illegible]
[illegible]	12:00			mud tank [illegible] up [illegible]

DRILLER

DAY TOUR

BIT RECORD				MUD RECORD			
BIT NO.				TIME			
SIZE				WEIGHT			
IADC CODE				PRESSURE GRADIENT			
MFG.				VISC.-SEC.			
TYPE				PV/YP	/	/	/
SER. NO.				GELS	/	/	/
JETS 1/32" /TFA in²				WL.-CC'S			
				pH			
DEPTH OUT				SOLIDS %			
DEPTH IN				MUD & CHEMICALS ADDED: TYPE / AMT. / TYPE / AMT.			
TOTAL FTG.							
TOTAL HRS.							
DULL CUT. STRUC. I O D L B G O R							
GPM/PUMP-PSI							

FOOTAGE FROM	TO	DR.-D RM.-R CORE.-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY RPM	WT. ON BIT 1000#	PUMP PRESS	PUMP NO. LINER SIZE	S.P.M.	PUMP NO. LINER SIZE	S.P.M.	METHOD RUN

DEVIATION RECORD	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
12:00				Rig up
				[illegible]
				[illegible] flow line
	12:00	12		[illegible] lights + [illegible] line

DRILLER [illegible]

EVENING TOUR

BIT RECORD				MUD RECORD			
BIT NO.				TIME			
SIZE				WEIGHT			
IADC CODE				PRESSURE GRADIENT			
MFG.				VISC.-SEC.			
TYPE				PV/YP	/	/	/
SER. NO.				GELS	/	/	/
JETS 1/32" /TFA in²				WL.-CC'S			
				pH			

FOOTAGE FROM	TO	DR.-D RM.-R CORE.-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY RPM	WT. ON BIT 1000#	PUMP PRESS	PUMP NO. LINER SIZE	S.P.M.	PUMP NO. LINER SIZE	S.P.M.	METHOD RUN

DEVIATION RECORD	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS

API WELL NUMBER	DATE
[illegible]	6-3-84

CONTRACTOR	RIG NO.
G[illegible] D[illegible]	-

SIGNATURE OF CONTRACTOR'S TOOL PUSHER

PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH

FIELD OR DIST.	COUNTY	STATE
[illegible]	[illegible]	[illegible]

LAST CASING TUBING OR LINER	SIZE	MAKE	WT. & GR.		NO. JOINTS	FEET	RKB. TO CSG. HD.	SET AT
	[illegible]	[illegible]	K	55	2	[illegible]	[illegible]	[illegible]

WIRE LINE RECORD REEL NO.

SIZE	NO. LINES	FT. SLIPPED
FT. CUT OFF	PRESENT LENGTH	
TON MI. OR TRIPS SINCE LAST CUT		
CUMULATIVE TON MI. OR TRIPS		

MORNING TOUR

BIT RECORD		
BIT NO.		
SIZE		
IADC CODE		
MFG.		
TYPE		
SER. NO.		
JETS 1/32" /TFA in²		
DEPTH OUT		
DEPTH IN		
TOTAL FTG.		
TOTAL HRS.		
DULL CUT. STRUC. I O D L		
B G O R		
GPM/PUMP-PSI		

MUD RECORD			
TIME			
WEIGHT			
PRESSURE GRADIENT			
VISC.-SEC			
PV/YP	/	/	/
GELS	/	/	/
WL CC'S			
pH			
SOLIDS %			

MUD & CHEMICALS ADDED

TYPE	AMT.	TYPE	AMT.

FOOTAGE FROM	FOOTAGE TO	DR.-D RM.-R CORE-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY RPM	WT. ON BIT 1000#	PUMP PRESS	PUMP NO. LINER SIZE	S.P.M.	PUMP NO. LINER SIZE	S.P.M.	METHOD RUN
40	100											

DEVIATION RECORD	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
[illegible]	[illegible]	2		[illegible]
[illegible]	[illegible]	[illegible]	20	[illegible]
			[illegible]	[illegible]
				[illegible]
				[illegible]
	10:30			
[illegible]	[illegible]	[illegible]		[illegible]

DRILLER

DAY TOUR

BIT RECORD		
BIT NO.	2	
SIZE	9 7/8	
IADC CODE		
MFG.		
TYPE		
SER. NO.		
JETS 1/32" /TFA in²	15 15 15	
DEPTH OUT		
DEPTH IN		
TOTAL FTG.		
TOTAL HRS.		
DULL CUT. STRUC. I O D L		
B G O R		
GPM/PUMP-PSI		

MUD RECORD			
TIME			
WEIGHT			
PRESSURE GRADIENT			
VISC.-SEC			
PV/YP	/	/	/
GELS	/	/	/
WL CC'S			
pH			
SOLIDS %			

MUD & CHEMICALS ADDED

TYPE	AMT.	TYPE	AMT.

FOOTAGE FROM	FOOTAGE TO	DR.-D RM.-R CORE-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY RPM	WT. ON BIT 1000#	PUMP PRESS	PUMP NO. LINER SIZE	S.P.M.	PUMP NO. LINER SIZE	S.P.M.	METHOD RUN
100	300				70	6000	400	6"				

DEVIATION RECORD	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
12:00	1:40	1 40	2	Drilling Sand + Shale
1:40	2:20		5	Condition Mud and Circulate Hole
2:20	2:45		2	Drilling Sand + Shale
2:45	6:55	3		Change out 2 Swabs on pump Dump mud pit of
6:55	12:00	5	2	Drilling Sand + Shale

DRILLER Randy Hova[illegible]

EVENING TOUR

BIT RECORD		
BIT NO.		
SIZE		
IADC CODE		
MFG.		
TYPE		
SER. NO.		
JETS 1/32" /TFA in²		

MUD RECORD			
TIME			
WEIGHT			
PRESSURE GRADIENT			
VISC.-SEC			
PV/YP	/	/	/
GELS	/	/	/
WL CC'S			
pH			

FOOTAGE FROM	FOOTAGE TO	DR.-D RM.-R CORE-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY RPM	WT. ON BIT 1000#	PUMP PRESS	PUMP NO. LINER SIZE	S.P.M.	PUMP NO. LINER SIZE	S.P.M.	METHOD RUN

DEVIATION RECORD	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION	DEPTH	DEV.	DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS

4/5

5-89-4 | 64-61

CONTRACTOR	RIG NO.
[illegible]	2

SIGNATURE OF CONTRACTOR'S TOOL PUSHER

PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH

FIELD OR DIST.	COUNTY	STATE
[illegible]	[illegible]	Ut

LAST CASING TUBING OR LINER	SIZE	MAKE	WT. & GR.	NO. JOINTS	FEET	RKB. TO CSG. HD.	SET AT
	13⅜		K 55	2	40	10	50

WIRE LINE RECORD — REEL NO. / SIZE / NO. LINES / FT. SLIPPED / FT. CUT OFF / PRESENT LENGTH / TON MI. OR TRIPS SINCE LAST CUT / CUMULATIVE TON MI. OR TRIPS

MORNING TOUR

FOOTAGE FROM	TO	DR.-D RM.-R CORE-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY RPM	WT. ON BIT 1000#	PUMP PRESS	PUMP NO. LINER SIZE	S.P.M.	PUMP NO. LINER SIZE	S.P.M.	METHOD RUN
300	360											

DEVIATION RECORD: DEPTH / DEV. / DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
2400	0340		2	[illegible] Temp 107° 354 [illegible]
				[illegible] Temp 110° 360 Ft KB TD [illegible] 240
0340	0[illegible]		5	Circulate + Condition hole
[illegible]	10[illegible]		[illegible]	[illegible] out of hole [illegible]
[illegible]	[illegible]		12	[illegible] casing (7")

(This is 5-89-4)

DRILLER

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG. / TYPE / SER. NO. / JETS 1/32" /TFA in² / DEPTH OUT / DEPTH IN / TOTAL FTG. / TOTAL HRS. / CUT. STRUC. I O D L B G O R / GPM/PUMP-PSI

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / VISC.-SEC / PV/YP / GELS / WL.-CC'S / pH / SOLIDS % / MUD & CHEMICALS ADDED: TYPE / AMT. / TYPE / AMT.

DAY TOUR

FOOTAGE FROM	TO	DR.-D RM.-R CORE-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY RPM	WT. ON BIT 1000#	PUMP PRESS	PUMP NO. LINER SIZE	S.P.M.	PUMP NO. LINER SIZE	S.P.M.	METHOD RUN

DEVIATION RECORD: DEPTH / DEV. / DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
12:00	1:00	1	12	Run 2 Jts 7" Casing [illegible] to Cement
1:00	1:30	1/2		Pump Cement — MODERATE Return
1:30	9:30	8	13	WOC Get Every Thing ready to [illegible]
9:30				Cut Conductor + 7" [illegible] casing [illegible]
	12:00	2 1/2		[illegible]

DRILLER [illegible]

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG. / TYPE / SER. NO. / JETS 1/32" /TFA in² / DEPTH OUT / DEPTH IN / TOTAL FTG. / TOTAL HRS. / CUT. STRUC. I O D L B G O R / GPM/PUMP-PSI

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / VISC.-SEC / PV/YP / GELS / WL.-CC'S / pH / SOLIDS % / MUD & CHEMICALS ADDED: TYPE / AMT. / TYPE / AMT.

