Jim Lieb

From: Monzeglio, Hope, NMENV [hope.monzeglio@state.nm.us]
Sent: Monday, April 02, 2007 7:54 AM
To: Ed Riege
Cc: Cobrain, Dave, NMENV; Jim Lieb; Steve Morris
Subject: Well logs

Hope - I was able to find info on all the wells except for RW1, RW2 and PW-3.
- Jim

Ed

Could you provide me with the well logs/construction details for the following wells: SWM-2, SWM-4, OW-1, OW-10, OW-11, OW-12, OW-13, OW-14, OW-29, OW-30, RW-1, RW-2, PW-2, PW-3, and PW-4. If you are unable to locate any of the well logs, please indicate that as well. Let me know if you will be able to get these to me by the end of April?

Thanks

Hope

Hope Monzeglio
Environmental Specialist
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, BLDG 1
Santa Fe NM 87505
Phone: (505) 476-6045
Main No.: (505-476-6000
Fax: (505)-476-6030
hope.monzeglio@state.nm.us

Websites:
New Mexico Environment Department
Hazardous Waste Bureau

Please note the new phone numbers

RECEIVED
APR 2007
NMED Hazardous Waste Bureau

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Jim Lieb

From: Jim Lieb
Sent: Tuesday, April 17, 2007 9:25 AM
To: 'Monzeglio, Hope, NMENV'
Cc: 'Chavez, Carl J, EMNRD'; Ed Riege; Steve Morris
Subject: RE: New API separator
Importance: High

Hope:

Just want to let you know I received your email and am preparing a reply update on the two items in your email that I will provide NMED and OCD by April 27. I reply to your other emails from today also in this email.

Siemens Water Technology Group is working on the design of the stainless steel liner system for the NAPIS now. So I have asked them to also provide some details including a sketch / diagram on the leak detection system. I will include their information in my reply to you regarding your email. Siemens has told us that, tentatively, installation of the liner in the first bay could begin as early as this July and the second bay and oil recovery sump ("existing oil sludge pit") may be accomplished by September.

We are also currently in process of evaluating flexible concrete coating systems that can seal and bridge cracking surfaces and effectively serve as the secondary containment liner. The repair of the NAPIS walls and floor in each bay must be completed prior to the installations of the SS liner.

Several weeks ago, I asked Bill Kingsley for a proposal for the monitoring well installations at the NAPIS. I anticipate he will provide a quote soon (perhaps today based on a call to him a few minutes ago). I will submit a purchase order as soon as he provides his quote to Giant. At this point I do not fore see any issue with meeting the July 29th deadline for the installation of the three monitoring wells at the NAPIS and report submittal. Installation of the wells will require some coordination so it will not interfere with bay repairs and coating and the Siemens installation of the SS liners. Hence, we aim for the completion the installation of the monitoring wells by early June if at all possible.

I am also putting together the well logs information you had requested for delivery by end of April. I believe that I should have the information to you by the end of this month. To assemble the information has meant looking in quite a few records and through a number of storage locations.

Trihydro will soon provide Giant with their proposal for the cleanup of the fan-out and ditch areas of the former RR Rack Lagoon (SWMU#8). We anticipate work beginning in May. I will forward a copy of their proposal to you for use as an informal "work plan".

If I forgot anything let me know. If you have any questions please call or respond to this email.

Regards,

Jim Lieb
Environmental Engineer
Giant Industries, Inc.
Ciniza Refinery
I-40, Exit 39
Jamestown, NM 87347
(505) 722-0227

fax (505) 722-0210
jlieb@giant.com

From: Monzeglio, Hope, NMENV [mailto:hope.monzeglio@state.nm.us]
Sent: Tuesday, April 17, 2007 8:19 AM
To: Ed Riege; Jim Lieb
Cc: Cobrain, Dave, NMENV; Chavez, Carl J, EMNRD; WPRICE@state.nm.us; Steve Morris
Subject: New API separator

Ed and Jim

I just want to get an update on the status of the New API separator.

Carl sent an e-mail to Jim dated 2/12/07 Subject: RE: Giant-Ciniza Refinery NAPIS Leakage Correction Plan. Three points of the email are addressed below:

1) Giant must install the monitoring wells regardless if Giant were to install a steel based secondary liner with secondary leak detection in the NAPI. The monitoring well installation work plan is still due to NMED and OCD on 2/28/07 as stated in your 12/29/06 proposal.

2) Giant states "At present we are anticipating equipping the existing sludge pit of the API with a small notch to catch any accumulated liquid in conjunction with a stand pipe that will be monitored." Giant must clarify this statement. What is the sludge pit of the API, is this the sump? Where will the notch be installed and what is its purpose? Describe the purpose of the stand pipe and describe its function in the sludge pit.

3) The description provided in number 4 is interpreted that Giant will be repairing one bay at at time and utilizing the other bay to handle the refinery's process waste water. If this interpretation is incorrect, Giant must clarify the process for handling refinery process water. Giant also states they will sample for TPH and benzene, this must include BTEX and MTBE.

Point 1) NMED sent a letter dated March 23, 2007 pertaining to the "Work Plan for the Monitoring Well Installation Around the New API Separator." The letter addressed the installation of three monitoring wells and the submission of a drilling report that summarizes the monitoring well installations and sampling activities to NMED and the Oil Conservation Division (OCD) within 120 days of receipt of this letter. From the return receipt card, Giant received this letter on March 29, 2007. Therefore the monitoring wells must be installed and the drilling report must be submitted to NMED on or before July 29, 2007.

Point 2) and 3), to my knowledge Giant has not responded to these questions. Please provide NMED and OCD a response to the above questions and provide us with an update for correcting the leakage from the New API separator by Friday April 27, 2007.

If you have questions please let me know.

Thanks

Hope

Hope Monzeglio
Environmental Specialist
New Mexico Environment Department
Hazardous Waste Bureau

2905 Rodeo Park Drive East, BLDG 1
Santa Fe NM 87505
Phone: (505) 476-6045
Main No.: (505-476-6000
Fax: (505)-476-6030
hope.monzeglio@state.nm.us

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Please note the new phone numbers

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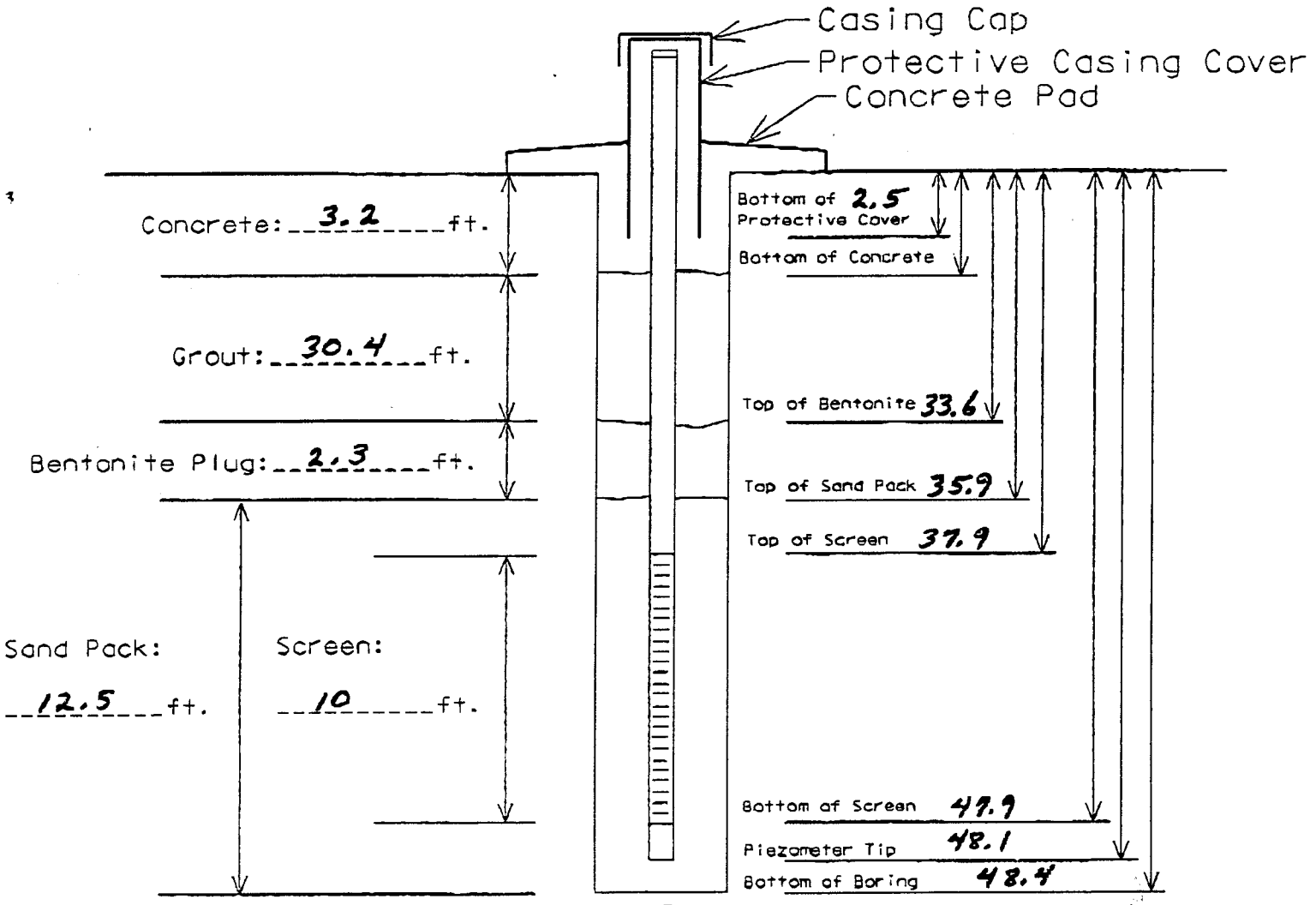
Installation Diagram

Monitoring Well No. OW-30



Boring Diameter: 8 5/8"

Sand Type: 20-40

Bollards, Type/Size: NONE

Bentonite: PELPLUG, TR-30 3/8" PELLETS

Screen Type/Size: 4", #10, SCH40 PVC

Cement/Grout: 6% BENTONITE/CEMENT

Riser Type/Size: 4", SCH 40, PVC

PRECISION ENGINEERING, INC.
505-523-7674

Water: POTABLE

Locking Expandable Casing Plug? YES

Site Northing: 5099.3

Other:

Bottom Cap Used? YES

Site Easting: 360.0

Project #: 96-134

Project Name: CINIZA REFINERY INVESTIGATION

Elevation: 6913.5

PROJECT: Giant Refinery
Ciniza

PRECISION ENGINEERING, INC.

LOG OF TEST BORINGS

FILE #: 96-133
ELEVATION: 6921.6
TOTAL DEPTH: 48.4
LOGGED BY: WHK
DATE: 8-28-96
STATIC WATER: 24.4
BORING ID: OW-30(0647)
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
0.0-6.5	///---///		C	**CLAY**, SILTY, DRY, RED BROWN, FIRM, SOME ROOT MATTER	PID-0ppm ALL SAMPLES
	///---///		C		
	///---///		C		
	///---///		C		
	///---///		C		
	///---///		C		
	///---///		C		
	///---///		C		
	///---///		C		
	///---///		C		
	///---///	5.0	C		
	///---///		C		
	///---///		C		
6.5	///---///		C		
6.5-13.1	////////		C	**CLAY**, RED BROWN, MOIST, STIFF, SOME ROOT MATTER, SOME CARBONATE NODULES < 1 cm	
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////	10	C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
13.1	////////		C		
13.1-13.8	///***///		C	**CLAY**, SANDY, CARBONATE NODULES APPROXIMATELY 3mm, STIFF, DAMP, RED BROWN	
	///***///		C		
13.8	///***///		C		
13.8-16.5	///---///	15	C	**CLAY**, SILTY, DAMP-MOIST, RED BROWN, STIFF	
	///---///		C		
	///---///		C		
16.5	///---///		C		
16.5-22.5	////////		C	**CLAY**, VERY STIFF, RED BROWN, MOIST	
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////	20	C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
22.5	////////		C		
22.5-23.2	////////		C	**CLAY**, SILTY, STIFF, MOIST, BROWN	

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID Hollow Stemmed Auger

PRECISION ENGINEERING, INC.

LOG OF TEST BORINGS

PROJECT: Giant Refinery
Ciniza

FILE #: 96-133
ELEVATION: 6921.6
TOTAL DEPTH: 48.4
LOGGED BY: WHK
DATE: 8-28-96
STATIC WATER: 24.4
BORING ID: OW-30(0647)
PAGE: 2

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
23.2-23.8	***---***		C	**SAND**, FINE, SILTY, BROWN, DAMP, MODERATELY DENSE	PID=0ppm
23.8	***---***		C		ALL SAMPLES
23.8-24.3	///---///		C	**CLAY**, SILTY, BROWN, VERY STIFF, MOIST	
24.3-39.7	////////	25	C	**CLAY**, BROWM, VERY STIFF, MOIST, SOME CARBONATE SPECKS > 28'	
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////	30	C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////	35	C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
39.7	////////		C		
39.7-41.7	///***///	40	C	**CLAY**, SANDY, WET, SOFT, RED BROWN, SANDIER @ 41.2-41.7	
	///***///		C		
	///***///		C		
41.7	///***///		C		
41.7-42.6	////////		C	**CLAY**, BLACK, WET, ABUNDANT CHARCOAL, SOFT, SOME ROOT MATTER	
42.6	////////		C		
42.6-44.2	///--*///		C	**CLAY**, LIGHT BROWN, WET, SOFT, VERY SLIGHTLY SANDY, SILTY	
	///--*///		C		
44.2	///--*///		C		
44.2-47.3	000SSS000		C	**GRAVEL**, **WATER BEARING**, CHERT, SANDSTONE, SOME LIMESTONE, MODERATELY DENSE	
	000SSS000	45	C		
	000SSS000		C		
	000SSS000		C		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID Hollow Stemmed Auger

PROJECT: Giant Refinery
Ciniza

PRECISION ENGINEERING, INC.