EVENING TOUR

FOOTAGE FROM	TO	DR.-D RM.-R CORE-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY RPM	WT. ON BIT 1000#	PUMP PRESS	PUMP NO. LINER SIZE	S.P.M.	PUMP NO. LINER SIZE	S.P.M.	METHOD RUN

DEVIATION RECORD: DEPTH / DEV. / DIRECTION

TIME LOG FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG. / TYPE / SER. NO. / JETS 1/32" /TFA in²

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / VISC.-SEC / PV/YP / GELS / WL.-CC'S / pH

5/5

5-87-   6-5-87

CONTRACTOR: Grimshaw Drilling [illegible]

RIG NO. 2

SIGNATURE OF CONTRACTOR'S TOOL-PUSHER

PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH

FIELD OR DIST. | COUNTY: Beaver | STATE: Ut

LAST CASING TUBING OR LINER	SIZE	MAKE	WT. & GR.	NO. JOINTS	FEET	RKB. TO CSG. HD.	SET AT
	13⅜		K 55	2	40	10	
	7		J 55	9	350	1	

WIRE LINE RECORD — REEL NO. | SIZE | NO. LINES | FT. SLIPPED | FT. CUT OFF | PRESENT LENGTH | TON MI. OR TRIPS SINCE LAST CUT | CUMULATIVE TON MI. OR TRIPS

MORNING TOUR

BIT RECORD: BIT NO. | SIZE | IADC CODE | MFG. | TYPE | SER. NO. | JETS 1/32" /TFA in² | DEPTH OUT | DEPTH IN | TOTAL FTG. | TOTAL HRS. | DULL: CUT. STRUC. I O D L / B G O R | GPM/PUMP-PSI

MUD RECORD: TIME | WEIGHT | PRESSURE GRADIENT | VISC.-SEC. | PV/YP | GELS | WL-CC'S | pH | SOLIDS % | MUD & CHEMICALS ADDED (TYPE, AMT.)

Air

FOOTAGE (FROM, TO) | DR.-D RM.-R CORE-C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY RPM | WT. ON BIT 1000# | PUMP PRESS | PUMP NO. (LINER SIZE, S.P.M.) | METHOD RUN

DEVIATION RECORD: DEPTH | DEV. | DIRECTION

FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
0400	0430	4½	14	Nipple up B.O.P's & ACC.
0430	05:30	1	21	[illegible] Blole Line
05:30	9:30	4	15	Testing BOP & waiting for State man, Clean Rig up & Tighten Door on BOP, Small Leak
				Test @ 250 PSI To 740 PSI 15 min start 0713 End 0730 [illegible]
0930	1200	2½	6	[illegible]

DRILLER: [illegible]

DAY TOUR

BIT RECORD: BIT NO. | SIZE | IADC CODE | MFG. | TYPE | SER. NO. | JETS 1/32" /TFA in² | DEPTH OUT | DEPTH IN | TOTAL FTG. | TOTAL HRS. | DULL: CUT. STRUC. I O D L / B G O R | GPM/PUMP-PSI

MUD RECORD: TIME | WEIGHT | PRESSURE GRADIENT | VISC.-SEC. | PV/YP | GELS | WL-CC'S | pH | SOLIDS % | MUD & CHEMICALS ADDED (TYPE, AMT.)

FOOTAGE FROM	TO	DR.-D RM.-R CORE-C	CORE NO.	FORMATION (SHOW CORE RECOVERY)
341	348			Drill Cement + Shoe
348	328			

DEVIATION RECORD: DEPTH | DEV. | DIRECTION

FROM	TO	ELAPSED TIME	CODE NO.	DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS
12:00	1:30	1½	2	Drill out 9 ft Cement & Shoe @ 341 to 348
1:30	2:30	1	6	Trip out of hole with bit
2:30			6	Trip in Hole with hammer + float
	5:30	3	21	Fix Break out Cat Head, wash floor
5:30	11:00	5½	2	Drilling Sand and Shale
11:00	12:00		6	Trip out of hole LFR

DRILLER: Randy [illegible]

EVENING TOUR

BIT RECORD: BIT NO. | SIZE | IADC CODE | MFG. | TYPE | SER. NO. | JETS 1/32" /TFA in²

MUD RECORD: TIME | WEIGHT | PRESSURE GRADIENT | VISC.-SEC. | PV/YP | GELS | WL-CC'S | pH

FOOTAGE (FROM, TO) | DR.-D RM.-R CORE-C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY RPM | WT. ON BIT 1000# | PUMP PRESS | PUMP NO. (LINER SIZE, S.P.M.) | METHOD RUN

DEVIATION RECORD: DEPTH | DEV. | DIRECTION

TIME LOG (FROM, TO) | ELAPSED TIME | CODE NO. | DETAILS OF OPERATIONS IN SEQUENCE AND REMARKS

Appendix B

"Slim Hole" Drilling Program

Objective: Drill/Complete exploratory hole to ±1500' TD and evaluate formation. Conductor casing 13 3/8" set at ±40-120', surface casing set at ±250'-400', 6 1/4" open hole to 1500' or producing formation.

Prepared by: Jay C. Hauth, July 1988
Version 2: October, 1988
Version 3: April, 1989

Sequence of Operations

1. Construct location and sump per rig requirements.

2. MIRU rotary drilling rig.

3. Mix spud mud per attached drilling fluids program
3a Drill 26¼" hole for 20" Conductor Casing.
4. Spud well with 17 1/2" bit and drill to ±40-120'. Run and cement 13 3/8" conductor per attached cementing program. Optionally, run 12" OD X .375" wall ASTM A53 gr B, seamless or ERW pipe, w/butt weld ends. Optionally, install master valve and rotating head w/ 6" flowline per attached drawing, per supervision/geology direction. Note requirement for ±50' handwheel extension with optional master valve.

5. Visually inspect and note on Tour Sheet whether all drill pipe is white banded, specifying that it meets AAODC API Class II inspection as to the following:
   1. Electromagnetic inspection of tubes (Sconoscope or Scanalog)
   2. Wall thickness and cross-sectional area (Ultrasonic or gamma ray)
   3. Tool jt inspection (electronic or mag particle)

Also check to see that all drill collar connections have been mag particle inspected and that all bottom hole assemblies have been magnafluxed prior to delivery. Note condition on Tour Sheet. Ensure that 7" casing is on location and in position to run. Ensure all casing accessories, wellhead equipment, and circulating head are on hand.

6. RIH with 9 7/8" bit and drill with mud to ±250'-400, depending on geology. Remove thread protectors, clean threads, drift and measure casing while drilling surface hole. Measure KB height and log on Tour Sheet. After casing point has been selected, drill any additional hole that might be required so that casing can be landed within 1' of bottom, and still space out correctly on surface. Maintain hole as straight as possible while drilling. Take drift shots every 100-200'. Run maximum reading thermometer on each survey. Maximum angle at TD 4 degrees or less. Maximum rate of change 1 degree per 100'. Monitor and record flow line temperatures every hour. Catch 2 sets of formation samples every 10'.

7. Upon reaching desired depth, circulate and condition mud until shaker screen is clean and viscosity is less than 45 sec/qt. Make wiper trip. Check for fill. If hole is in good condition, circulate bottoms up, POOH, and laydown 9 7/8" drilling assembly. If tight hole was encountered on wiper

trip, then make another wiper trip. It may also be necessary to further condition mud.

8. Rig up and run 7" casing to TD, per attached casing program. Run in hole slowly to avoid breaking down formation and losing circulation. Circulate past any bridges encountered. Use proper makeup torque on casing, and geothermal casing dope on threads.

9. Once casing has been run to TD, circulate hole clean, while reciprocating casing, with at least two full circulations. Circulate until hole is clean, mud is in good shape, and viscosity is less than 45 sec/qt. Check bottoms up time to be sure mud is not channeling.

10. When mud is in good shape, cement casing as per attached cement program. Monitor and record cement data to assure adherence to cmt. program. Catch cement samples. If possible, reciprocate casing while pumping cement. Land casing approximately 1' off bottom. Center casing in rotary table.

11. WOC 8 hrs. (check samples to determine if additional time is req'd) Monitor cement in annulus. If it falls back, bring it back to surface with 1" pipe.

12. Land and cut off 7" casing. Weld on 7" x 300 SR Starter flange. Test between welds. Check with level to be sure flange is on correctly. Callout surveyors to survey casing head location.

13. Make sure that BOP equipment has been inspected by the manufacturer or an authorized agent prior to arrival and that all equipment is proper and in good shape on delivery. Nipple up BOP equipment per attachment. Test 7" casing and BOP equipment to 500 psi with BLM representative present to witness. Log test data and request BLM witness to sign name and successful test completion on Tour Sheet.

14. Trip in hole with 6 1/4" mill tooth bit and tag cement. Log top of cement on Tour Sheet. Drill out baffle plate, cement and float shoe from 7" csg with spud mud. Drill 10' of formation and then trip to pick up button bit or hammer/hammer bit. If the decision is made to air drill, run float in bit sub and unload mud out of hole with air on the trip back in. If the decision is made to drill with mud, then displace the spud mud out of the hole with the gel/water/polymer system when you reach bottom with bit. See attached mud system details.

15. Drill 6 1/4" hole with air, foam, or mud to 1500', or until producing formation is encountered. Test formations per engineer's direction, log per permit and engineer/geologist requirements. Operate BOP on each trip out of hole and log on Tour Sheet. Ensure accumulator is holding pressure.

16. Upon reaching TD, circulate hole clean, laydown drill string, ND BOPs, clean location and release rig.

17. Submit all reports as required by regulatory agencies.

Drilling Fluids Program

17 1/2" and 9 7/8 " surface hole, 0- ±250'-400'

Mud System: Gel, lime, water, LCM (Spud Mud)
Mix 15-20 Lb/Bbl bentonite in fresh water. Flocculate with lime.

Weight: As low as possible with mechanical solids control equipment

Viscosity: 45-55 sec/qt or as needed to clean hole

Water loss: No control

Total hardness: No control

pH: Mix lime through chemical barrel to maintain 9.5-10.5 pH

Comments: Lost circulation through this interval is possible. No formation pressures are anticipated. Keep plastic viscosity down and yield point up. Run solids control equipment continuously. Break circulation slowly and trip slowly. Use Desco to thin mud if necessary.

6 1/4" Hole, ±250'/400' - TD

Mud system: Polymer, gel, soda ash, Desco, high temp thinner. Drill out cement with Spud Mud and then dump Spud Mud. Build new system. Mud up in clean steel pits by mixing, with fresh water, 1/2 lb/bbl caustic soda and a ratio of 8 bentonite to 1 Drispac regular. Mix bentonite first and then slowly add (30 min/sk) Drispac. (Substitute a high molecular weight anionic liquid polymer such as Magcobar Rapid Mud for Drispac if so desired)

Weight: As low as practical with water and mechanical solids control equipment.

Viscosity: 38-45 sec/qt with bentonite and Drispac (8:1 ratio of bentonite:Drispac) Stay on this ratio to maintain viscosity after Mud-up.

Water Loss: No control

Total Hardness: Below 300 ppm with soda ash.

pH: 9.5-10.5

Rheology: Control flow properties at reasonable levels with Desco thinner. If downhole temperatures increase to where Desco is not effective, then use high temp thinner

Torque, Drag, Hole Stability, and high temp lubricant: Add 2 ppb Soltex additive as necesary.

Lost Circulation (surface to TD): Methods to be used as follows:
1. Lost circulation materials such as nut plug, cotton seed hulls, saw dust, medium Kwik-Seal, etc.
2. Gunk Squeezes
3. Cement
4. Lighter-than-water drilling fluids

Abnormal Presure: Weight material (barite) should be on location at all times.

Corrosion: Add corrosion inhibitors such as oxygen scavengers or scaling amines to control corrosion.

Stable Foam Make-up:
Mix 1/2 - 2 ppb Drispac in water
1-2 ppb soda ash
5-10% foamer just before use (use alpha olefin sulfonate for high temp foamer)
Air-Mud ratio required = 100:1 to 300:1

Special considerations:
1. Drilling recorder to monitor rate of penetration
2. Catch drill cutting samples (2 sets) every 10', cleaned, sacked, and labeled in accordance with geologist direction. Collect samples every 5' on conductor.
3. All lost circulation zones encountered shall be recorded in Tour book, recording both the depth at which the loss occurred, as well as amount and rate of fluid lost.
4. In and Out temperatures, both mud and air, shall be recorded in Tour book every hour.
5. Temperatures should be taken with every directional survey by running a maximum registering thermometer in the survey instrument.

Casing Program

Conductor casing: ±40-120' 13 3/8" 61 ppf J-55 BT&C in 17 1/2" hole
Optional: ±40-120' 12" OD X .375" wall ASTM A53 gr B, seamless or ERW pipe, w/butt weld ends, in 17 1/2" hole.

Surface Casing: ±250'-400' x 7" J-55 20 ppf ST&C Range 2 Casing

Torque: 3200 ft-lbs

Drift ID: 6.331"

Strength ratings:
 Yield - 2992 psi
 Collapse - 1816 psi
 Tension - 187,200 lb

Accessories:

Float equipment: flapper type conventional float shoe on bottom of string and baffle plate installed one jt up from bottom

Centralizers: 2 centralizers installed in the middle of the bottom 2 jts (7" x 9 7/8" bow type)

Wellhead equipment: 7" x 300 SR SOW starter flange for wellhead. 300 SR gate valve for master valve.

Notes:

- Tack weld shoe, also top and bottom of couplings on bottom three jts
- Lower casing in hole slowly to avoid formation breakdown and lost circ.
- Use geothermal grade thread dope on casing threads

Cementing program

±250'-400 x 9 7/8" hole x 7" casing surface job

Slurry description: API Class "G" or "H" cement mixed with 5.0 gal/sk water

Requires: .2301 sk/linear ft in 9 7/8" annulus

Slurry wt: 15.8 lbs/gal or 118 lbs/cu. ft.

Yield: 1.15 cu.ft./sk

Water requirement: 5.0 gal/sk or 0.67 cu.ft./sk

Pump time: 1-2 hrs

24 compressive strength: 2915 psi

7" J-55 20 ppf ST&C casing displacement= .0404 bbl/linear ft or .2273 cu.ft./linear ft.

Note: calculate cement job with 100% excess in open hole; 50% in cased hole is OK.

H2S Safety

The H2S safety company will be called out to perform certification training, install and maintain properly operating H2S monitors, and provide on-location advice and expertise regarding safety related items. The monitors will be rigged up prior to spudding the hole, and the safety man will be available on location no later than drilling out the production casing.

In all matters of safety, the H2S safety man has the FINAL WORD on procedures. NO DRILLING OPERATIONS SHALL BE CONDUCTED CONTRARY TO THE H2S SAFETY MAN'S DIRECTION. NO EXCEPTIONS.

H2S monitors will be installed at the following locations:

1. Mud return line
2. Vicinity of floor
3. Vicinity of wellhead/BOP's
4. Additional locations per Safety Man direction, MEI/contractor recommendations.

Windsocks will be installed as to be visible from various areas of location. An H2S warning sign (with green/yellow/red warning flags) is to be installed on the access road, and the appropriate flag will be displayed, depending on current operations. Two different briefing areas will be established, to allow safe briefing in any wind condition. Emergency breathing equipment (5 min. and working-size Scott Air Packs; workline hose; high-pressure air bottles in safety trailer, etc.) will be available.

Prior to spud, all rig personnel shall successfully complete an H2S training/certification course presented by the safety man. This will include Air Pack use, operation and location of H2S monitors around the rig, location and use of briefing areas, and general information regarding safety. Throughout drilling operations, rig personnel will have procedural update briefings, safety meetings, etc., as needed.

H2S ALARM PROCEDURE
POST PROMINENTLY IN DOGHOUSE

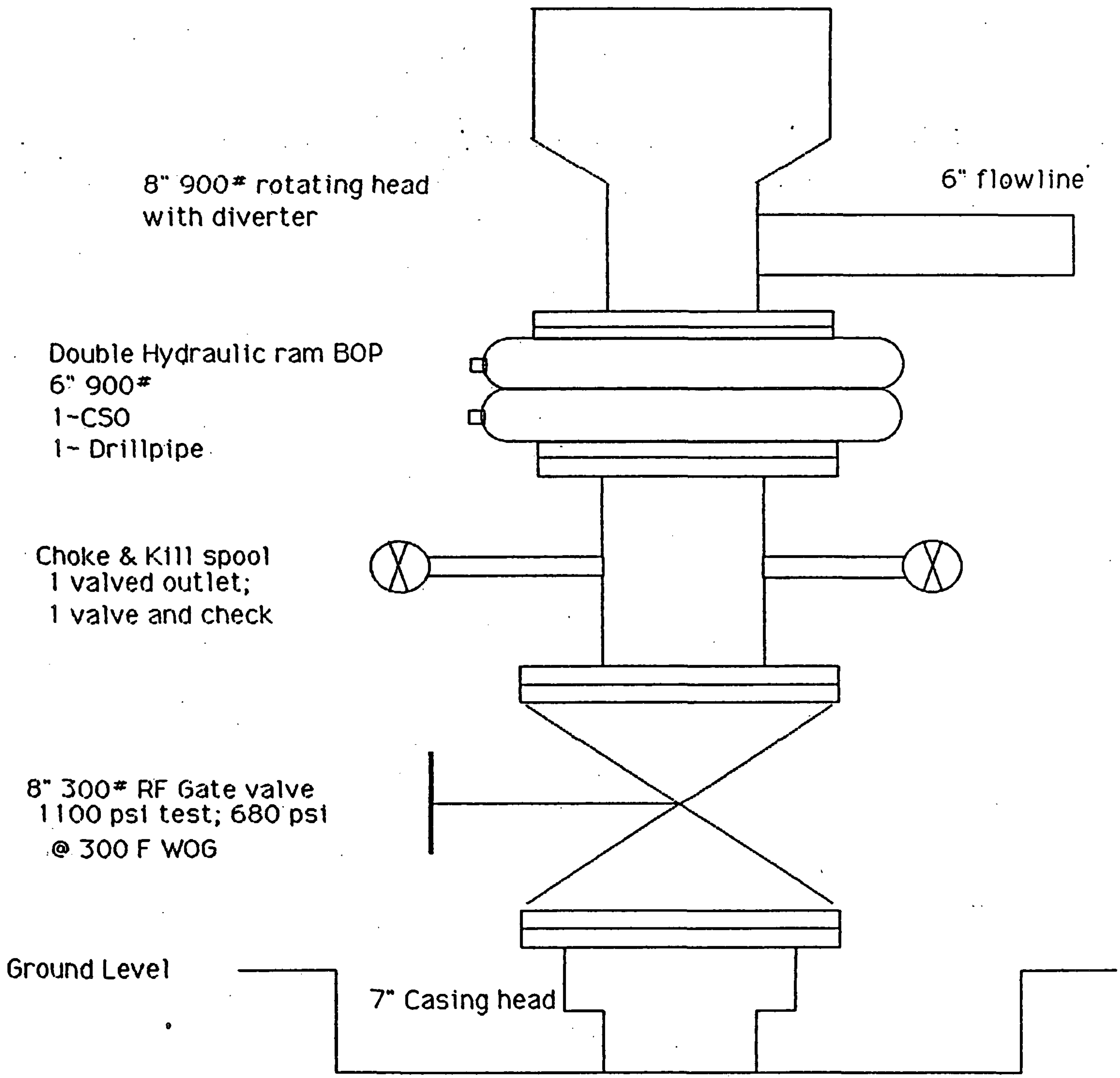
IN CASE OF H2S ALARM:

1. MASK UP WITH ESCAPE UNIT

2. GO IMMEDIATELY TO THE UPWIND BRIEFING AREA

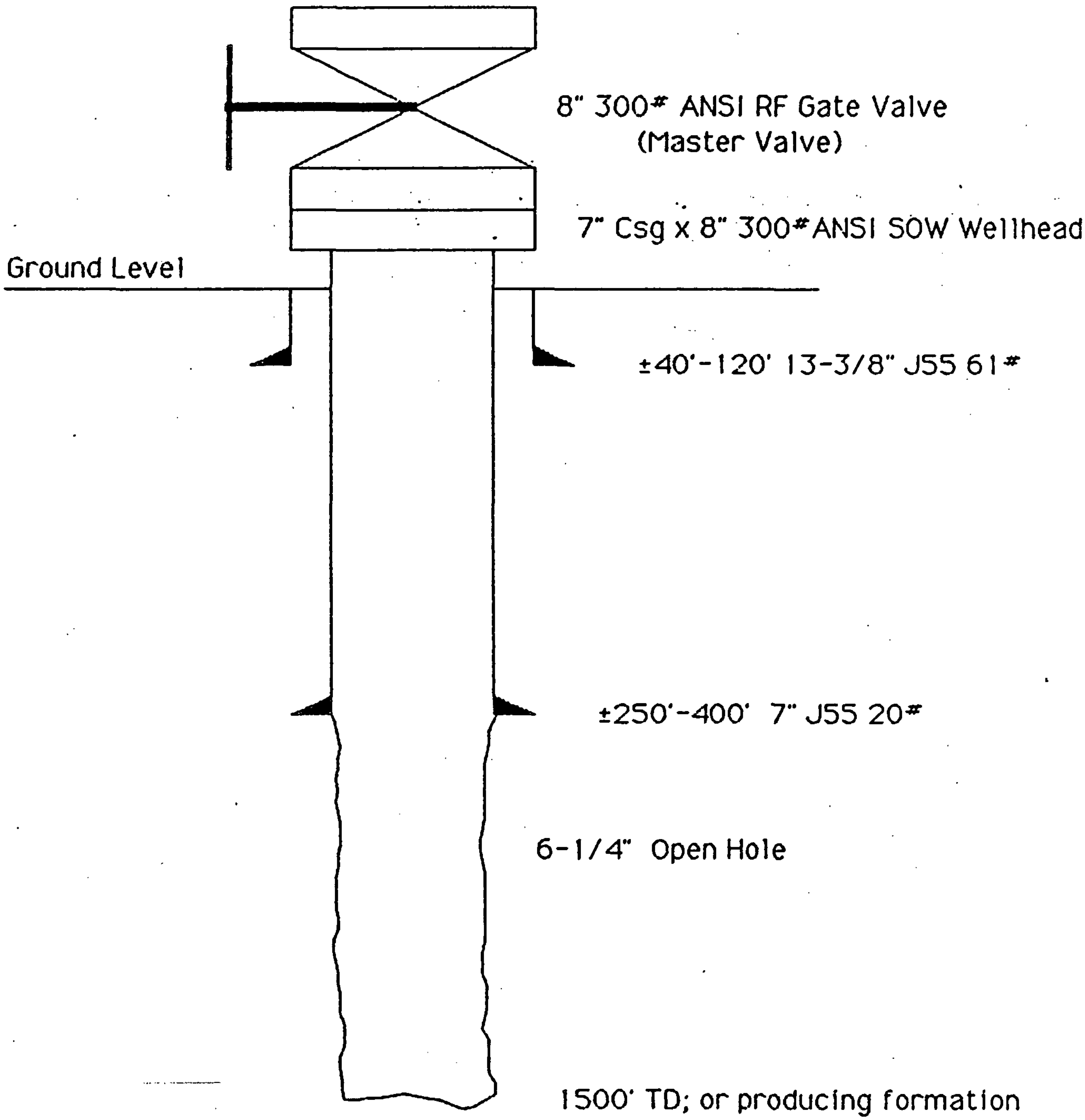
NO EXCEPTIONS UNLESS DIRECTED BY H2S SAFETY MAN ON LOCATION

Blowout Preventer Details; 7" casing



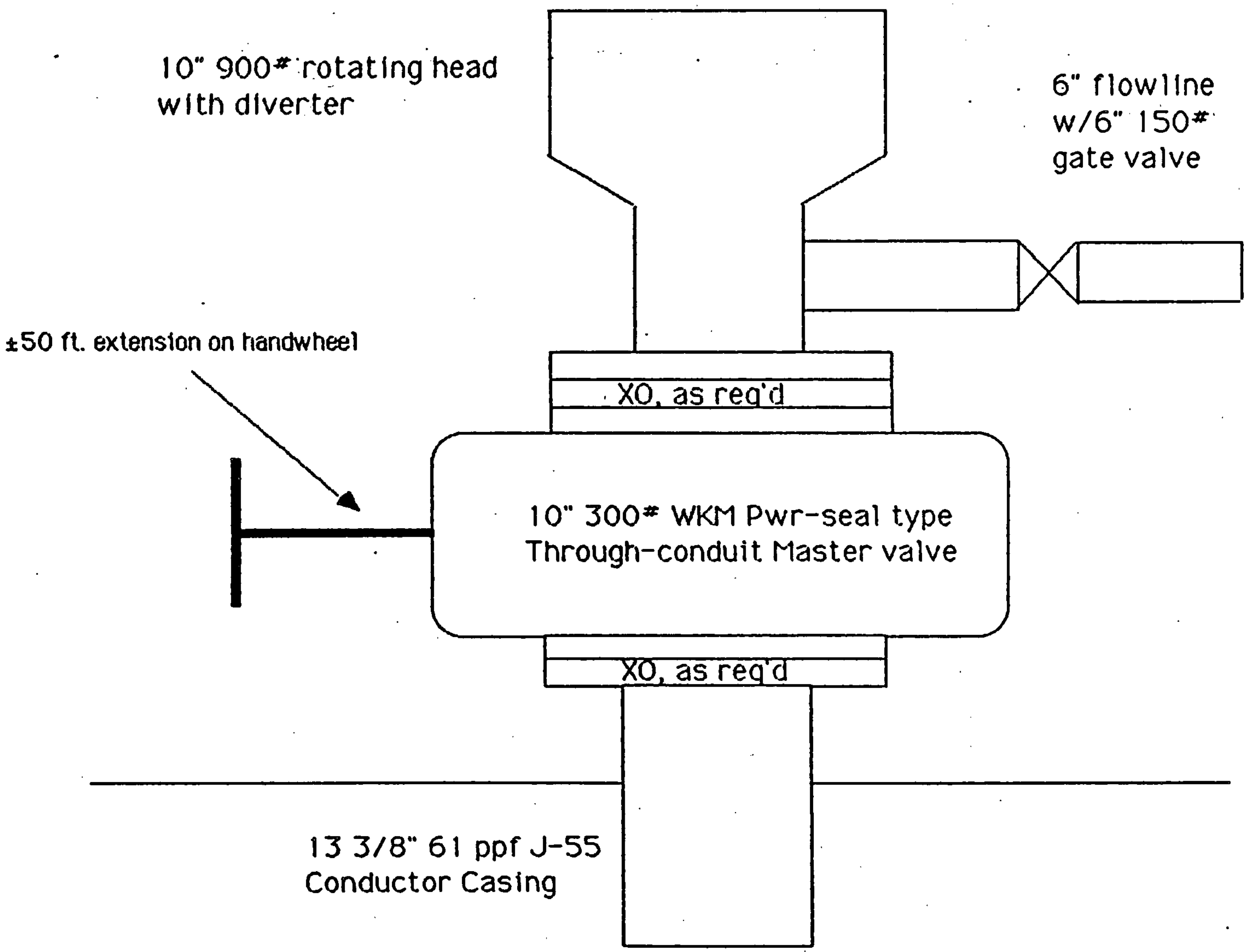
JCH 9/88

Slim Hole Completion Details



Not to Scale

Blowout Preventer Details; 13 3/8" casing (optional, as req'd on slim hole program)



JCH 10/5/88

Appendix C

LITHOLOGIC LOG OF MEI WELL S-89-4

Prepared for
Mother Earth Industries, Inc.
7350 E. Evans Road, Suite B
Scottsdale, Arizona 85260

By
Joseph N. Moore
Salt Lake City, Utah

July, 1989

EXECUTIVE SUMMARY

MEI well S-89-4 was drilled into a structurally complex fault block. The rocks encountered in this well are similar to those in other MEI wells and include alluvial deposits and soils, Three Creeks Tuff, Wales Canyon Tuff, a pyroxene-bearing dike, and the Coconino Sandstone. However, repetition of the Wales Canyon Tuff and the underlying soils developed on the Coconino Sandstone demonstrate that the upper 460 feet of S-49-4 are part of a gravitational glide block that moved from east to west.

The Coconino Sandstone which hosts the steam reservoir was encountered at a depth of 600 feet in S-89-4 and at 850 feet in S-89-1. These relationships indicate that S-89-4 is located in a different fault block than S-89-1. The most likely orientation of the fault that separates these blocks is easterly, with movement down to the north.

The volcanic and sedimentary rocks of S-89-4 have been intensely altered to mixtures of quartz, pyrite, calcite, and sericite. These minerals indicate that temperatures during hydrothermal alteration did not exceed 200° to 225°C.

MEI well S-89-4 was sampled to a depth of 620 feet. This report describes the lithologies and alteration assemblages encountered in the well.

LITHOLOGIC RELATIONSHIPS

The lithologies encountered in S-89-4 are illustrated in the attached log. The rocks encountered in this well include alluvial deposits and altered soils(?), the Three Creeks Tuff, the Wales Canyon Tuff, a pyroxene-bearing dike, and the Coconino Sandstone. However, as discussed below, gravitational gliding has resulted in a repetition of the Wales Canyon Tuff and the sedimentary deposits overlying the Coconino Sandstone.