LOG OF TEST BORINGS

FILE #: 96-133
ELEVATION: 6921.6
TOTAL DEPTH: 48.4
LOGGED BY: WHK
DATE: 8-28-96
STATIC WATER: 24.4
BORING ID: OW-30(0647)
PAGE: 3

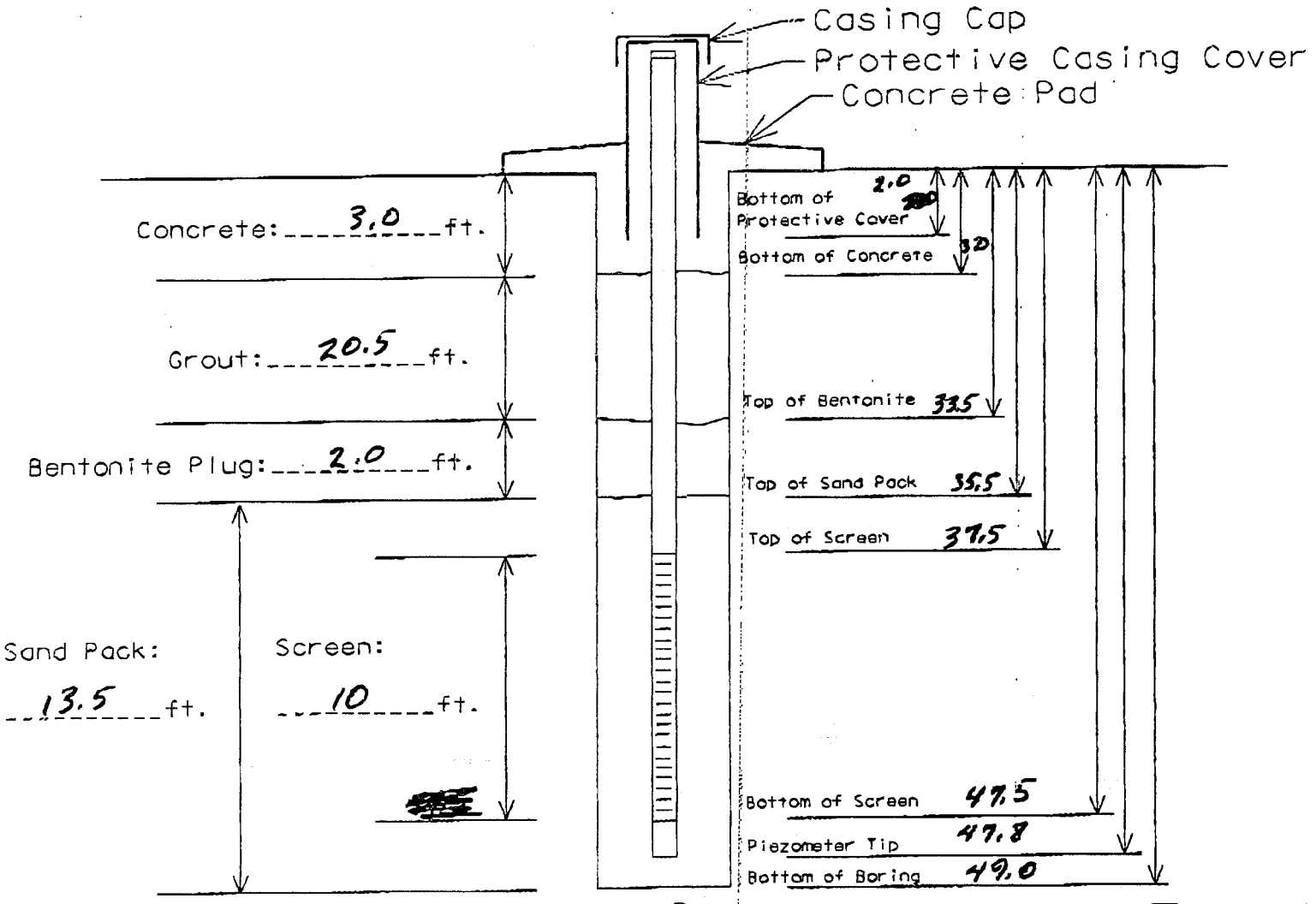
DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
44.2-47.3 47.3	000SSS000 000SSS000 000SSS000		C C C	**GRAVEL**, **WATER BEARING**, CHERT, SANDSTONE, SOME LIMESTONE, MODERATELY DENSE	PID=0ppm ALL SAMPLES
47.3-48.4	========= =========		C C	**SHALE**, **CHINLE FORMATION**, MOIST, HARD, RED TO WHITE (CARBONATE INDURATION)	
TOTAL DEPTH		50 55 60 65		NOTE: STATIC WATER ELEVATION 33.5 @ .5 HOURS AND 24.4 @ 72 HOURS	

SIZE AND TYPE OF BORING: 4 1/4" ID Hollow Stemmed Auger

LOGGED BY: WHK

Installation Diagram

Monitoring Well No. OW29



Boring Diameter: 8 5/8

Sand Type: COLORADO 20-40 SILICA

Bentonite: 3/8" PELETIZED

Cement/Grout: 6% BENT./CEMENT

Water: —

Other: —

Bollards. Type/Size: —

Screen Type/Size: 4" ID / 10 SLOT (.010), PVC

Riser Type/Size: 4" ID / PVC

Locking Expandable Casing Plug? YES

Bottom Cap Used? YES

Site Northing:

Site Easting:

Elevation:

Project #:

Project Name: CINIZA REFINERY

PRECISION ENGINEERING INC.
505-523-7674

PRECISION ENGINEERING, INC.

LOG OF TEST BORINGS

PROJECT: Giant Refinery Ciniza

FILE #: 96-133
ELEVATION: 6913.5
TOTAL DEPTH: 49.0
LOGGED BY: WHK
DATE: 8-23-96
STATIC WATER: 30.6
BORING ID: OW-29(0644)
PAGE: 1

DEPTH	PLOT	SCALE	SAMPLER	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
0.0-6.9	///--////		C	**CLAY**, SLIGHTLY SILTY, DAMP TO DRY, DARK RED BROWN, STIFF	PID=0ppm ALL SAMPLES
	///--////		C		
	///--////		C		
	///--////		C		
	///--////		C		
	///--////		C		
	///--////		C		
	///--////		C		
	///--////		C		
	///--////		C		
	///--////	5.0	C		
	///--////		C		
	///--////		C		
	///--////		C		
6.9	///--////		C		
6.9-7.4	///**////		C	**CLAY**, SLIGHTLY SANDY, ROOT MATTER, RED BROWN, MOIST, STIFF	
7.4-10.6	///---///		C	**CLAY**, SILTY, ROOT MATTER, RED BROWN, MOIST, SOME CALCIUM CARBONATE NODULES < 2 mm, STIFF-HARD	
	///---///		C		
	///---///		C		
	///---///		C		
	///---///	10	C		
10.6	///---///		C		
10.6-14.3	////////		C	**CLAY**, RED BROWN, WET, STIFF	
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
14.3	////////		C		
14.3-14.7	///**////		C	**CLAY**, SLIGHTLY SANDY, MOIST, STIFF, RED BROWN	
14.7-14.9	///---///	15	C	**CLAY**, SILTY, STIFF, MOIST, RED BROWN	
14.9-16.0	***//****		C	**SAND**, SLIGHTLY CLAYEY, DENSE, MOIST, RED BROWN	
16.0	***//****		C		
16.0-20.5	////////		C	**CLAY**, MOIST, RED BROWN, HARD, CHARCOAL 19-20'	
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////		C		
	////////	20	C		
20.5	////////		C		
20.5-22.2	///***///		C	**CLAY**, SANDY, CHARCOAL, RED BROWN, STIFF, MOIST	
	///***///		C		
22.2	///***///		C		
22.2-24.3	///---///		C	CLAY, SILTY, SILT IN LAMINATIONS, DRY-MOIST	
	///---///		C		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID Hollow Stemmed Auger

PRECISION ENGINEERING, INC.

LOG OF TEST BORINGS

PROJECT: Giant Refinery Ciniza

FILE #: 96-133
ELEVATION: 6913.5
TOTAL DEPTH: 49.0
LOGGED BY: WHK
DATE: 8-23-96
STATIC WATER: 30.6
BORING ID: OW-29(0644)
PAGE: 2

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
22.2-24.3	///---///		C	**CLAY**, SILTY, SILT IN LAMINATIONS, DRY-MOIST	PID=0ppm ALL SAMPLES
	///---///		C		
24.3	///---///		C		
24.3-36.8	///**////	25	C	**CLAY**, ROOT MATTER, RED BROWN, STIFF, MOIST, SLIGHTLY BLOCKY, SOME CARBONATE NODULES APPROXIMATELY 1/2 cm AT 26.0-27.5, FRACTURES DURING SAMPLING FORM SLICKENSIDED SURFACES, SLIGHTLY SANDY 33.5-33.8', WET > 35'	
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////	30	C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
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	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
	///**////	35	C		
	///**////		C		
	///**////		C		
	///**////		C		
36.8	///**////		C		
36.8-37.1	*********		C	**SAND**, LIGHT BROWN, WET, MEDIUM, DENSE	
37.1-39.6	////0////		C	**CLAY**, LIGHT BROWN, WET, SOFT, SOME 3/4" GRAVEL RARE	
	////0////		C		
	////0////		C		
	////0////		C		
	////0////		C		
39.6	////0////		C		
39.6-40.4	///***///	40	C	**CLAY**, COARSE SANDY, WET, SOFT, LIGHT BROWN, CALCIUM CARBONATE	
40.4	///***///		C		
40.4-43.4	///**////		C	**CLAY**, LIGHT BROWN, WET, SOFT, SLIGHTLY SANDY > 42.5'	
	///**////		C		
	///**////		C		
	///**////		C		
	///**////		C		
43.4	///**////		C		
43.4-47.0	000//0000		C	**GRAVEL**, SLIGHTLY CLAYEY, CHERT, LIMESTONE, PETRIFIED WOOD, SANDSTONE, MULTICOLORED TO LIGHT RED BROWN, DENSE, **WATER BEARING**, SANDIER >45'	
	000//0000		C		
	000//0000	45	C		
	000//0000		C		
	000//0000		C		

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID Hollow Stemmed Auger

PRECISION ENGINEERING, INC.

LOG OF TEST BORINGS

PROJECT: Giant Refinery Ciniza

FILE #: 96-133
ELEVATION: 6913.5
TOTAL DEPTH: 49.0
LOGGED BY: WHK
DATE: 8-23-96
STATIC WATER: 30.6
BORING ID: OW-29(0644)
PAGE: 3

DEPTH	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	PID (ppm)
43.4-47.0 47.0	000//0000 000//0000		C C	GRAVEL, SLIGHTLY CLAYEY, CHERT, LIMESTONE, PETRIFIED WOOD, SANDSTONE, MULTICOLORED TO LIGHT RED BROWN, DENSE, WATER BEARING, SANDIER > 45'	PID=0ppm ALL SAMPLES
47.0-49.0	======== ======== ======== ========		C	SHALE, RED PURPLE, DENSE, DAMP-MOIST (APPEARS DRY), NO WATER	
TOTAL DEPTH		50 55 60 65		NOTE: COMPLETED AS A 4" MONITORING WELL. SEE COMPLETION DIAGRAM.	

LOGGED BY: WHK

SIZE AND TYPE OF BORING: 4 1/4" ID Hollow Stemmed Auger

BORING OW-12

SURFACE ELEVATION: 6030 FEET

LABORATORY TEST DATA

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSI)	STRENGTH TEST DATA: SHEAR STRENGTH (PSI)	STRENGTH TEST DATA: DEVIATOR STRESS (PSI)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)
0									
10									
20									
30									
40									
50									
60									
70									
80									
90									
100									
110									
120									
130									
140									
150									
160									

SCARLEN

PENETRATION RATE - MINUTES/6 INCHES

SYMBOLS	DESCRIPTION
GM	TRIASSIC PERIOD
SS	CHINLE FORMATION LIGHT BROWN FINE SAND WITH GRAVEL-SIZED FRAGMENTS OF CHERT, LIMESTONE, AND PETRIFIED WOOD, SOFT, HIGHLY WEATHERED
	3 FEET: SANDSTONE, LIGHT BROWN, FINE-GRAINED WITH SOME MEDIUM TO COARSE GRAINS, COMPOSED OF QUARTZ WITH MINOR CHERT AND LIMESTONE, HARD, FRESH
	GRADES SOFT FROM 17 FEET GRADES HARD FROM 20 TO 24 FEET
SHALE	24 FEET: SHALE, REDDISH BROWN, SILTY, SANDY, WITH GRAVEL-SIZED FRAGMENTS OF PETRIFIED WOOD AND LIMESTONE, SOFT, FRESH
	GRADES HARD FROM 29 FEET
	GRADES SOFT FROM 40 FEET
	GRADES HARD FROM 49 FEET
SS	61 FEET: SANDSTONE, GRAY, SILTY, FINE-TO MEDIUM-GRAINED, CALCAREOUS, HARD, FRESH
SHALE	64 FEET: SHALE, GRAY, SILTY, SANDY, SOFT, FRESH
	GRADES HARD FROM 90 FEET
SS	104 FEET: SANDSTONE, GRAY TO BLUISH GRAY, FINE-GRAINED, THINLY BEDDED, NONCALCAREOUS, WITH INTERBEDDED REDDISH BROWN SANDY MUDSTONE, HARD, FRESH GRADES BROWN FROM 112 FEET
SHALE	143 FEET: SHALE, GRAY, SILTY, SANDY, HARD, FRESH

DORINDA

BORING COMPLETED AT 145.0 FEET ON 12/15/80.
4-INCH PVC PIEZOMETER INSTALLED WITH PERFORATIONS FROM 117.8 TO 137.8 FEET.
GRAVEL PLACED FROM 105.0 TO 137.8 FEET AND BORING SEALED WITH BENTONITE AND CEMENT TO SURFACE.
GROUND WATER LEVEL MEASURED AT 47.3 FEET BELOW GROUND ON 1/5/81.

LOG OF BORINGS

DAMES & MOORE

BORING OW-13

SURFACE ELEVATION: 6914 FEET

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)
0									
10									
20									
30									
40									
50									
60									
70									
80									
90									
100									
110									
120									
130									
140									
150									
160									

PENETRATION RATE MINUTES/FOOT	SYMBOLS	DESCRIPTION
1.4	CL	TRIASSIC PERIOD CHINLE FORMATION REDDISH BROWN SILTY FINE SANDY CLAY, SOFT, HIGHLY WEATHERED
2.6	SHALE	GRADES WITH GRAVEL FROM 3 TO 6 FEET
3.6		8 FEET: SHALE, REDDISH BROWN, SILTY WITH SOME FINE SAND, SOFT, FRESH
4.0		
3.0		
3.0		GRADES WITH THIN LIMESTONE INTERBEDS FROM 26 TO 32 FEET
3.3		
4.4		GRADES GRAY AND HARD FROM 40 FEET
4.8		
4.6		GRADES REDDISH BROWN FROM 55 FEET
4.0		
4.3		
7.5		
6.7		
5.0		
6.5	SS/MS	70 FEET: SANDSTONE, WHITE TO GRAY, FINE-GRAINED, INTERBEDDED WITH REDDISH BROWN SANDY MUDSTONE, THIN BEDDED, HARD, FRESH
6.7		
6.0		
5.0	SS	79 FEET: SANDSTONE, LIGHT BROWN, FINE-GRAINED WITH SOME MEDIUM TO COARSE GRAINS, SLIGHTLY CALCAREOUS, COMPOSED OF QUARTZ WITH MINOR LIMESTONE, HARD, FRESH
6.0		
6.7		
10.0		
8.0		
6.4		
	SHALE	104 FEET: SHALE, REDDISH BROWN, SANDY, WITH OCCASIONAL THIN INTERBEDS OF SANDSTONE AND LIMESTONE, HARD, FRESH

BORING COMPLETED AT 108.0 FEET ON 12/10/80.
BORING ALLOWED TO CAVE FROM 98.2 TO 104.0 FEET.
4-INCH PVC PIEZOMETER INSTALLED WITH PERFORATIONS FROM 78.2 TO 98.2 FEET.
GRAVEL PLACED FROM 74.0 TO 98.2 FEET AND BORING SEALED WITH BENTONITE AND CEMENT TO SURFACE.
GROUND WATER LEVEL MEASURED AT 23.2 FEET BELOW GROUND ON 1/5/81.

LOG OF BORINGS

DAMES & MOORE

BORING OW-14

SURFACE ELEVATION: 6923 FEET

DEPTH IN FEET	LABORATORY TEST DATA: TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)
0									
10									
20									
30									
40									
50									
60									
70									
80									
90									
100									
110									
120									
130									
140									
150									
160									

PENETRATION RATE MINUTES/FOOT	SYMBOLS	DESCRIPTION
2.0, 1.7, 1.6, 1.7, 2.6	CL	TRIASSIC PERIOD CHINLE FORMATION REDDISH BROWN SILTY, FINE SANDY CLAY, CALCAREOUS, SOFT, HIGHLY WEATHERED
2.2, 2.6, 2.4	SM	24 FEET: REDDISH BROWN SILTY, VERY FINE SAND, SOFT, HIGHLY WEATHERED
5.0, 4.0	SS	39 FEET: SANDSTONE, BROWN, FINE-TO COARSE-GRAINED SILTY, WITH OCCASIONAL THIN INTERBEDS OF LIMESTONE, HARD, FRESH

BORING COMPLETED AT 45.0 FEET ON 12/17/80.
4-INCH PVC PIEZOMETER INSTALLED WITH PERFORATIONS FROM 35.0 TO 45.0 FEET.
GRAVEL PLACED FROM 30.0 TO 45.0 FEET AND BORING SEALED WITH BENTONITE AND CEMENT TO SURFACE.
GROUND WATER LEVEL MEASURED AT 25.8 FEET BELOW GROUND ON 1/5/81.

BAD LOG

LOG OF BORINGS

DAMES & MOORE

BORING OW-11

SURFACE ELEVATION: ~~8923~~ 6923 FEET

Date Completed 12/30/80

Coordinates 1365 N, 1455 W

LABORATORY TEST DATA

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)
0									
10									
20									
30									
40									
50									
60									
70									
80									
90									
100									
110									
120									
130									
140									
150									
160									

PENETRATION RATE MINUTES/FOOT

1.6, 1.4, 2.4, 3.0, 6.5, 2.4, 12.5, 4.4, 5.5, 4.0, 3.1, 4.3, 5.0, 8.0, 2.5, 3.3, 4.0, 2.3, 3.6, 2.3, 4.3, 4.5, 2.7, 3.0, 3.5, 4.0, 4.3, 3.5, 3.3, 4.5, 2.7, 4.5, 2.0, 6.5, 5.0, 2.3, 2.3, 2.7, 3.0, 2.2, 2.3, 2.2, 2.7, 3.3, 2.7, 2.2

SYMBOLS	DESCRIPTION
SM	TRIASSIC PERIOD CHINLE FORMATION REDDISH BROWN SILTY FINE SAND, SOFT, HIGHLY WEATHERED GRADES WITH GRAVEL-SIZED FRAGMENTS OF FINE SANDSTONE AND LIMESTONE FROM 7 FEET
SHALE	13 FEET: SHALE, GRAY, SILTY, WITH OCCASIONAL THIN INTERBEDS OF WHITE SANDSTONE, SOFT, FRESH GRADES WITH REDDISH BROWN SANDSTONE INTERBEDS FROM 20 FEET GRADES WITH LAYER OF WHITE, FINE-GRAINED SANDSTONE FROM 23 TO 24 FEET
SS	30 FEET: SANDSTONE, WHITE, FINE-GRAINED, WITH GRAVEL-SIZED FRAGMENTS OF CHERT, OCCASIONAL THIN INTERBEDS OF REDDISH BROWN FINE-GRAINED SANDSTONE, THINLY BEDDED, HARD, FRESH
SHALE	40 FEET: SHALE, GRAY TO PURPLE, SILTY AND SANDY, SOFT, FRESH GRADES WITH SOME SAND FROM 47 FEET GRADES GRAY AND HARD FROM 50 TO 55 FEET GRADES WHITE TO LIGHT GRAY FROM 55 FEET, SOFT GRADES PURPLE FROM 68 FEET GRADES GRAY FROM 78 FEET GRADES WITH OCCASIONAL THIN INTERBEDS OF LIMESTONE AND GRAVEL-SIZED FRAGMENTS OF CHERT FROM 92 FEET GRADES REDDISH BROWN FROM 103 FEET GRADES GRAY AND HARD FROM 110 FEET GRADES SOFT WITH NO INTERBEDS FROM 114 FEET GRADES PURPLISH GRAY FROM 117 FEET GRADES GRAY FROM 140 FEET

GRAVEL

BORING COMPLETED AT 150.0 FEET ON 12/30/80.
4-INCH PVC PIEZOMETER INSTALLED WITH PERFORATIONS FROM 43.0 TO 65.0 FEET.
GRAVEL PLACED FROM 35.0 TO 65.0 FEET AND BORING SEALED WITH BENTONITE AND CEMENT TO SURFACE.
GROUND WATER LEVEL MEASURED AT 20.2 FEET BELOW GROUND ON 1/5/81.
Bottom of casing 65.73'

LOG OF BORINGS

DAMES & MOORE

MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT
HAZARDOUS WASTE SECTION
P.O. BOX 26110
SANTA FE, NEW MEXICO 87502

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	SMW-5
WELL LOCATION (LONGITUDE)	108 26' 03"
WELL LOCATION (LATITUDE)	35 29' 41"
NEW MEXICO STATE PLANE	(X) 320,778.61 (Y) 1,636,054.28
AQUIFER NAME	Ciniza Sand
AQUIFER CONFINED? xx	UNCONFINED?
WELL INSTALLATION DATE	9-25-85
DRILLING METHOD	HLWAG
INNER CASING DIAMETER	2.0"
BOREHOLE DIAMETER	6.5"
CASING MATERIAL	SS304
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6800.68
ELEV. BOTTOM OF WELL CASING	6801.78
ELEV. BOTTOM OF SCREENED INT.	6804.78
ELEVATION OF SCREENED INTERVAL	6824.78
SURVEYED ELEVATION OF CASING TOP	6878.02

DATE OF REPORT 2-26-96

SIGNATURE Dorinda Mancini
NAME (TYPED) Dorinda Mancini

BORING OW-10

SURFACE ELEVATION: 6872 FEET

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)
0									
10									
20									
30									
40									
50									
60									
70									
80									
90									
100									
110									
120									
130									
140									
150									
160									

PENETRATION RATE MINUTES/FOOT

PENETRATION RATE (MINUTES/FOOT)	SYMBOLS	DESCRIPTION
1.0 – 1.4	CL	TRIASSIC PERIOD CHINLE FORMATION REDDISH BROWN SILTY CLAY, SOFT, HIGHLY WEATHERED GRADES WITH TRACE TO SOME MEDIUM TO FINE-GRAINED SAND-SIZED PARTICLES OF CHERT, PETRIFIED WOOD, AND LIMESTONE FROM 5 FEET
1.4	ML	10 FEET: REDDISH BROWN SILTY FINE-GRAINED SAND, WITH SOME CLAY, SOFT, HIGHLY WEATHERED
1.4 – 2.0	CL	13 FEET: REDDISH BROWN SILTY CLAY WITH SOME SAND, SOFT, HIGHLY WEATHERED SAND GRADES OUT FROM 16 FEET GRADES WITH SAND FROM 24 FEET GRADES WITH OCCASIONAL THIN INTERBEDS OF SANDSTONE FROM 28 FEET
2.0 – 2.8		
2.8 – 3.0	SS	34 FEET: SANDSTONE, COLOR VARIES FROM DARK AND REDDISH BROWN TO WHITE TO LIGHT GRAY, SILTY, FINE-GRAINED, NONCALCAREOUS, SOFT, FRESH
3.0 – 6.7		GRADES BROWN FROM 45 FEET
6.7 – 2.9		
2.9 – 4.6		
4.6 – 5.0	SHALE	63 FEET: SHALE, GRAY TO PURPLISH GRAY, SILTY, WITH OCCASIONAL THIN INTERBEDS OF TAN TO BROWN, FINE-GRAINED, CALCAREOUS SANDSTONE, HARD, FRESH

BORING COMPLETED AT 68.0 FEET ON 11/25/80.
4-INCH PVC PIEZOMETER INSTALLED WITH PERFORATIONS FROM 40.0 TO 60.0 FEET.
GRAVEL PLACED FROM 36.0 TO 68.0 FEET AND BORING SEALED WITH BENTONITE AND CEMENT TO SURFACE.
GROUND WATER LEVEL MEASURED AT 1.7 FEET BELOW GROUND ON 1/5/81.

LOG OF BORINGS

DAMES & MOORE

BORING OW-2

SURFACE ELEVATION: 6871 FEET

3L2

284A

LABORATORY TEST DATA

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)
0									
10									
20									
30									
40									
50									
60									
70									
80									
90									
100									
110									
120									
130									
140									
150									
160									

PENETRATION RATE MINUTES/FOOT

PENETRATION RATE MINUTES/FOOT	SYMBOLS	DESCRIPTION
	ML	TRIASSIC PERIOD CHINLE FORMATION REDDISH BROWN SILTY CLAY, SOFT, HIGHLY WEATHERED
1.8		
2.0		7-6-84
3.0		
4.0	SHALE	34 FEET: SHALE, REDDISH BROWN, SILTY, CALCAREOUS, SOFT, FRESH
2.4		
3.5		GRADES BROWN FROM 50 FEET
1.9		
2.0		GRADES WITH SOME FINE SAND FROM 58 FEET
1.4		
2.0		SILT AND FINE SAND GRADES OUT FROM 70 FEET
1.4		
		GRADES DARK GRAY FROM 75 FEET
1.0		GRADES WITH TRACE TO SOME SILT FROM 80 FEET
2.3		
2.5	SHALE	83 FEET: SHALE, DARK BROWN TO BLACK, WITH SOME SAND AND GRAVEL-SIZED FRAGMENTS OF PETRIFIED WOOD, HARD
10.0		
7.8		GRADES GRAY FROM 88 FEET
11.2		
7.5		GRADES PURPLE TO GRAY FROM 100 FEET
7.0		
5.0		GRADES SOFT FROM 110 FEET
3.4		
4.4		GRADES HARD FROM 120 TO 125 FEET
5.0		GRADES REDDISH BROWN FROM 125 FEET, SOFT
3.8		GRADES HARD FROM 130 FEET
5.0		GRADES TO PURPLE AND REDDISH BROWN FROM 135 FEET
5.4		
5.0	SS	143 FEET: SANDSTONE, BROWN, FINE-GRAINED, SUBANGULAR, CALCAREOUS, WELL SORTED, SOFT
4.0		SHALE 162.5 FEET: SHALE, PURPLE TO REDDISH BROWN, WITH SOME SILT, HARD
3.6		
4.4		BORING COMPLETED AT 163.0 FEET ON 10/31/80. 4-INCH PVC PIEZOMETER INSTALLED WITH PERFORATIONS FROM 48.0 TO 68.0 FEET. GRAVEL PLACED FROM 43.0 TO 68.0 FEET AND BORING SEALED WITH BENTONITE AND CEMENT TO SURFACE. GROUND WATER LEVEL MEASURED AT 21.2 FEET BELOW GROUND 1/5/81.
5.0		

LOG OF BORINGS

BORING OW-1

SURFACE ELEVATION: 6868 FEET

DEPTH IN FEET	LABORATORY TEST DATA: TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)
0									
10									
20									
30									
40									
50									
60									
70									
80									
90									
100									
110									
120									
130									
140									
150									
160									

PENETRATION RATE MINUTES/FOOT	SYMBOLS	DESCRIPTION
6.0, 5.0, 4.0, 4.2	CL	TRIASSIC PERIOD CHINLE FORMATION RED TO REDDISH BROWN CLAY WITH TRACE TO SOME SILT, CALCAREOUS, HIGHLY WEATHERED
3.8, 4.1, 5.6, 5.0, 4.2, 4.6, 5.4, 4.2, 3.6, 4.0, 5.4, 8.0	SHALE	27 FEET: SHALE, REDDISH BROWN, SILTY, CALCAREOUS, SOFT, FRESH GRADES HARD FROM 33 FEET GRADES WITH OCCASIONAL THIN LIMESTONE INTERBEDS FROM 40 TO 50 FEET GRADES WITH THIN SANDSTONE INTERBEDS FROM 45 TO 50 FEET GRADES SOFT FROM 65 FEET GRADES WITH THIN SANDSTONE AND LIMESTONE INTERBEDS FROM 75 FEET, HARD
5.2, 4.2, 3.6	SS	86 FEET: SANDSTONE, VARIEGATED BROWN TO LIGHT GRAY, FINE GRAINED, SILTY, SOFT, WITH ROUNDED TO SUBROUNDED, CLEAR TO FROSTED QUARTZ GRAINS, MICACEOUS, FRESH
		SHALE 98 FEET: SHALE, REDDISH BROWN, SILTY, SOFT, FRESH

BORING COMPLETED AT 99.3 FEET ON 11/10/80.
4-INCH PVC PIEZOMETER INSTALLED WITH PERFORATIONS FROM 89.3 TO 99.3 FEET.
GRAVEL PLACED FROM 88.0 TO 99.3 FEET AND SEALED WITH CEMENT AND BENTONITE TO SURFACE.
GROUND WATER LEVEL MEASURED AT 6.4 FEET BELOW GROUND ON 1/5/81.