The alluvial deposits in S-89-4 extend from the surface to a depth of 120 feet. These deposits consist of poorly consolidated sands and gravels composed of the volcanic and sedimentary rocks exposed in the adjacent hills. Layers of gravel, consisting of coarse rounded clasts of these lithologies occur at 60-70, 90-100, and 110-120 feet.

The cuttings between 120 and 160 feet consist dominantly of light-gray Three Creeks Tuff, although a variety of sedimentary and volcanic rock fragments, and aggregates of sulphides are also present. These fragments appear to represent material derived from the shallow alluvial deposits.

Between 160 and 350 feet, the cuttings consist of uniformly gray Three Creeks Tuff. This ash-flow tuff is characterized by approximately 50% phenocrysts of quartz, plagioclase, biotite, potassium feldspar, and hornblende in a matrix of densely welded shards and ash. The Three Creeks Tuff is distinguished from other ash-flow tuffs by the common occurrence of dipyramidal quartz and its coarse grain size. Thin sections of the Three Creeks Tuff from S-89-4 show that the phenocrysts and matrix of the rock have been strongly altered to clays, sericite, quartz, and carbonate.

The Three Creeks Tuff in S-89-4 appears to rest on densely welded Wales Canyon Tuff. Although also crystal-rich and mineralogically similar to the Three Creeks Tuff, the Wales Canyon Tuff is finer grained and lacks the conspicuous quartz phenocrysts that characterizes the overlying ash-flow tuffs. Thin sections show that the Wales Canyon Tuff, like the Three Creeks Tuff has been intensely altered. Nevertheless, the general features of the Wales Canyon Tuff can still be distinguished.

Two intervals of Wales Canyon Tuff, separated by altered soil(?) containing fragments of Coconino Sandstone, were encountered in the well. The Wales Canyon Tuff is present between 350 and 450 feet and again between 460 and 590 feet. The lower section of Wales Canyon Tuff ranges from medium-gray(460-560 feet) to light-gray(560-600 feet) in color.

Fragments of a porphyritic pyroxene-bearing dike are present near the base of the Three Creeks Tuff at 360 feet and in the underlying Wales Canyon Tuff. Thin sections from 350-360 show that the dike contains phenocrysts of enstatite accompanied by minor altered olivine(?) and clinopyroxene. The matrix of the dike consists of fine-grained plagioclase, clinopyroxene, potassium feldspar, and magnetite. In contrast to the associated ash-flow tuffs which are strongly altered, fragments of the dike are relatively fresh.

The mineralogy of the dike fragments is similar to that of the "latite" dikes and domes mapped by Moore and Samberg (1978) in the Sulphurdale area. Based on the mapped relationships, it can be shown that the "latite" was emplaced after the Three Creeks Tuff at 27 my but before the Osiris Tuff at 22 my. Moore and Samberg (1978) concluded that the "latites" were related to intrusion of a quartz monzonite stock that underlies Sulphurdale.

Fragments of Coconino Sandstone occur in a 20 foot zone between 440 and 460 feet and below 590 feet. Chips from a depth of 450-460 feet contain clasts of both Coconino Sandstone and highly altered Wales Canyon Tuff. These clasts occur in a matrix of fine-grained quartz and sericite. The presence of both lithologies suggests that this clastic rock represents a fault breccia.

In contrast, chips from a depth of 590-610 feet consist of fragments of sandstone in a matrix of sericite and quartz. These chips are interpreted as representing soil developed on the underlying Coconino Sandstone prior to the deposition of the Wales Canyon Tuff.

The top of the Coconino Sandstone was encountered at a depth of 600 feet. Thin sections show that the sandstone consists dominantly of quartz cemented by quartz overgrowths.

HYDROTHERMAL ALTERATION

With few exceptions, the rocks encountered in S-89-4 display intense argillic alteration. In order to better characterize the alteration assemblages and textures, thin sections of selected intervals were examined. The location of the thin sections is shown on the accompanying log. Brief descriptions of the thin sections are presented in Appendix 1.

The alluvial deposits have been hydrothermally altered to clays and aggregates of sulphides. X-ray diffraction analyses of similar aggregates from S-89-5 indicate that the sulphide minerals include both pyrite and marcasite.

Petrographic examination of a thin section from 134-140 feet which contains abundant sluffed material indicates that some of the fragments of Three Creeks Tuff contain fine-grained clay (probably kaolin), calcite, and sericite (mixed layer illite/smectite or illite). Textural relationships suggest that calcite was partially dissolved prior to deposition of the clay.

Both the matrix and the phenocrysts of the ash-flow tuffs have been intensely altered. Plagioclase phenocrysts have been altered to mixtures of clays or sericite, and calcite. Biotite phenocrysts throughout the well have been replaced by fine-grained mixtures of quartz, sheet silicates (clays, sericite, and light green chlorite/smectite?), pyrite, magnetite, and leucoxene. All of the hornblende originally present in the rocks has been completely altered to calcite, clays or sericite, and opaque minerals.

The matrix of the ash-flow tuffs has been variably altered to mixtures of quartz and sericite (or clays). Much of this quartz probably represents recrystallization of cristobalite formed during devitrification of the originally glassy shards and ash matrix. Similarly, the sheet silicates present in the matrix appear to represent an alteration product of the potassium feldspar formed during devitrification. Silicification of the ash-flow tuffs was observed in the thin section from 450-460 feet.

Pyrite is the only sulphide identified in the volcanic and sedimentary rocks beneath the alluvium. It occurs as disseminated crystals within the matrix of the ash-flow tuffs, as a replacement of biotite, and in veins where it is commonly associated with calcite.

In contrast to the intense alteration that characterizes the Three Creeks and Wales Canyon Tuffs, alteration of the pyroxene-bearing dike is very weak. Phenocrysts of a ferromagnesian mineral that appears to have been olivine(?) have been completely altered to serpentine, chlorite, and a pleochroic sheet silicate (celadonite?). Although the pyroxenes are generally fresh, the margins of some of the phenocrysts have been replaced by fine-grained amphibole.

Veins are common throughout the wells and are found in all rock types. Vein assemblages in chips of the ash-flow tuffs include: calcite + pyrite ± quartz, calcite + quartz, calcite, quartz ± sericite, calcite + barite + quartz + sericite + pyrite, and pyrite. Veins of chalcedony + calcite + sericite cut fragments of the pyroxene-bearing dike whereas veins and open space fillings of quartz, pyrite, and quartz + pyrite + sericite are present in the Coconino Sandstone.

In summary, the secondary mineral assemblages observed in S-89-4 are similar to those encountered in other MEI wells. These assemblages are typical of low to moderate temperature regimes. The presence of both interlayered illite/smectite and chalcedony, for example, suggest that temperatures were probably no higher than 200 - 250°C during alteration (Henley and Ellis, 1983; Fournier, 1985). Significantly, minerals typical of higher temperature regimes (225 to 250°C) such as epidote have not been observed in this well.

The differences in the degree of hydrothermal alteration between the pyroxene-bearing dike and the ash-flow tuffs suggests that either the dike postdates the bulk of the alteration or that it has been relatively impermeable to the geothermal fluids. It is not possible to provide a definitive answer to this question since volcanic rocks younger than the dike have not been encountered in the wells.

STRUCTURAL RELATIONSHIPS

The distribution of volcanic and sedimentary rocks in S-89-4 demonstrate that this well was drilled within a gravitational glide block adjacent to steeply dipping faults. The accompanying lithologic log shows that this gravitational glide block extends to a depth of 460 feet and includes both the Three Creeks and Wales Canyon Tuffs. The similarity between the fault breccia and soil encountered at 440-460 and 590-610 feet respectively suggests that the glide plane was localized within incompetent horizons developed on top of the Coconino Sandstone. As noted above, this fault zone is marked by a breccia containing clasts of both the Coconino Sandstone and the Wales Canyon Tuff.

Fault breccia is also present near the base of the well at 600-610 feet. A thin section from this interval shows that the breccia is cemented by fine-grained quartz. Minor silicification is also present in cuttings from the base of the Wales Canyon Tuff.

The depth to the Coconino Sandstone in S-89-4 (600 feet) is approximately 250 feet shallower than it is in well S-89-1. These relationships indicate that S-89-4 is in an upthrown block relative to S-89-1. The most likely orientation of the fault between these wells is easterly, parallel to the major east-west trending structure located adjacent to wells 24-7 and S-87-3. However, the presence of silicification in chips from the base of the Wales Canyon Tuff indicates that faulting postdates deposition of these volcanic rocks.

REFERENCES

Fournier, R.O., 1985, The behavior of silica in hydrothermal systems: Reviews in Economic Geology, v. 2, pa. 45-61.

Henley, R.W., and Ellis, A.J., 1983, Geothermal systems, ancient and modern: a geochemical review: Earth Science Reviews, v. 64, p. 599-612.

Moore, J.N. and Samberg, S.M., 1979, Geology of the Cove Fort-Sulphurdale KGRA: University of Utah Research Institute Report 18, 44p.

APPENDIX 1
THIN SECTION DESCRIPTIONS

130-140 feet: Chips in this sample consist of approximately equal amounts of Three Creeks Tuff and fragments of alluvium. These fragments consist of Coconino Sandstone, Bullion Canyon lava flows, limestone, and dacite. Alteration of the Three Creeks Tuff is intense. Plagioclase, biotite and hornblende have been altered to sericite, chlorite/smectite, kaolin(?), pyrite, leucoxene, and iron oxides. Veins of pyrite and calcite + pyrite ± quartz are present. Textural relationships suggest that dissolution of calcite occurred prior to deposition of koalin. Unaltered potassium feldspar is present in many chips.

180-190 feet: Intensely altered Three Creeks Tuff. Phenocrysts have been altered to sericite, quartz, calcite, leucoxene, and pyrite. Fresh potassium feldspar is common. 30-50% of the matrix of the ash-flow tuff has been altered to quartz and sericite. Veins of calcite + pyrite are present. Disseminated calcite and pyrite are also present in the matrix.

260-270 feet: Intensely altered Three Creeks Tuff as above. Approximately 60-75% of the matrix of the ash-flow tuff has been altered. Veins of calcite + pyrite ± quartz ± sericite and calcite + quartz are present.

360-370 feet: Intensely altered Three Creeks Tuff as above and approximately 30% chips of a pyroxene-bearing dike. Phenocrysts in the dike consist primarily of enstatite accompanied by minor altered olivine (?) and clinopyroxene. The matrix of the dike is completely crystalline and consists of plagioclase, clinopyroxene, potassium feldspar, and magnetite. Alteration of the dike is limited to replacement of the olivine by serpentine, chlorite, and a pleochroic sheet silicate (celadonite?) and to minor alteration of the pyroxene rims to fine-grained amphibole. Veins of chalcedony + calcite + sericite cut the dike.

450-460 feet: Intensely altered Wales Canyon Tuff and breccia. Feldspar phenocrysts of the Wales Canyon Tuff have been altered to sericite and calcite whereas the ferromagnesian minerals have been replaced by sericite, calcite, leucoxene, and pyrite. The ash-flow tuff is cut by veins of calcite + pyrite, quartz + sericite, calcite + barite + quartz + sericite + pyrite. The edges of the barite crystals show evidence of being resorbed. Minor silicification of the Wales Canyon Tuff, and open space fillings of quartz are present.

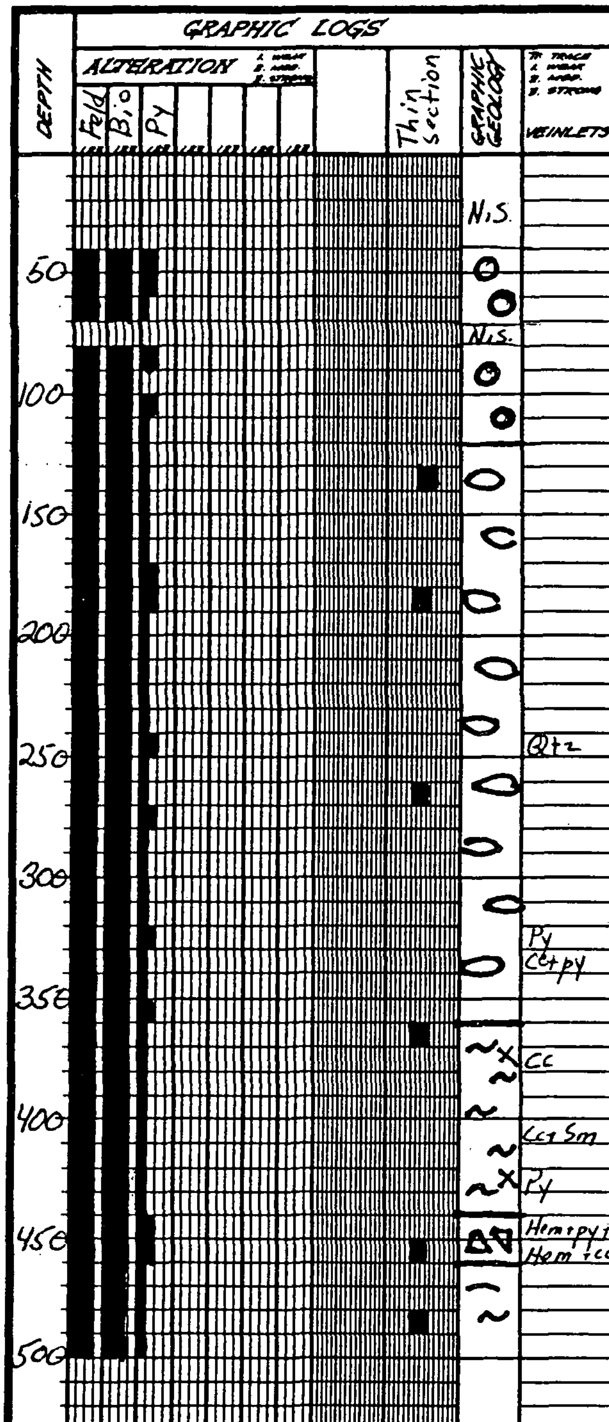
The breccia contains clasts of Coconino Sandstone and Wales Canyon Tuff in a matrix of quartz and sericite. The breccia is cut by veins of calcite.

480-490 feet: Intensely altered Wales Canyon Tuff as above. Veins of calcite + pyrite and pyrite are common.

590-600 feet: Intensely altered Wales Canyon Tuff as above and altered soil(?). Fragments of silicified tuff containing open space fillings of quartz and pyrite are present. In contrast to chips from 480-490 feet, carbonate is a minor alteration product. The altered soil(?) consists of fragments of Coconino Sandstone in a matrix of sericite, quartz and pyrite.

600-610 feet: Coconino Sandstone. Approximately 30% of the chips consist of breccia containing fragments of Coconino Sandstone in a matrix of fine-grained quartz. Veins of pyrite, quartz + sericite + pyrite and open space fillings of quartz are present.

GRAPHIC LOGS



DESCRIPTIONS

40-120: Alluvium- poorly consolidated and sorted deposits. Fragments altered to kaolin(?) and aggregates of pyrite and marcasite are common. Gravels occur at 60-70, 80-90, and 110-120.

120- 350: Three Creeks Tuff. The ash-flow tuff is medium-gray in color and strongly altered to clays, sericite, and quartz

350-440: Wales Canyon Tuff. The ash-flow tuff is light gray in color and intensely altered to sericite and quartz.

360-370, 430-440: Pyroxene bearing dike. Fragments of the dike are dark-gray in color and weakly altered. The dike may be contemporaneous with intrusion of the quartz-monzonite Stock that underlies Sulphurdale

440-460: Breccia: Chips of Coconino Sandstone and Wales Canyon Tuff. Individual chips contain fragments of both lithologies in a matrix of quartz and sericite

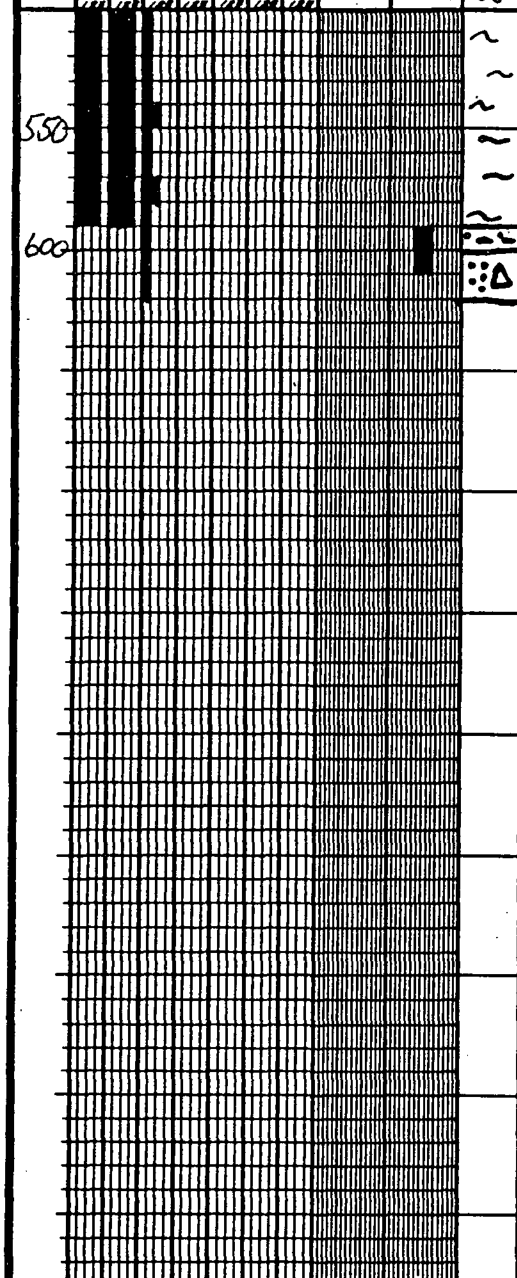
DRILL HOLE: S-89-4

LOCATION: Sulphurdale

LOGGED BY: JMM

GRAPHIC LOGS

DEPTH | ALTERATION (1. WEAK, 2. MOD., 3. STRONG): Feld, Bio, Py | Thin Section | GRAPHIC GEOLOGY | VEINLETS (Tr. TRACE, 1. WEAK, 2. MOD., 3. STRONG)



VEINLETS	DESCRIPTIONS
Qtz	460-590: Wales Canyon Tuff. The ash-flow tuff is intensely altered to quartz and sericite. Rocks between 460 and 560 feet are medium-gray in color; between 560 and 590 the rocks are light grey. Some quartz veining at 590
Py	
Py	
Py+CC	
Qtz+Py	
Qtz+Py	
Qtz+Py	590-600: Altered soil(?) fragments of Coconino Sandstone, some of which occur in a matrix of quartz and sericite
	600-620: Coconino Sandstone Fragments of sandstone in a matrix of fine-grained quartz common. (fault breccia)

DRILL HOLE S-89-4
LOCATION Sulphurdale

LOGGED BY JNM

Appendix D

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER RIGHTS

Norman H. Bangerter
Governor
Dee C. Hansen
Executive Director
Robert L. Morgan
State Engineer

1636 West North Temple, Suite 220
Salt Lake City, Utah 84116-3156
801-538-7240

April 14, 1989

Mr. Jay C. Hauth, Operations Manager
Mother Earth Industries, Inc.
3761 South 700 East, Suite 200
Salt Lake City, UT 84106

RE: Request to Drill Slim Holes S89-1 through S89-7
Expiration Date: October 14, 1989

Dear Mr. Hauth:

Reference is made to your request of April 5, 1989, to drill seven "slim hole" geothermal wells as part of MEI's continued field development program at the Cove Fort/Sulfurdale KGRA. The location of the wells is to be:

S89-1 South 3211 feet and East 609 feet from the NW Corner of Section 7, T26S, R6W, SLB&M;

S89-2 South 2853 feet and East 578 feet from the NW Corner of Section 7, T26S, R6W, SLB&M;

S89-3 South 3597 feet and East 1108 feet from the NW Corner of Section 7, T26S, R6W, SLB&M;

S89-4 South 3456 feet and East 354 feet from the NW Corner of Section 7, T26S, R6W, SLB&M;

S89-5 South 3684 feet and West 225 feet from the NE Corner of Section 12, T26S, R7W, SLB&M;

S89-6 South 3369 feet and West 465 feet from the NE Corner of Section 12, T26S, R7W, SLB&M;

S89-7 South 3129 feet and West 915 feet from the NE Corner of Section 12, T26S, R7W, SLB&M.