KEY TO BORINGS
ROCK SYMBOLS

SHALE SANDSTONE MUDSTONE

NOTES:
1. PENETRATION RATE IN MINUTES PER FOOT WAS DETERMINED BY THE TIME REQUIRED TO DRILL EACH INTERVAL SHOWN WITH A CABLE TOOL RIG.
2. ESTIMATES OF SOIL CONSISTENCY AND ROCK STRENGTH ARE BASED ON PENETRATION RATE USING THE FOLLOWING CRITERIA:
   $<$ 4.2 MIN./FT.-SOFT
   $>$ 4.2 MIN./FT.-HARD
3. ELEVATION GIVEN IN FEET ABOVE MEAN SEA LEVEL.
4. SOIL CLASSIFICATION IS BASED ON UNIFIED SOIL CLASSIFICATION SYSTEM (PLATE A2-1).
5. ALL DEPTHS REFER TO DEPTH BELOW GROUND.
6. SEE PLATE 1 FOR LOCATION OF WELLS.

LOG OF BORINGS

MONITORING WELL MW-4

SURFACE ELEVATION: 6883 FEET
(Unsurveyed)

LABORATORY TEST DATA

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	BLOWS/FT. SAMPLES
0										
10										
20										
30										
40										
50										
60										
70										
80										
90										
100										
110										
120										
130										
140										
150										
160										

SYMBOLS	DESCRIPTION
CL	REDDISH-BROWN SILTY CLAY, LOOSE
CL	REDDISH-BROWN CLAY, FIRM WATER LEVEL 8.7 FEET B.G. 10/18/81 GRADES SILTY AND SANDY (COARSE) 20-25 FEET
SH	VARIEGATED REDDISH-BROWN, GREEN AND LIGHT PURPLE SILTY SHALE GRADES REDDISH-BROWN TO RED-ORANGE, 65-70 FEET
SH/LS	VARIEGATED LIGHT GREEN TO DARK RED SHALE AND THIN LIMESTONE BED
SH	REDDISH-ORANGE, SLIGHTLY SANDY SHALE
SS	WHITE TO LIGHT GRAY, CLAYEY SANDSTONE
SH	PURPLE SANDY SHALE
SS	WHITE TO LIGHT GRAY SANDSTONE, HARD
SH	PURPLE SHALE WITH THIN LENSES OF CLAYEY SAND

BORING COMPLETED AT 120.0 FEET ON 10/16/81.

SCREENED INTERVAL

DAMES & MOORE

MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT
HAZARDOUS WASTE SECTION
P.O. BOX 26110
SANTA FE, NEW MEXICO 87502

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	MW-4
WELL LOCATION (LONGITUDE)	108 26' 54"
WELL LOCATION (LATITUDE)	35 29' 30"
NEW MEXICO STATE PLANE	(X) 321,602.07 (Y) 1,635,066.25
AQUIFER NAME xx	Sonsela
AQUIFER CONFINED?	UNCONFINED?
WELL INSTALLATION DATE	10-16-81
DRILLING METHOD	Cable
INNER CASING DIAMETER	5.0"
BOREHOLE DIAMETER	10.0"
CASING MATERIAL	PVC
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6761.60
ELEV. BOTTOM OF WELL CASING	6761.60
ELEV. BOTTOM OF SCREENED INT.	6761.60
ELEVATION OF SCREENED INTERVAL	6781.60
SURVEYED ELEVATION OF CASING TOP	6882.54

DATE OF REPORT 2-26-96

SIGNATURE Dorinda Mancini
NAME (TYPED) Dorinda Mancini

MONITORING WELL MW-2

SURFACE ELEVATION: 6877 FEET
(Unsurveyed)

LABORATORY TEST DATA

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	BLOWS/FT SAMPLES
0										
10										
20										
30										
40										
50										
60										
70										
80										
90										
100										
110										
120										
130										
140										
150										
160										

SYMBOLS	DESCRIPTION
CL	REDDISH-BROWN SILTY CLAY, TRACE MEDIUM TO COARSE SAND AS LOOSE TO FIRM BLEBS
	WATER LEVEL 9.1 FEET B.G. 10/18/81
SC	PINKISH-PURPLE, SLIGHTLY SANDY (FINE) CLAY
SH	VARIEGATED REDDISH-BROWN, GREEN AND LIGHT PURPLE, SANDY TO SILTY SHALE
CL	REDDISH-BROWN SILTY CLAY, FIRM
LS/SH	LIGHT GREEN TO DARK RED LIMESTONE INTERBEDDED WITH SHALE
LS	LIGHT GREEN LIMESTONE, HARD
SS	WHITE TO LIGHT-GRAY, FINE TO MEDIUM SAND; SOME CLAY; GRADES GREENISH GRAY TO FINE, COARSE TO MEDIUM SAND
SH	DEEP PURPLE SHALE, FIRM

BORING COMPLETED AT 138.0 FEET ON 10/15/81

SCREENED INTERVAL

DAMES & MOORE

MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT
HAZARDOUS WASTE SECTION
P.O. BOX 26110
SANTA FE, NEW MEXICO 87502

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	MW-2
WELL LOCATION (LONGITUDE)	108 26' 00"
WELL LOCATION (LATITUDE)	35 29" 43"
NEW MEXICO STATE PLANE	(X) 321,035.35 (Y) 1,636,184.06
AQUIFER NAME	Sonsela
AQUIFER CONFINED? xx	UNCONFINED?
WELL INSTALLATION DATE	10-15-81
DRILLING METHOD	Cable
INNER CASING DIAMETER	5.0"
BOREHOLE DIAMETER	10.0"
CASING MATERIAL	PVC
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6741.90
ELEV. BOTTOM OF WELL CASING	6741.90
ELEV. BOTTOM OF SCREENED INT.	6747.90
ELEVATION OF SCREENED INTERVAL	6847.90
SURVEYED ELEVATION OF CASING TOP	6880.84

DATE OF REPORT 2-26-96

SIGNATURE Dorinda Mancini
NAME (TYPED) Dorinda Mancini

MONITORING WELL MW4

SURFACE ELEVATION: 6876 FEET
(Unsurveyed)

LABORATORY TEST DATA

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	BLOWS/FT	SAMPLES
0											
10											
20											
30											
40											
50											
60											
70											
80											
90											
100											
110											
120											
130											
140											
150											
160											

SYMBOLS	DESCRIPTION
CL	REDDISH-BROWN SILTY CLAY, TRACE OF MEDIUM TO COARSE SAND AS SLEBS AND THIN INTERBEDS
	WATER LEVEL 14.8 FEET B.G. 10/18/83
SC	PINKISH-PURPLE, SLIGHTLY SANDY (FINE) CLAY
SH	VARIEGATED SILTY SHALE, REDDISH BROWN GRADING TO GREEN AND LIGHT PURPLE
CL	REDDISH-BROWN SILTY CLAY, FIRM
LS/SH	VARIEGATED LIGHT GREEN AND DARK RED LIMESTONE INTERBEDDED WITH SHALE
SH	REDDISH-ORANGE SHALE
LS	LIGHT-GREEN LIMESTONE DENSE, HARD
SS	LIGHT GREENISH-GRAY, MEDIUM TO FINE, LOOSELY CEMENTED SANDSTONE INTERBEDDED WITH LIGHT GRAY, LOOSE CLAY
SH	REDDISH-PURPLE SHALE

BORING COMPLETED AT 150.0 FEET ON 10/19/83.

SCREENED INTERVAL

DAMES & MOORE

MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT
HAZARDOUS WASTE SECTION
P.O. BOX 26110
SANTA FE, NEW MEXICO 87502

FACILITY NAME		Giant Refining Co. - Ciniza
EPA I.D. NUMBER		NMD000333211-2
COUNTY		McKinley
WELL NUMBER		MW-1
WELL LOCATION (LONGITUDE)		108 25' 36"
WELL LOCATION (LATITUDE)		35 29' 08"
NEW MEXICO STATE PLANE	(X)	320,903.76
	(Y)	1,636,112.13
AQUIFER NAME		Sonsela
AQUIFER CONFINED? xx		UNCONFINED?
WELL INSTALLATION DATE		10-14-81
DRILLING METHOD		Cable
INNER CASING DIAMETER		5.0"
BOREHOLE DIAMETER		10.0"
CASING MATERIAL		PVC

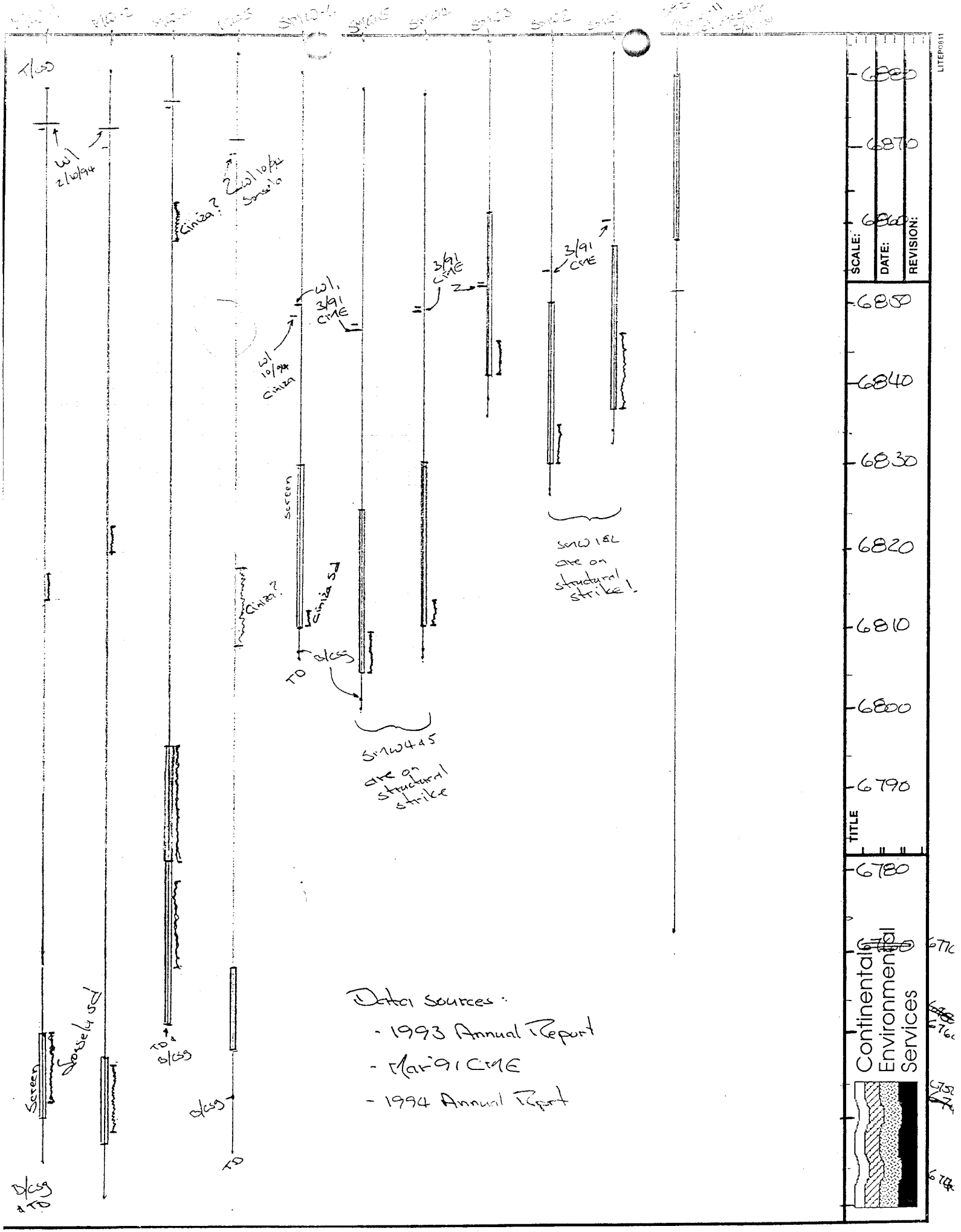
MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT
HAZARDOUS WASTE SECTION
P.O. BOX 26110
SANTA FE, NEW MEXICO 87502

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	MW-1
WELL LOCATION (LONGITUDE)	108 25' 36"
WELL LOCATION (LATITUDE)	35 29' 08"
NEW MEXICO STATE PLANE	(X) 320,903.76 (Y) 1,636,112.13
AQUIFER NAME	Sonsela
AQUIFER CONFINED? xx	UNCONFINED?
WELL INSTALLATION DATE	10-14-81
DRILLING METHOD	Cable
INNER CASING DIAMETER	5.0"
BOREHOLE DIAMETER	10.0"
CASING MATERIAL	PVC
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6745.80
ELEV. BOTTOM OF WELL CASING	6745.80
ELEV. BOTTOM OF SCREENED INT.	6750.80
ELEVATION OF SCREENED INTERVAL	6760.80
SURVEYED ELEVATION OF CASING TOP	6878.52