By this letter you are hereby granted permission to drill, subject to the following conditions:

1. Your request is approved as a test well application only. If, at a later date, it is desired to bring the well to production, it will be necessary to obtain the State Engineer's approval on the appropriate water right application(s) at or previous to that time.

2. The driller must be bonded and have a current well driller's permit from the Division of Water Rights. A federal bond covering the well will satisfy the bonding requirement.

3. These wells may be drilled to a maximum of 1500 feet. The applicant must obtain written permission from the State Engineer prior to drilling to a depth significantly beyond 1500 feet, i.e., to a depth requiring changes or additions to the Plan of Operations submitted to the State Engineer, or posing a threat to the safety of personnel rig equipment and/or the structural integrity of the well.

4. The applicant must notify the Division of Water Rights at least 24 hours prior to 1) the commencement of drilling, and 2) testing the BOP equipment and the surface casing, so that a representative may be on site for the inspections. The applicant must also notify the Division prior to testing the well for flow or resource characteristics so that a representative of the Division may observe the test.

5. The casing shall be installed according to the schedule in the plan of operations in the request to drill, summarized as follows:

   A. The conductor casing (13-3/8 inch) shall be installed to a depth of 40-120 feet and the annular space shall be cemented back solid to the surface.

   B. The surface casing (7 inch) shall be set to a depth of 250-400 feet and cemented back to the surface. Blow-out prevention equipment shall be installed and tested <u>before drilling further</u>.

   C. The well may be drilled open-hole below the surface casing.

   Any variances from the Plan of Operations must be approved by the State Engineer prior to their implementation.

6. The BOP Equipment and the surface casing shall be pressure tested in accordance with federal regulations as contained in Federal GRO Order No. 2. The applicant shall notify the Division prior to the test so that a representative of the Division may witness the test.

7. Mud return temperatures shall be monitored and recorded at least with the addition of each new drill pipe, or 30 feet, whichever is less. If the return temperatures reach 125 degrees Fahrenheit before the surface casing has been set, drilling shall cease immediately until casing has been set and/or BOP equipment has been installed and successfully tested.

8. The driller shall take all necessary precautions to prevent fires, blow-outs, or others hazards and to conduct all activities in a safe and workmanlike manner. The driller shall be prepared with proper equipment and drilling techniques to handle either artesian or thermal pressure, or both, particularly in the bedrock layers which apparently form the reservoir matrix. The driller shall utilize such equipment as is necessary to contain the well at any stage, whether above or within the bedrock layer. Appropriate H2S warning devices shall be utilized during all drilling and testing operations, and personnel shall be instructed in proper emergency procedures and the use of emergency equipment.

9. The applicant shall provide for proper and safe disposal of any geothermal fluids produced during the drilling or testing of the well. Plans for disposal pits or other facilities must be approved by the State Engineer prior to the commencement of testing. No more water may be diverted from any of the wells than is necessary to conduct the tests associated with drilling. Any extended flow test to determine the production capabilities of the well must be approved in writing by the State Engineer prior to the commencement of testing.

10. In case of any emergency, the applicant shall immediately notify the Division at one of the numbers listed below:

	Work	Home
Gerald Stoker	(801) 586-4231	
John Solum	(801) 538-7406	(801) 546-1979
Kent Jones	(801) 538-7405	(801) 561-9901

It is the responsibility of the applicant to notify the Division.

11. The applicant shall submit to the Division all drilling reports and logs at the completion of drilling, and geologic data, chemical analyses, and test results at the completion of testing or earlier if the State Engineer determines that the information is necessary for immediate decisions regarding the management of the resource. This information will, at the request of the applicant, be held confidential until it is released by the applicant.

12. This approval is conditioned upon the proper easements and trespass agreements being obtained from Provo City, the fee hold of the land where the proposed well S89-3 will reside. A copy of such agreements shall be provided the Division of Water Rights before the approval of S89-3 is considered final.

This is permission for the licensed driller to begin drilling the geothermal test well. Note that the expiration date of this letter is October 14, 1989.

Please notify Gerald Stoker, the Area Engineer, at 586-4231 or John Solum, at 538-7406 prior to the commencement of drilling operations.

This is not permission for you to develop a final test well to be used for production purposes, but is only intended to develop sufficient information to determine if a likely geothermal resource is available in the area. It is the responsibility of the applicant to obtain proper water rights and other necessary permits.

Yours very truly,

Robert A. Morgan

For Kent Jones, P.E.
Directing Appropriations Engineer

KLJ:JS:rc

cc: Gerald W. Stoker
Jerry Bronicel
Delano Development Company

Appendix E

S89-4 Field Cost Est				
Based on Grimshaw Drlg, Inc. proposed costs				
1000' TD, Not incl MEI administrative costs				
or D7, Backhoe, etc.				
Item	**GDI Est**	**5/31/89**	**6/1/89**	**6/2/89**
Mob/rigup	2000	2000		
Construct Pad	250	250		
Drill 17 1/2" hole 40' @$31/ft	1240		1240	
Run 13 3/8" Conductor	150		150	
Cement conductor, WOC 6 hrs	600			600
Drill 9 7/8" hole 310' @ $18/ft				
Run 7" casing x 300' (4 hrs)	400			
Cement 7" casing, WOC (16 hrs tot)	1600			
NU/Test BOPE (16 hrs)	1600			
Drill 6 1/4" hole 360'-500' @$12.50/ft	2500			
Drill 6 1/4" hole 500'-626' @$15/ft	7500			
Trip out/2 hr flowtest/"trip in" (5 hrs)				
GDI Subtotal:	17840			
Land & Marine Rentals	2500			
Drilex Rentals	1350			
Compressor rental (1/2 mo)	2400	2400		
Casing 40' 13 3/8 @ $19.00/ft	0		760	
Casing 320 ft 7" @ $7.00/ft	0			
Single shot/geolograph (Eastman)	112			
Mud/chemicals	2500			
Fuel/lubricants	2500			1588.73
Cement Conductor (Carling)	300		450	
Cement 7" (Dowell)	3500			
H2S Safety	1500			
Geologist	1000			
Wellhead equip	1630			
9 7/8" bit				
Welder	500			
Mechanic, repairs	0			
Generator rental (1 wk)	0	700		
	$37,632			
Daily Total:		$5,350	$2,600	$2,189
Cum Total:		$5,350	$7,950	$10,139

S89-4 Field Cost Est				
Based on Grimshaw Drlg, Inc. proposed costs				
1000' TD, Not incl MEI administrative costs				
or D7, Backhoe, etc.				
			(Final)	
Item	**6/3/89**	**6/4/89**	**6/5/89**	**Totals**
Mob/rigup				**2000**
Construct Pad				**250**
Drill 17 1/2" hole 40' @$31/ft				**1240**
Run 13 3/8" Conductor				**150**
Cement conductor, WOC 6 hrs				**600**
Drill 9 7/8" hole 310' @ $18/ft	5580			**5580**
Run 7" casing x 300' (4 hrs)		400		**400**
Cement 7" casing, WOC (16 hrs tot)		1600		**1600**
NU/Test BOPE (16 hrs)			1600	**1600**
Drill 6 1/4" hole 360'-500' @$12.50/ft			1750	**1750**
Drill 6 1/4" hole 500'-626' @$15/ft			1890	**1890**
Trip out/2 hr flowtest/"trip in" (5 hrs)			500	**500**
GDI Subtotal:				
Land & Marine Rentals			889	**889**
Drilex Rentals			1325	**1325**
Compressor rental (1/2 mo)				**2400**
Casing 40' 13 3/8 @ $19.00/ft				**760**
Casing 320 ft 7" @ $7.00/ft		2240		**2240**
Single shot/geolograph (Eastman)	28	28	28	**84**
Mud/chemicals			1125	**1125**
Fuel/lubricants				**1589**
Cement Conductor (Carling)				**450**
Cement 7" (Dowell)		3793.66		**3794**
H2S Safety		385	1050.56	**1436**
Geologist			950	**950**
Wellhead equip		1630		**1630**
9 7/8" bit	200			
Welder		320		**320**
Mechanic, repairs	54.10			**54**
Generator rental (1 wk)				**700**
			5% Contingency:	**1865**
Daily Total:	$5,862	$10,397	$11,108	
Cum Total:	$16,001	$26,397	$37,505	**$39,170**