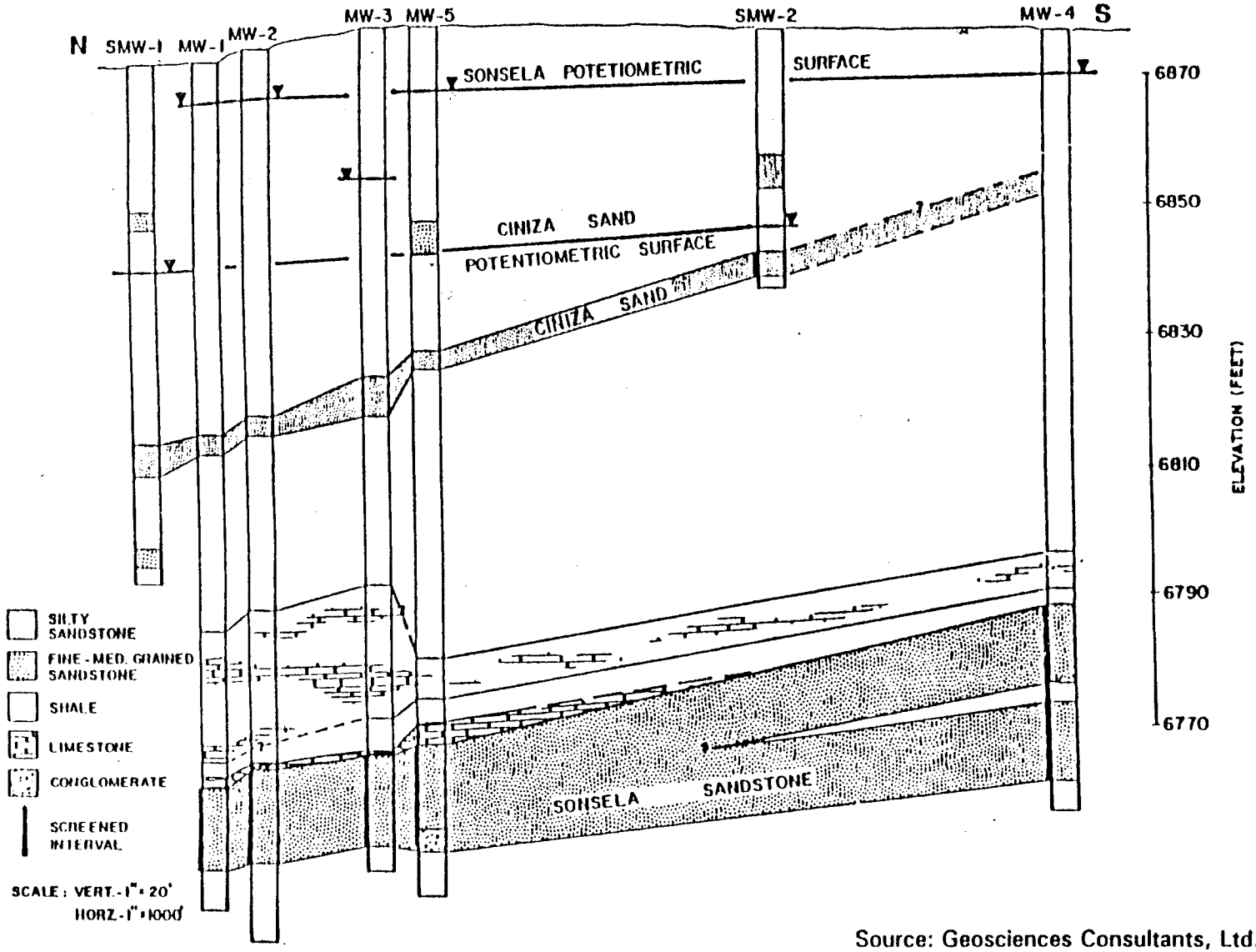
DATE OF REPORT 2-26-96

SIGNATURE Dorinda Mancini
NAME (TYPED) Dorinda Mancini



Data sources:

- 1993 Annual Report
- Mar 91 CME
- 1994 Annual Report

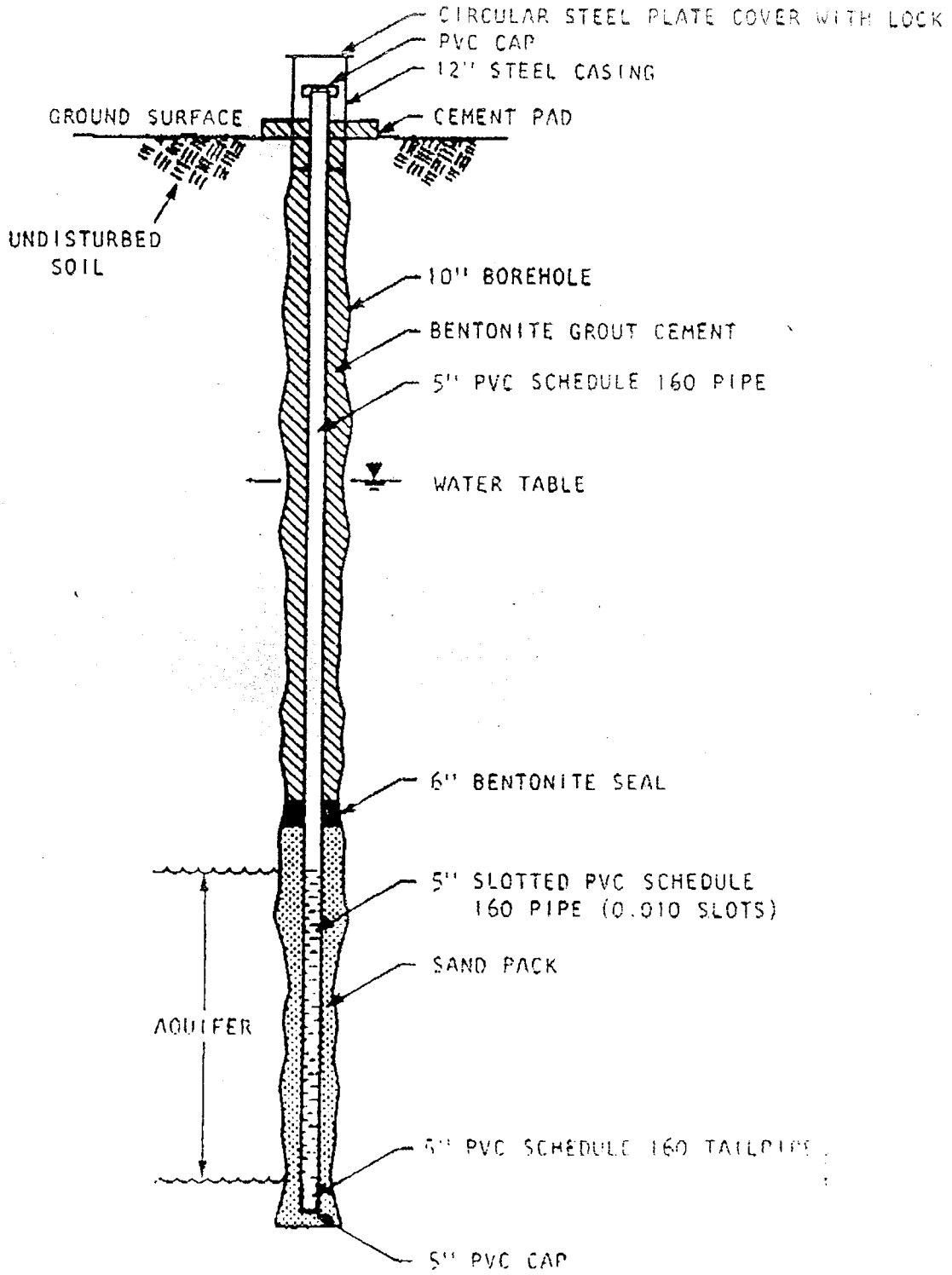


Source: Geosciences Consultants, Ltd. 1986

SEC DONOHUE
Environment & Infrastructure

FIGURE 3
GEOLOGIC CROSS SECTION

CINIZA REFINERY
GIANT REFINING COMPANY
GALLUP, NEW MEXICO

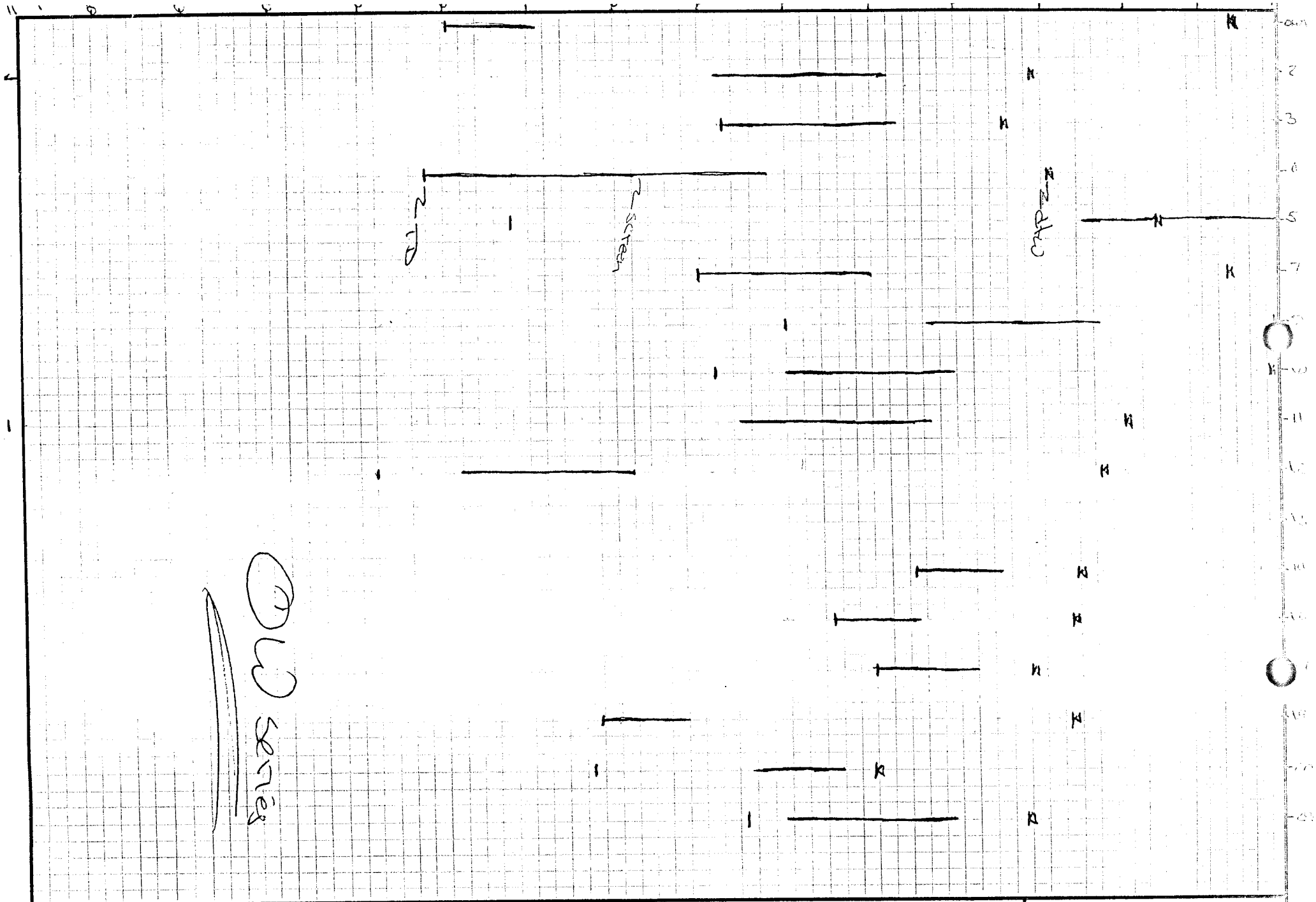


PREPARED FOR **Shell Oil Co.**

MONITORING WELL CONSTRUCTION DETAILS

BY **Dames & Moore** Plate 5

WELL I.D.	(YES/NO)	RATIONALE
MW-1	NO	Well logged, documented installation in the Sonsela.
MW-2	NO	Well logged, documented installation in the Sonsela.
MW-3	NO	Well logged, documented installation in the Sonsela.
MW-4	NO	Well logged, documented installation in the Sonsela.
MW-5	NO	Well logged, documented installation in the Sonsela.
SMW-1	**YES**	Well is no longer monitored. Connects fluvial sands with zone on top of Chinle shale.
SMW-2	**YES**	Well is no longer monitored. Connects fluvial sands with zone on top of Chinle shale.
SMW-3	**YES**	Connects fluvial sands with zone on top of Chinle shale.
SMW-4	**YES**	Connects fluvial sands with zone on top of Chinle shale.
SMW-5	**YES**	Connects fluvial sands with zone on top of Chinle shale.
SMW-6	**YES**	Produces no water.



Continental Environmental Services

TITLE from GTRF 06E
Geoscience Consultants Y86
Table 3-1

1 screen
2 dtw
— TD

OW series

SCALE:

DATE:

REVISION:

LITEP0011

Bill Crawford

review suitability of wells for sampling when perforations are not located in the aquifer

TABLE 2
SUMMARY OF WELL DATA

NAME	COORDINATES [1] NORTH	COORDINATES [1] WEST	GROUND [1] ELEVATION	TOTAL DEPTH (ft)	DATE COMPLETED	AQUIFER [3][4] INTERVAL (ft)	DEPTH OF [2] WATER TABLE (ft)	ELEVATION WATER TABLE (ft)
OW-1	3190	5150	6868	99.5	11/10/80	86-98	6.4	6861.6
OW-2	5985	5125	6871	163	10/31/80	143-162.5	31.2	6839.8
OW-3	5855	4220	6876	67	11/04/80	-	34.4	6841.6
OW-4	4960	3565	6881	102	11/07/80	100-102	29.2	6851.8
OW-5	4325	2970	6882	92	11/12/80	82-92	16.2	6865.8
OW-7	3875	3740	6872	70	11/18/80	-	6.7	6865.3
OW-9	2215	3445	6873	60	11/21/80	23-46	0.6	6872.4
OW-10	2710	3470	6872	68	11/25/80	34-63	1.7	6870.3
OW-11	1365	1455	6923	150	12/30/80	30-40	20.2	6902.8
OW-12	4490	1540	6939	145	12/15/80	104-143	47.3	6891.7
OW-13	4790	970	6914	108	12/10/80	70-104	23.2	6890.8
OW-14	4245	495	6923	45	12/17/80	39-45	25.8	6897.2
OW-16	3800	1365	6942	55	12/02/80	47-50	26.8	6915.2
OW-17	3885	1195	6941	50	1/03/81	40-42	31.8	6909.2
OW-18	3955	1020	6932	82	12/04/80	61-82	-	?
OW-20	2965	410	6961	83	12/19/80	70-82	50.2	6910.8
OW-24	5475	3875	6878	65	1/02/81	-	32.5	6845.5
				1,505				

[1] Estimated - survey required

[3] Depth underlined is maximum depth of well

[4] Does not include zones of sandy shale below

History of Drilling Water Well No. 2

North Well

Well No. 2 was spudded in on September 24, 1956, by a Franks 5,000 Rotary Rig owned by The Barron Drilling Company of Farmington, New Mexico. A 12-3/4" bit was used to a depth of 227 feet, the depth at which the alluvial fill was depleted and no further surface water was encountered. The hole was then reamed with a 20" reamer back to the 227 foot level and 16" O.D. casing was set and cemented by The Halliburton Company. It should be noted that the sand stratum in this well carried much deeper than in Well No. 1. A total of 200 sacks of cement was used to cement the 227 feet of surface casing.

The hole was reduced to a 15" hole, using a 12-3/4" bit after the cement had set for 24 hours. The drilling was moderately easy until a hard formation was hit at 312 feet and continued through the stratum at 390 feet. The conglomerate at 390 feet did not contain water although it had all the necessary characteristics. From 400 feet to 580 feet, the stratum was very hard and slow drilling - Mudstone, which contained considerable gypsum and gravel mineral particles. In this formation, there was some mud dilution as it was necessary to bring the mud weight up to 11.0 pounds. The second water pay was hit in the aquifer of sandstone from 580 feet to 620 feet. This was not, however, the Glorietta formation, but does produce some water pay. Drilling became very slow and one more aquifer was hit in the lower red member at 630 feet which produced a small quantity of water. The first indication of the Glorietta was struck at 725 feet but this aquifer was only 15 feet in thickness. However, it seemed to yield considerable water as mud dilution became a problem. It was now necessary to go to 12 pound mud to hold the drive from this level. The main Glorietta formation was struck at 792 feet and carried through to 885 feet.

At 950 feet, a crevice was struck and circulation was lost completely. It was necessary to add over 600 sacks of lost-circulation material before the crevice could be plugged. After circulation was restored, the crevice was cemented by The Halliburton Company from 945 feet to 965 feet and allowed to set for 24 hours. Drilling was then resumed and the hole drilled through the cement with no further trouble. The Yeso formation played out at 1,070 feet and the drilling stopped.

The 12" casing was run and, due to caving, was stuck at 965 feet, the point at which the crevice cementing was terminated. It was then necessary to clear the hole with a 9-3/4" bit and run a second string of pipe. The 8-7/8" O.D. casing was set at 950 feet to 1,075 feet and a cement plug at the bottom.

The well was shot perforated by Schlumberger, six (6) shots to the foot, alternating six shots of jets and six shots of bullets as indicated on the well graph. After perforating, the well flowed 270 gpm artesian and developed 140 pounds shut-in pressure.

Smith Machinery Company ran the pumping test with a 10" turbine set at 600 feet. The results of which indicated that the well will produce 370 gpm steady at 600 feet which is 100 to 150 feet above the main producing aquifer in this well. With a submersible pump set at 900 feet, this well should produce at least 500 gpm with no detrimental effects on the well.

J. E. Druley
January 14, 1957

LITHOLOGIC LOG

CINIZA REFINERY

Water Well No. 2

Material	Thickness (feet)	Depth (feet)
QUATERNARY:		
ALLUVIUM:		
Clay and Sand	74	74
Sand, pale-red (10R 4/2), very fine to medium grains; subangular to rounded; clear and frosted quartz, minor dark minerals and gypsum; weak calcareous cement	116	190
TRIASSIC:		
CHINLE FORMATION:		
Petrified Forest member:		
Mudstone, grayish-red (5R 4/2) mottled with white; minor dark minerals	10	200
Sandstone, grayish-red-purple (5RP 4/2) and white, very-fine to medium-grained; poorly sorted; subangular to rounded grains; frosted to clear quartz, minor to abundant dark minerals; calcareous; some mudstone, possibly caved from higher zone.	30	230
Siltstone, grayish-red-purple (5RP 4/2) and white; some clay and medium to coarse sand; minor dark minerals	30	260
Mudstone, grayish-purple (5RP 4/2) and white; some shaly partings; minor gypsum; noncalcareous Mudstone, white to light-gray (N7); some gypsum; non-calcareous Mudstone, grayish-red-purple (5RP 4/2) and light-gray (N7); minor gypsum; sandy in lower part, quartz and dark minerals; noncalcareous	50	310

	Thickness (feet)	Depth (feet)
Sandstone, grayish-red (5R 4/2), very-fine to very-coarse grained; gravel up to 6mm across; angular to subangular; pebbles are sandy siltstone; some clay; noncalcareous - small gravel scattered.	30	340
Siltstone, grayish-red (5R 4/2); fine to coarse sand and pebbles of sandstone and siltstone common; limonite and dark minerals rare; calcareous.		
Siltstone, grayish-red (5R 4/2) and white; very fine to fine frosted grains of quartz sand; dark minerals common, mica rare, secondary calcite abundant.		
Siltstone, grayish-red (5R 4/2); limonite and dark minerals rare; gypsum abundant; calcareous	50	390
Conglomerate, grayish-red (5R 4/2) and white, very-fine to fine pebbles of siltstone and sandstone, angular to subrounded; some calcareous material	10	400
Mudstone, grayish-red (5R 4/2); slightly shaly parting; minor limonite; noncalcareous; some gravel		
Mudstone, grayish-red (10R 4/2) to grayish-red-purple mottled with white; minor limonite; calcareous		
Mudstone, grayish-red (10R 4/2) to grayish-red-purple; minor limonite; calcareous; very-fine to fine gravel composed of grayish-red siltstone and sandstone common, more dark minerals in gravel than in 390-400 foot interval		
Mudstone, grayish-red (10R 4/2); gypsum common; calcareous		
Mudstone, grayish-red (10R 4/2) to dark-reddish-brown (10R 3/4); partly sandy; quartz and dark minerals rare, gypsum abundant; calcareous	178	578
Lower Red member:		
Sandstone, light-gray (N7) to grayish-red-purple (5RP 4/2), very-fine grained to silty; poorly sorted; abundant quartz and dark minerals, minor limonite; calcareous		
Sandstone, light-gray (N7) to grayish-purple (5RP 4/2), very-fine grained to coarse grained; poorly sorted; some very-fine gravel; grains are stained and frosted quartz, minor dark minerals, and siltstone; calcareous; gravel increases in lower part	43	621
Mudstone, grayish-red-purple (5RP 4/2) and white; minor gypsum; some clear to frosted quartz sands and minor dark minerals; calcareous		
Mudstone, pale-reddish-brown (10R 5/4) and white; gypsum common; some sand and gravel; calcareous	24	645
Sandstone, light-brownish-gray (5YR 6/1) to pale-reddish-brown (10R 5/4), very-fine to medium-grained; poorly sorted; stained and frosted quartz abundant, dark minerals common, limonite rare; noncalcareous	26	671

	Thickness (feet)	Depth (feet)
Siltstone, pale-red (10R 6/2), well sorted; minor sand; calcareous	43	714
Shinarump member:		
Mudstone, grayish-red (10R 4/2) and mottled white; angular to subangular sand and gravel common; grains are chiefly light-gray sandstone, greenish-gray siltstone, and grayish-red-purple mudstone, minor limestone	5	719
Siltstone, pale-red (10R 6/2), poorly sorted; stained quartz sand common, minor dark minerals and limonite; calcareous	5	724
Moenkopi formation:		
Sandstone, pale-red (10R 6/2) to yellowish-gray (5Y 8/1), medium to very-fine grained and silty; poorly sorted; chiefly clear quartz, minor stained quartz and dark minerals, mica rare; calcareous; some limestone and mudstone pebbles. Sandstone, silty, grayish-orange-pink (5YR 7/2), fine grained; well sorted; clear quartz, minor dark minerals and limonite; weak calcareous cement	15	739
Siltstone, grayish-red-purple (5RP 6/2); well sorted; minor dark minerals; strongly calcareous	11	750
Mudstone, grayish-red-purple (5RP 6/2), grayish-red (10R 4/2), and light-gray (N7); minor dark minerals and limonite; noncalcareous Mudstone, light-gray (N7) to grayish-red-purple (5RP 4/2), light color caused by leaching; some sand and very-fine to fine gravel; curved partings prominent; dark minerals common; noncalcareous	32	782
Conglomerate, various colors, fine to medium grained; angular to subrounded; pebbles are chiefly medium-dark-gray (N4) cherty limestone	10	792
PERMIAN:		
GLORIETTA FORMATION:		
Sandstone, grayish-orange-pink (5YR 7/2), very-fine to fine grained; medium sorting; subrounded to rounded; clear quartz, minor dark minerals and limonite; strong calcareous cement Sandstone, grayish-orange-pink (10R 8/2_ and yellowish-gray (5Y 8/1), very-fine to fine grained; some silt; minor dark minerals, limonite common, highly calcareous	93	885

	Thickness (feet)	Depth (feet)
YESO FORMATION:		
Upper member:		
Mudstone, grayish-red (10R 4/2); grayish-red-purple (5RP 4/2), and light-gray (N7); dark minerals rare, minor limonite; partly calcareous	10	895
Sandstone, grayish-orange-pink (5YR 7/2) to pale-red (10R 6/2), very-fine to fine grained; subrounded to rounded; minor dark minerals and limonite; calcareous Sandstone, very-pale-orange (10YR 8/2), very-fine grained and silty; sorting poor to medium; clear quartz; silica cement; dark minerals and limonite rare; noncalcareous	55	950
Crevice	10	960
Sandstone, moderate-orange-pink (5YR 8/4), very-fine to fine grained and silty; poorly sorted; clear to frosted quartz, silica cement; dark minerals and limonite rare; calcareous Sandstone, pale-red (10R 6/2) to pale-brown (5YR 5/2), very-fine to fine grained and silty; clear and stained quartz, dark minerals and limonite common; calcareous Sandstone, white to pinkish-gray (5YR 8/1), very-fine grained; subrounded; sorting good; clear quartz, silica cement, dark minerals and limonite rare; noncalcareous	80	1,040
Siltstone, light-brown (5YR 6/4) to moderate-brown (5YR 4/4); has appearance of soil; some quartz sand and bands of white calcareous material; highly calcareous Siltstone, grayish-red (5R 4/2) and white; grains of frosted quartz and dark minerals rare; medium calcareous; some light-olive-gray (5Y 6/1), finely crystalline limestone and some dark minerals and mica in lower part; noncalcareous	10	1,050
Sandstone, light-olive-gray (5Y 6/1) and yellowish-gray very-fine grained and silty; some medium quartz grains; poorly sorted; noncalcareous; some greenish-gray (5GY 6/1) calcareous mudstone	20	1,070
Mudstone, grayish-red (5R 4/2); fine grained quartz and dark minerals common; calcareous	5	1,075

J.E.D.
1/14/57

EL PASO NATURAL GAS PRODUCTS COMPANY

Water Analysis

Water Well No. 2 — Ciniza Refinery

Sampled: November 15, 1956 by Jim Druley

Total Hardness as $CaCO_3$	625
Calcium as $CaCO_3$	460
Magnesium as $CaCO_3$	155
P - Alkalinity	0
Total Alkalinity as $CaCO_3$	168
Chlorides as Cl	16
Sulfate as SO_4	440
Silica as SiO_2	6
Total Iron as Fe	0.9
Color No.	N.L.
pH	7.2

All results expressed as parts per million.

J.E.D.
1/14/57

TEST DATA

Water Well No. 2

Test Pump: 10" Peerless, 12 Stages, Set at 600 Feet

Pumping Level - Feet	GPM	Remarks
285	220	Muddy - 1 Hour
365	260	Pumped - 1 Hour
465	290	Pumped - 1 Hour
510	330	Pumped - 1 Hour
600	370	Pumped - 4 Days

Note: At a pumping rate of 370 GPM at 600 feet, the pumping level raised to 550 feet after four days pumping. The well recovered it's artesian flow of 270 GPM in 14 minutes after pump was shut off. Shut-in pressure on this well is 140 psig, the same as Well No. 1.

J.E.D.
1/14/57

Post-it® Fax Note 7671	Date 10/8/03	# of pages ▸ 21
To Diane Barnes	From D Kilcarni	
Co./Dept.	Co.	
Phone #	Phone #	
Fax # 505-326-3747	Fax #	

January 27, 2000

PRECISION ENGINEERING INC.

Ciniza Refinery Water Well #4

--

Gallup, New Mexico

File No.: 99-058

Submitted To:

Mr. Eddie Stalcup
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico
87301

History of Drilling Water Well #4
Ciniza Refining Company

The well was spudded in on November 12, 1999 with a Gardner-Denver 2000, Rig #10, owned and operated by United Drilling Inc. of Roswell, NM. The pilot hole was drilled using a 7 7/8" J33 (carbide button) bit to depth of 175' to a sandstone bed competent to anchor the surface casing below the alluvium and shallow water producing zones. The Sonsela member of the Chinle Formation was encountered at a depth of 15' to 85' which produced some water (not measured) that thinned the drilling mud.

The hole was reamed to 32" with three passes. The first was a 17 1/2" mill tooth bit and the hole extended an additional five feet to allow for the length of the reamer and pilot bit. The mill tooth seemed to drilled faster than the button bit, especially in the mudstone. The 17 1/2" bit was used as the pilot for the 24" reamer and also on the 32" reamer. Both reamers had open ports, not jets, at the cones, which did not keep the mudstone from balling up on the cones and slowed drilling.

Twenty four inch surface casing was run to a depth of 175'. The casing was a welded, flush joint. Concern was expressed by the drilling contractor that the casing might collapse if cemented in one stage so it was decided to cement in two stages. Cement was tremmied from bottom to top by the drilling contractor. Two yards of concrete were required to bring the cement to surface after shrink back.

A 9 7/8" mill tooth bit was used to extend the pilot hole from below the surface casing. The mill tooth penetrated the mudstones better than the previously used button bit.

Sloughing of the mudstones in the Chinle Formation mixed with cuttings throughout the hole masking the strata being drilled. After electric/nuclear logs were run, the strata could better be determined.

Formation water began thinning the drilling mud at 570', interbedded sandstone and mudstone were encountered at this depth. An increase in pit volume was apparent at 620'. Drilling had stopped at 650' for the night and was flowing 13.5 gallons per minute the next morning. The drilling contractor had been working daylight tour only but began 24 hour operations when the well started flowing. The viscosity was increased from 45 to 55 and the weight increased from 9.9 to 11.5 lbs./gal. This viscosity and weight stabilized the water flow but not the sloughing of the Chinle formation. Drilling rates averaged 5 minutes per foot.