Appendix F

12 HOUR CHART

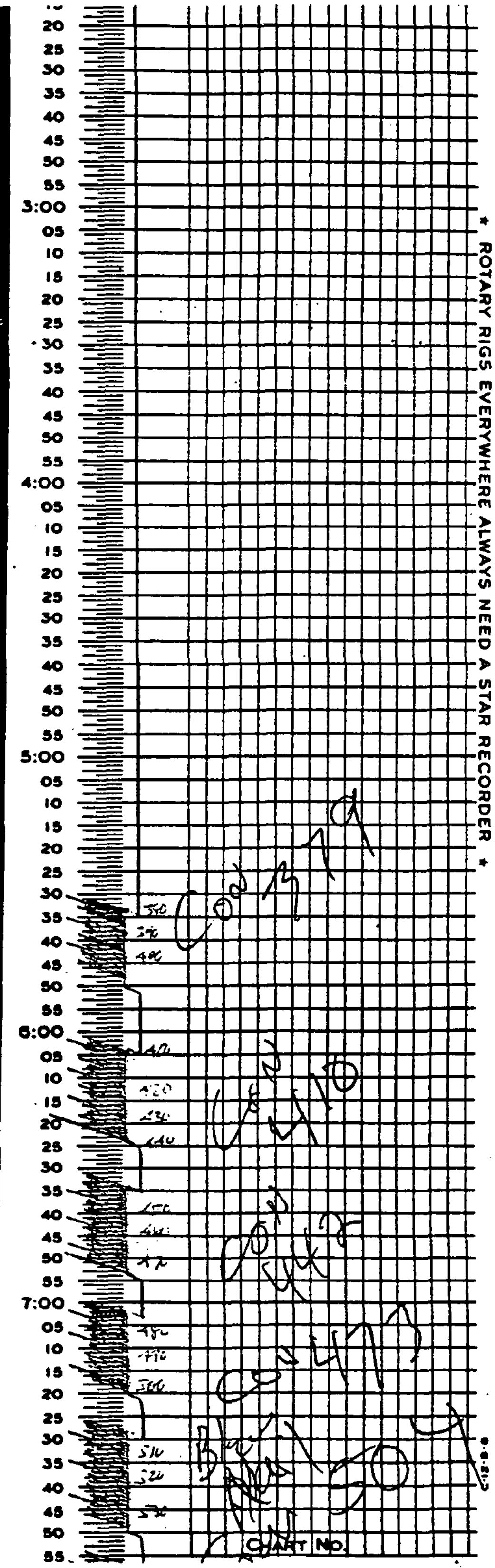
COMPANY: MEI
WELL:
TOTAL DEPTH ON: 379
TIME ON:
DATE: 6/5/89
WELL NUMBER: S-89-4
TOTAL DEPTH OFF: 540

REMARKS

TIME RECORD — OPERATION RECORD

8:00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55
9:00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55
10:00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55
11:00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55
12:00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55
1:00, 05

* ROTARY RIGS EVERYWHERE ALWAYS NEED A STAR RECORDER *


3:00
4:00
5:00
6:00
7:00
* ROTARY RIGS EVERYWHERE ALWAYS NEED A STAR RECORDER *
CHART NO.

Eastman Christensen

★ A STAR CORDING ★

12 HOUR CHART

COMPANY: MEI

WELL: S-89-4

TOTAL DEPTH ON: 525

TIME ON:

DATE: 6-8-89

WELL NUMBER:

TOTAL DEPTH OFF: 628 TD

REMARKS

TIME RECORD	OPERATION RECORD
8:00	
05	530 Con 535
10	
15	
20	540
25	
30	550
35	560 Con 565
40	
45	
50	570
55	580 Con 597
9:00	590
05	Fix lights on floor
10	600
15	610 Con 628
20	620 Steam
25	
30	
35	
40	
45	
50	
55	
10:00	
05	
10	
15	
20	
25	
30	
35	
40	
45	
50	
55	
11:00	
05	
10	
15	
20	
25	
30	
35	
40	
45	
50	
55	
12:00	
05	
10	
15	
20	
25	
30	
35	

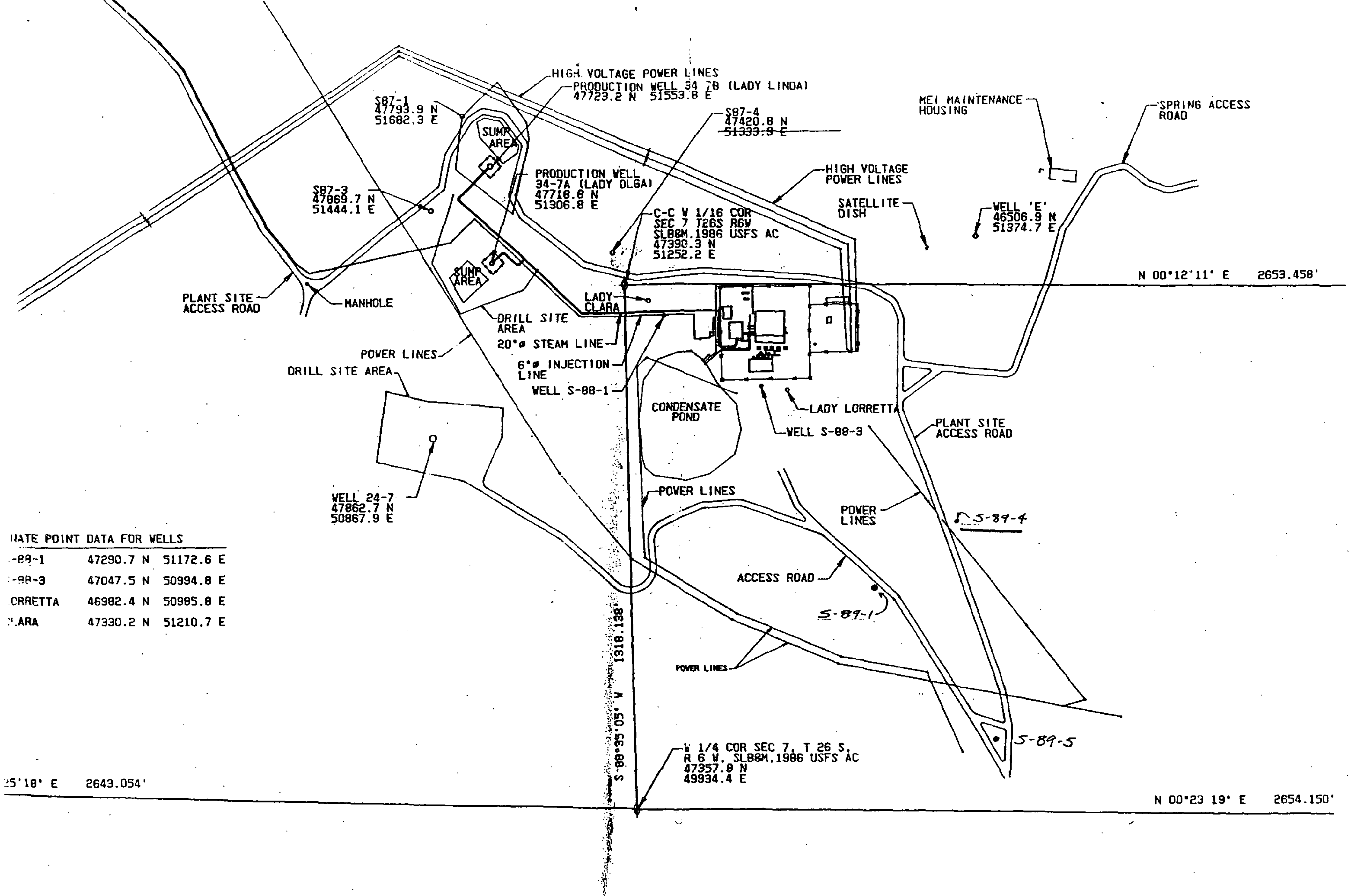

HIGH VOLTAGE POWER LINES
PRODUCTION WELL 34 7B (LADY LINDA) 47723.2 N 51553.8 E
S87-1 47793.9 N 51682.3 E
SUMP AREA
MEI MAINTENANCE HOUSING
SPRING ACCESS ROAD
S87-4 47420.8 N 51333.9 E
PRODUCTION WELL 34-7A (LADY OLGA) 47718.8 N 51306.8 E
HIGH VOLTAGE POWER LINES
S87-3 47869.7 N 51444.1 E
SATELLITE DISH
WELL 'E' 46506.9 N 51374.7 E
C-C W 1/16 COR SEC 7 T26S R6W SLB&M.1986 USFS AC 47390.3 N 51252.2 E
N 00°12'11" E 2653.458'
SUMP AREA
PLANT SITE ACCESS ROAD
MANHOLE
LADY CLARA
DRILL SITE AREA
20"ø STEAM LINE
POWER LINES
6"ø INJECTION LINE
DRILL SITE AREA
WELL S-88-1
CONDENSATE POND
LADY LORRETTA
PLANT SITE ACCESS ROAD
WELL S-88-3
WELL 24-7 47862.7 N 50867.9 E
POWER LINES
POWER LINES
S-89-4
NATE POINT DATA FOR WELLS
-88-1 47290.7 N 51172.6 E
-88-3 47047.5 N 50994.8 E
ORRETTA 46982.4 N 50985.8 E
LARA 47330.2 N 51210.7 E
ACCESS ROAD
S-89-1
S 88°35'05" W 1318.138'
POWER LINES
S-89-5
W 1/4 COR SEC 7, T 26 S, R 6 W, SLB&M,1986 USFS AC 47357.8 N 49934.4 E
25'18" E 2643.054'
N 00°23 19" E 2654.150'

Plate I
1" = 307'