Hard sandstone was encountered at 655'. The bit seemed to be locked up at 735' but when pulled for inspection it was undergauge and replaced. A 9 7/8" button bit was installed and reamed 150' back to bottom. After 240' of dense sandstone drilling was stopped and the hole was logged. Using the E-logs and neutron-density logs the formations were identified and it was decided to continue drilling.

A 7 7/8" inch button bit (original pilot bit) was used and more collars were added to increase weight. Until this point the hole had remained almost vertical but started deviating dramatically with the extra weight.

Limestone was encountered at 1060' which is in the Yeso Formation and drilling was stopped at 1076'.

Reaming for the production casing began from the bottom of the surface casing to 775' with a 17 1/2" bit. A cone from the 17 1/2" bit was lost and was washed to the bottom with the 7 7/8" bit. The reaming was accomplished using 9 lbs./gal. mud to make up volume and allowed to thin as the well began to flow.

A 13 3/8" threaded casing was to be run from surface to 750' but because of deviation the casing could only be run to 733'. The casing was cemented from the bottom to top by BJ Well Services from Farmington, NM.

The hole was reamed with a 12 1/2" bit from 775 to 1075' and the well was completed open hole below 733'.

Initial flow rate after drilling was 120 gallons per minute with dissolved solids at 1300 ppm.

To increase production the lower Chinle Formation was perforated. The casing was perforated by Schlumberger from 560'-715' at eight shots per foot using tubing guns with jet shot.

The initial flow rate after perforation was approximately 150 gallons per minute and dissolved solids at 600 ppm.

CINIZA WATER WELL #4
(Replacement of water well #1)

UNITED DRILLING CO. Roswell, NM
Rig #10, Gardner-Denver 2000
Measurements from kelly bushing 6' above ground
Bit 7 7/8" J33 button bit.

11-12-99
Alluvium

0-5 Sand, fine to medium, red-brown, sub angular, chert, quartz-frosted; some petrified wood pieces, some clay.

5-10 Gravel, sandy, coarse, sub-angular, sandstone, quartz, chert.

10-15 Clay, red-brown, slightly sandy.

Chinle Formation
Petrified Forest Member

Sonsela Sandstone Bed (12')

15-20 Sandstone, fine to medium, quartz, chert.

20-25 Sandstone, fine, mainly quartz, some frosting, sub-rounded to rounded, chert.

25-30 Sandstone, fine, well sorted, calcite cemented, sub-rounded, typically frosted ~I% dark lithics, cuttings are coarse sand size. Hard drilling.

30-35 Same as above.
33-34' mudstone stringer.

11-13-99

35-40 Sandstone, very fine, well sorted, round to sub-rounded, some frosting, dominately quartz, <10% other, <1% dark lithics. Easier drilling

40-45 Same as above, ~1% dark lithics, some shaly stringers.

45-50 Same as above, dense again at 50'.

50-55 Same as above with shaly stringers throughout, sandstone is dense, chert/quartz fine grains, quartz rounded, frosted 50%; shale is dark red to purple; chert appears to be associated with the shale, shaly @ 54'.

55-60 Shale/mudstone purple with light blue to white chert.

60-65 Shale/mudstone purple to dark red, some grey pieces, dense, shale/mudstone interbedded ~1'.
Drilling Rate: 2 min/ft.

65-70 Mudstone/shale interbedded, some chert/silicious chips, some blue-green shale, white appears to be gypsum, very soft/friable when wet, suspect high montmorillonite content.

70-75 Sandstone, fine, well sorted, 1% dark lithics, few limestone pieces, silica cemented, hard drilling.

75-80 Sandstone, quartz, well sorted, very fine, silica cemented hard (mature); some thin shale interbeds (dark purple), hard, fissile, softens in water (montmorillonite?); some black shards of silica rock with copper colored veins (phlogopite).

80-85 Sandstone, white well sorted, very fine, rounded to well rounded, weaker than above.

85 **Bottom of Sonsela Sandstone Bed**

85-90 Mudstone-shaly (fissile) soft, purple to white or light grey, fissile, feels sticky (montmorillonite), some quartz grains, relatively easy drilling.

90-95 Same as above with 10% white pieces, purple primary, very sticky and soft when wet.

95-100 Same as above.

100-105 Same as above some blue-green interbedded with purple layers.

105-110 Same as above.

110-115 Same as above.

115-120 Same as above, slightly more light green to white mudstone.

Deviation survey @ 100' = 1/2 degree.

120-125 Same as above.

125-130 Same as above.

130-135 Same as above.

135-140 Same as above.

140-145 Same as above, slightly denser drilling, slightly brighter red-purple.

145-150 Same as above, softer drilling.

150-155 Same as above, firmer drilling ~1ft/min.

155-160 Same as above.

160-165 Same as above.

165-170 Same as above.

170-175 Same as above. @172 hard drilling. Very fine sandstone, some chert interbedded with sandstone. Drilling rates as follows: 172-173: 6 min; 173-174: 3 min; 174-175: 12 min. Circulate to run casing.

Terminated pilot hole to ream for surface casing.

Went from 7 7/8" bit to 17 1/2" bit.

11-14-99
Began reaming 17 1/2" hole, slow drilling in sandstone, 80' drilled.

11-15-99
Deviation survey @ 90' = 1/4 degree. (5.25"/100')

Sonsela making some water and diluting mud, mixed mud.

175-180 Same as above, easier drilling with the mill tooth bit. Sandstone, very fine, super mature, white, well sorted silica cement, interbedded with mudstone.

Increased depth of hole to allow for the larger reamers to reach the 175' depth.

Deviation survey @ 160' = 1/8 degree. (2"/100')

11-16-99
Start drilling 24" hole.

11-17-99
Drill 24" hole to 135' progress slow. Pull bit to inspect, cones are clogged with clay.

11-18-99
Mix mud, clean off pilot bit and reaming bit, finish reaming 24" hole.

11-19-99

Begin Reaming 32". Using 32" reamer with 17 1/2" pilot. Cannot get 17 1/2" plus 24" and 32" reamer in the hole since substructure is only 6 feet high.
Thirty two inch bit may "waller" unless lightly loaded.

11-20-99
Ream 32" hole.

11-21-99
Ream 32" hole.

11-22-99
Finish reaming 32" hole, condition and circulate hole. Lay down pipe and collars and reamer, run tremmie pipe, remove rotary table. 1:30-4:00pm wait on orders. Giant agreed to allow structural welders to place surface casing-will not allow on production casing. 4:00-7:30 pm run 175' of 24" casing and cutoff.

11-23-99
Replace rotary table, adjust tremmie, place first 8 yards of cement on outside of casing.

11-24-99
Place second 8 yards of cement.

11-25-99 thru 11-28-99
Shutdown for Thanksgiving.

11-29-99
Place 2 yards concrete at top of casing (15'). Mixed mud began drilling 9 7/8" SDC mill tooth bit (Smith) 1:30 pm.

180-185 Siltstone, hard, white/light tan, slightly cemented, some carbonate pieces (appears to be cement); some mudstone.

185-190 Mudstone, (claystone) dense, grey-blue to light brown, some very thin siltstone lenses.

190-195 Same as above.

195-200 Same as above.

200-205 Mudstone, dense, blue-grey, more siltstone than above, some chert/quartz grains, amber to yellow-brown in the (claystone, siltstone) matrix.

205-210 Same as above.
Drilling Rate: 2.5 min/ft.

210-215 Same as above, better cutting returns.

215-220 Sandstone, 50%, red-purple, very fine, well sorted, stained yellow, effervesces with HCl; mudstone, 50%, red-purple and white (soft), chert.

220-225 Mudstone, red-purple, white (soft), no sandstone, clear quartz with impurities (black specs).

225-230 Same as above.
Drilling Rate: 225-235 1ft/min.

230-235 Same as above, amber quartz grains.

235-240 Same as above, 2% sandstone, clear and stained (yellow to red) effervesces.

240-245 Same as above, 1% stained sandstone, chert.

245-250 Same as above, no sandstone, plus chert.

250-255 Same as above, 1% clear sandstone, chert.

255-260 Same as above.

260-265 Mudstone, red-purple, 2% blue-grey, no sandstone or chert.

265-270 Same as above, 10% blue-grey.

270-275 Same as above, 30% blue-grey.

275-280 Same as above.

Deviation survey @ 248' = 1/4 degree.

Stuck in hole at 275' cuttings fell back in and stuck bit while running deviation survey. Circulated and freed pipe.

11-30-99
Mud flowing from casing approximately 1 gpm.
Viscosity 36 seconds.

280-285 Mudstone, Same as above.

285-290 Sandstone/siltstone interbedded. Sandstone is partially silica cemented, some carbonate cemented (50%/50%), multicolored silica particles in sandstone; siltstone is red-purple, weak (easily broken). Sandstone 60% of section.

290-295 Sandstone/siltstone, with interbedded dark lithic particles (50%), 40% sandstone, siltstone is more competent (dense). Drilling Rate: 2 ft/min.

295-300 Same as above, slightly more siltstone, 70%, red-purple.

300-305 Sandstone, (70%) white, little staining, carbonate cement; some mudstone, 80% red-purple, 20% blue-green. Drilling Rate: 2 min/ft

305-310 Mudstone, red-purple, some minor sandstone pieces (likely washed up), some limonite staining. Drilling Rate: 2 min/ft.

310-315 Same as above.

315-320 Same as above.

320-325 Same as above, 10% sandstone

Viscosity 46 seconds.

325-330 Mudstone, red-purple 90%, grey 5%, sandstone 5%.

330-335 Same as above.

335-340 Same as above, no sandstone.

340-345 Same as above.

345-350 Same as above. Drilling Rate: 1 min/ft.

350-355 Same as above.

Viscosity 45 seconds

355-360 Same as above. Drilling Rate: 3 min/ft.

360-365 Same as above.

365-370 Same as above.

370-375 Same as above, purple mudstone, firmer. Drilling Rate: 4 ft/min.

Deviation survey @ 248' = 1/4 degree.

375-380 Same as above. Viscosity 46 seconds;

380-385 Same as above.

385-390 Same as above. Drilling Rate: 2 min/ft.

390-395 Same as above.

395-400 Same as above but brighter red, some very thin gypsum plates.

400-405 Same as above, firmer, especially the blue-grey material
Drilling Rate: 4 min/ft.

405-410 Mudstone, brown-red, firmer.

Viscosity: 46 seconds; Weight: 8.9 lbs/gal.

410-415 Same as above.

415-420 Same as above.

420-425 Same as above.

425-430 Same as above. Drilling Rate: 3-4 min/ft.

430-435 Same as above.

435-440 Same as above.

440-445 Same as above. Drilling Rate: 1-2 min/ft.

Viscosity: 44 seconds; Weight: 9.9 lbs/gal.

445-450 Same as above.

450-455 Same as above.

455-460 Same as above. Dense.

12-1-99

Well flowing 1 gpm.
Viscosity: 46 seconds; Weight: 9.1 lbs/gal.

460-465 Same as above.

465-470 Same as above.

Deviation survey @ 435' = 3/8 degree.

470-475 Same as above.

475-480 Same as above (mainly claystone).

Viscosity: 43 seconds; Weight: 9.3 lbs/gal.

480-485 Same as above, slightly more red, some blue-grey mottling ~15%. Pits gaining volume.

485-490 Mudstone, red-brown, red-purple, 5-10% grey mottling; siltstone, yellow-red, brown, slightly calcareous.

490-495 Same as above.

495-500 Same as above.

500-505 Same as above.

505-510 Same as above with ~2% sandstone white and dark lithics (50%-50%).

510-515 Same as above.

515-520 Same as above.

520-525 Same as above.

Viscosity: 58 seconds; Weight: 9.9 lbs/gal. Mixed 10 sacks gel.

525-530 Same as above with some siltstone; ~10% sandstone, white, hard, calcareous cement, quartz (50%) dark lithics (50%), very fine grained.

530-535 Same as above with ~1% sandstone.

535-540 Same as above.

Viscosity: 48 seconds; Weight: 9.9 lbs/gal.
Drilling Rate: 2 min/ft.

540-545 Same as above.

Blue Water Creek and Shinarump Undifferentiated

545-550 Same as above, 50% grey, 50% red, soft to firm .

Drilling Rate: 4 min/ft.

550-555 Same as above with some gypsum.

555-560 Same as above.

Drilling Rate: 5 min/ft from 558-573. (At 573' increased rotation speed to try to increase drill rate)

560-565 Same as above some firmer grey.

565-570 Same as above, 60% red, 40% grey

570-575 Same as above, 70% red, 30% grey.

575-580 Same as above, 50% grey, 50% red, a few sandstones grains.

580-585 Same as above.

585-590 Same as above, ~2% sandstone, quartz with silica cement.

590-595 Same as above some limonite.

Drilling Rate: 5 min/ft.

595-600 Same as above, a little siltier, 5% sandstone, very fine to fine, some limonite staining.

Viscosity: 43 seconds; Weight: 9.9 lbs/gal.

600-605 Same as above, silty mudstone, white and yellow stained, sandstone 10%.

605-610 Same as above with red sandstone, 15%.

610-615 Same as above, 5% sandstone.

615-620 Same as above, 5% sandstone. Less limonite.

Viscosity: 39 seconds; Weight: 9.9 lbs/gal.

620-625 Same as above, 3% sandstone.

Pit volume appears to have increased since morning.

625-630 Same as above.

630-635 Same as above.

Mixed mud. Viscosity: 57 seconds; Weight: 10.0 lbs/gal.
Larger and more cuttings. 30% sandstone (origin?)
Lowered pit approximately 1 foot at 2:30 pm. Full again at 4:30 pm.

635-640 Silty mudstone, red, firm to soft; sandstone, red, soft, very fine, slightly calcareous cement.

640-645 Sandstone, red-purple, some white, some mudstone, primarily siltstone, sandstone is typically dark colored minerals, very fine but some larger particles, rounded, some limonite.
Drilling Rate: 5 min/ft.

Viscosity: 56 seconds; Weight: 10.4 lbs/gal.

645-650 Sandstone, clean, well rounded, quartz and dark lithics, silica cement, some limonite stained.

Viscosity: 55 seconds; Weight: 10.6 lbs/gal.

12/3/99

Well flowing-estimate 10 gpm (end of pipe not reachable)

12/4/99
Flowing clear - measured 13 1/2 gpm

Deviation survey @623' = 7/16 degrees.

Drilling Rate: 2 min/ft.

650-655 Sandstone, red; mudstone, grey, most likely cave in.

Viscosity: 55 seconds; Weight: 11.5 lbs/gal.

655-660 Same as above, 5% light grey sandstone, well rounded, quartz, silica cement.

660-665 Sandstone, red, very fine, 5% light grey sandstone, red and white chert, grey mudstone, some gypsum.

665-670 Sandstone, red, 50%, some light grey sandstone, some limonite; grey, mudstone.

670-675 Same as above. Red sandstone consists of quartz, sub-rounded, red stained, very fine; grey mudstone. Drilling Rate: 4 min/ft.

675-680 Mudstone, grey; sandstone, light red, soft; siltstone, firm. Small piece of well rounded gravel (silica), 20% purple silty mudstone.

680-685 Sandstone, light red, soft, 50%; light grey sandstone, firm, 20%; 10% of sandstone is strongly calcareous; purple silty mudstone.
Drilling Rate: 4-5 min/ft.

Viscosity: 50 seconds; Weight: 11.5 lbs/gal.

685-690 Sandstone 60% light red; 20% purple siltstone; 20% grey mudstone, some dark grains and is firmer.

690-695 Sandstone, 80%; light red, soft, very fine, well sorted, stained quartz, and light grey, finer, lithics in well sorted quartz, calcareous; 20% silty, grey mudstone; some limestone.

695-700 Light red, well sorted, soft, calcareous sandstone; medium grey mudstone, silty, some limonite.
Drilling Rate: 10 min/ft.

700-705 Sandstone, red-brown, firm, calcareous when crushed, very fine, quartz with red stain, pale red, silty to very fine sandstone, hard, quartz and dark minerals, 80%; mudstone, grey and purple mudstone (20%).

705-710 Sandstone, 60% light red; 20% red mudstone; 10% light grey sandstone with limonite; 10% sandstone with angular red mudstone clasts to very fine sand, calcareous when crushed, hard.
Drilling Rate: 10 min/ft

710-715 Same as above.

Pump not pumping well. Viscosity 78. Half of volume as before.

715-720 Same as above with more grey and red mottled mudstone, and gypsum.

Moenkopi Formation (820')

720-725 Sandstone, pale red, 60%, effervesces when broken; mudstone, grey, 20%, 5% mottled; 5% limestone.
Drilling Rate: 10 min/ft, Viscosity 90, Weight 11.5

725-730 Same as above.

Trip bit; locked up

12/5/99
Bit O.K. - 2 jets plugged - clean bit and return trip (did not change bit). Bit in excellent condition otherwise.

Viscosity: 74 seconds; Weight: 11.5 lbs/gal.

Circulate, pebbly chert and other silica rocks, sandstone - pale red, fine not calcareous, quartz grains in pale red matrix, some (approximately 10%) dark lithic rock grains also - also medium grey mudstone (15%) rounded, easily broken by hand. Very slow drilling. Still poor pumping. 730-731 Calcite infilling (1/4") 6:50am - Shut down - no progress (3/4') since 4:40am. Trip bit still locking up. Bit worn, replaced with carbide button, (Security).

12/6/99
Work on pumps. Trip back in hole. Ream 150 feet with new button fit - old button bit was undergauge.
6:15pm - Drilling Rate: 12 min/ft

730-735 Sandstone, pale red to light red, 70%, well sorted quartz, slight staining, red sandstone; 30% grey mudstone, dark purple mudstone.

735-740 Same as above. 10% white sandstone, same characteristics as the pale red - some dark chert, some white mudstone.
Drilling Rate: 20 min/ft.

Viscosity: 50 seconds; Weight: 11.5 lbs/gal.

740-745 Same as above. 10% white mudstone mottled with purple; grainy (gypsum?).
Drilling Rate: 15 min/ft,

Viscosity: 40 seconds; Weight: 11.4 lbs/gal.

745-750 Same as above. Some cherty limestone (?) fizzles some.

Deviation survey @ = 7/16 degrees.

Viscosity: 46 seconds; Weight: 11.5 lbs/gal.

12/6/99
11:50pm - Swivel leaking
Viscosity: 46 seconds; Weight: 11.4 lbs/gal.

750-755 Sandstone, 50% light red, 40% pale red, to 10% white, very fine, well sorted, clear quartz, very fine dark lithics, non-calcareous, angular to sub-angular; 1-2% overall limestone, grey-green to grey. 1% dark red mudstone.
Drilling Rate: 8 - 10 min/ft

755-760 Same as above, effervesces when particles are crushed, mudstone approximately 15%, hard drilling.
Drilling Rate: 8-10 min/ft.

760-765 Same as above, pale red sandstone, frosted, 60%, sandstone is non-calcareous; approximately 10% mudstone, some grey claystone approximately 2%.
Drilling Rate: 12-13 min/ft

Viscosity: 66 seconds; Weight: 11.6 lbs/gal.

765-770 Same as above.

770-775 Same as above, approximately 40% mudstone - dark red/purple with minor grey to light blue white, sandstone still very light red to tan, angular to sub-angular, quartz frosted, well sorted, some red staining gives overall light red color, non-calcareous, red staining very slightly calcareous.

775-780 Same as above. Minor limestone pieces are angular - sub-angular, well sorted quartz, non-calcareous/mudstone is calcareous.

Drilling Rate: 9-10 min/ft. Bit bounced significantly in this interval.

780-785 Same as above. Some clear, some frosted, mainly angular, very fine; approximately 30% purple, 15% grey - blue mudstone.
Drilling Rate: 7-10 min/ft.

Viscosity: 50 seconds; Weight: 11.6 lbs/gal.

785-790 Sandstone, 50% white, quartz, well sorted, very fine, angular to sub-angular dark lithic rock, rare mica, very weakly calcareous; approximately 5% mudstone, primarily blue grey, some brown-red/purple,
Drilling Rate:7-10 min/ft.

790-795 Same as above.
Drilling Rate:6-7 min/ft.

Viscosity: 52 seconds; Weight: 11.8 lbs/gal.

795-800 Same as above.

800-805 Same as above, Drilling Rate:8-10 min/ft.

805-810 Same as above, Drilling Rate:8 min/ft.

810-815 Same as above, Drilling Rate:6-7 min/ft.

Viscosity: 51 seconds; Weight: 11.8 lbs/gal.

815-820 Same as above, Drilling Rate:8-10 min/ft.

820-825 Same as above, Drilling Rate:12 min/ft.

825-830 Same as above.

830-835 Same as above.

835-840 Same as above, some less red,
Drilling Rate:11 min/ft.

Viscosity: 52 seconds; Weight: 11.9 lbs/gal.

840-845 Same as above, more tan, less pale red, 80% tan 20% pale red.
Drilling Rate: 20 min/ft.

Glorietta Formation (846')

845-850 Same as above.
Drilling Rate:5-8 min/ft.

Viscosity: 51 seconds; Weight: 11.9 lbs/gal.

850-855 Same as above, slightly yellow tan-yellow a little easier to break.

855-860 Same as above, only 2% lithics in sandstone.
Drilling Rate:8 min/ft.

Viscosity: 52 seconds; Weight: 11.9 lbs/gal.

860-865 Same as above, less yellow.
Drilling Rate: 10 min/ft.

865-870 Same as above, tan.

Viscosity: 51 seconds; Weight: 11.9 lbs/gal.

870-875 Same as above, some yellow mostly tan, one fracture face with red staining.

Table has been popping some, approximately 30 feet.

875-880 Same as above.
Drilling Rate:10 min/ft.

Viscosity: 55 seconds; Weight: 11.9 lbs/gal.

<u>12/7/99</u>

880-885 Same as above.

885-890 Same sandstone, shows more mudstone (red-purple) than above approximately 30%, many sandstone pieces show fracture-dendritic psilomelane, hematite coating on faces, non-calcareous.
Drilling Rate: 20 min/ft.

890-895 Same as above, non-calcareous, angular, clear but some frosted, very fine approximately 15-20% mudstone.

Viscosity: 54 seconds; Weight: 11.9 lbs/gal.

895-900 Mudstone plus sandstone interbeds, sandstone as above, mudstone (887-993), mudstone dark red-purple, non-calcareous, mudstone/sandstone approximately 60/40%, suspect rate in mudstone approximately 40 min/ft, sandstone 6-10 min/ft.

Viscosity: 56 seconds; Weight: 12 lbs/gal.

900-905 Sandstone, same sandstone as above, approximately 20% mudstone, slow drilling appears to be in mudstone.
Drilling Rate: 9-12 min/ft.

Viscosity: 57 seconds; Weight: 12 lbs/gal.

905-910 Same as above.

12/8/99 Drilling 1:05 pm
7 7/8 bit. 15,000 lbs on bit
Drilling Rate:5 min/ft.
Viscosity: 46 seconds; Weight: 11.8 lbs/gal.

910-915 Same sandstone plus slough from trip, mostly red purple mudstone, wall cake balls.

915-920 Sandstone, white as above plus red purple mudstone 50/50%, as above, one piece of light red very, very fine sandstone, non-calcareous, one piece of greenish-grey mudstone, 10% grey mudstone.
Drilling Rate:8-10 min/ft.

920-925 Sandstone-red purple mudstone-grey mudstone (softer than red-purple) 40/30/30%.

925-930 Same as above, sandstone plus red-purple mudstone plus grey mudstone.
Drilling Rate: 12 min/ft.

Viscosity: 48 seconds; Weight: 11.8 lbs/gal.

935-940 Sandstone, white, very few lithics, sub-angular, well sorted, 40%, slightly calcareous when crushed; red brown mudstone 40%; grey plus purple mudstone, 20% mottled together.
Drilling Rate:10 min/ft.

Viscosity: 49 seconds; Weight: 11.9 lbs/gal.

940-945 Sandstone, white to tan (as above); purple plus grey mudstone, soft red brown mudstone, blocky, firmer.

945-950 Same as above.

Yeso Formation (948')
950-955 Red brown mudstone 60% (grey mottled modules); 35% sandstone, very slightly calcareous; 5% greenish grey mudstone.

955-960 Mudstone, red brown, blocky in appearance, 30%; mudstone, red purple, 30%; sandstone, tan white, slightly calcareous, 30%; greenish grey mudstone with quartz sand, lithics were green modules 8%; red sandstone with quartz lithics, banded as to silt and sand, a few grey mud balls.
Viscosity: 48 seconds; Weight: 12 lbs/gal.

Deviation survey @ 928' = 1 1/4 degrees

960-965 Sandstone, light grey (same as above); 40%-mudstone red brown 30%; red purple 5%; light grey mudstone, medium soft 20%; grey mud balls 5%.
Drilling Rate: 10-12 min/ft.

965-970 Sandstone, light grey to tan 60%; red brown mudstone 35%; red purple 5%.

<u>12/9/99 1:20 am</u>

970-975 Sandstone, strongly calcareous when broken, light grey, very fine, angular to sub-angular, quartz, flakes crumble easily, some red brown mudstone washes up with sandstone-suspect washout from above.
Drilling Rate:12 min/ft.

Viscosity: 46 seconds; Weight: 12 lbs/gal.

975-980 Same as above.

980-985 Sandstone as above; red brown mudstone, some medium grey mudstone 60/40%, sandstone/mudstone approximately 50/50%, mudstone/sandstone is likely interbedded although some washing may be occuring-caliper log will tell
Drilling Rate: 9-10 min/ft.

Viscosity: 51 seconds; Weight: 12 lbs/gal.

985-990 Mudstone, red brown 90%, grey/purple 10%, minor light blue grey, some mottled red brown/blue grey, crumbly, few pieces of sandstone but rare.
Drilling Rate:7-10 min/ft.

990-995 Sandstone/mudstone 50/50%, sandstone is very fine, weakly calcareous, light blue grey-very light red, quartz, rounded to sub-rounded, slightly frosted to clear; mudstone 50/50%, red brown-light blue grey-medium grey, some mudstone washing from above.
Drilling Rate:5-6 min/ft.

Viscosity: 52 seconds; Weight: 12.1 lbs/gal.

995-1000 Same as above, some chert.
Drilling Rate: 5-6 min/ft.

Viscosity: 55 seconds; Weight: 12.2 lbs/gal.

1000-1005 Same as above, slightly more mudstone-approximately 60%, grey mudstone is slightly calcareous.

1005-1010 Same as above, some chert, sandstone is calcareous when broken.
Drilling Rate:7-10 min/ft.

Viscosity: 7-10 seconds; Weight: 12.2 lbs/gal.

1010-1015 Same as above, mudstone/sandstone approximately 70/30%; mudstone red brown/blue grey approximately 80/20%.

1015-1020 Sandstone, very slightly calcareous, sub-rounded, generally clear, very fine light grey-white, crumbles easily; approximately 25% shale that appears to have sloughed from walls above (large pieces), red brown and mottled, medium to light brown grey.

1020-1025 Same as above.

1025-1030 Same as above, some blue green mudstone pieces, some (minor) dark red sandstone, very fine non-calcareous, some clay balls with sample, added water and cleaned pit.
Drilling Rate:7-9 min/ft.

Viscosity: 43 seconds; Weight: 11.8 lbs/gal.

1030-1035 Same as above.

1035-1040 Same as above.

1040-1045 Same as above, 40% sandstone.

1045-1050 Same as above, 70% sandstone, sandstone appears a little coarser.

1050-1055 Same as above, 70% sandstone, some sandstones have slightly larger quartz grains, sub-rounded, clear.
Drilling Rate: 10 min/ft.
Viscosity: 56 seconds; Weight: 11.6 lbs/gal.

1055-1060 Same as above, 60% sandstone, dark grey, hard limestone 20%.

Rotary table very noisy at 1057'.

1060-1065 Limestone, hard, dark grey to grey 60/30%, red purple mudstone 10%, sandstone grey, limestones may be partially dolomitized.
Drilling Rate:10 min/ft.

Viscosity: 48 seconds; Weight: 11.6 lbs/gal.

1065-1070 Limestone 70%, red brown 15%, red purple, 18%, white soft to clay balls 8%, grey mudballs 8%.

Total depth 1076 feet

Deviation survey @ 1040' = 1 1/2 degrees

12/10/99 - 12/15/99

Ream 17 1/2"to 775'.
Set 13 3/8" casing to 731' and cement.
Cone lost off reaming bit. Washed hole to 1075'.
Cone at 1076'.

12/16/99

Begin reaming 12" hole. Well completed as open hole from 731' to 1020. The 7 7/8" rathole is from 1020' to 1076'.

Well shut in pressure, before perforating, on 1/10/00 was 112 psi with unrestricted flow at approximately 110 gpm.

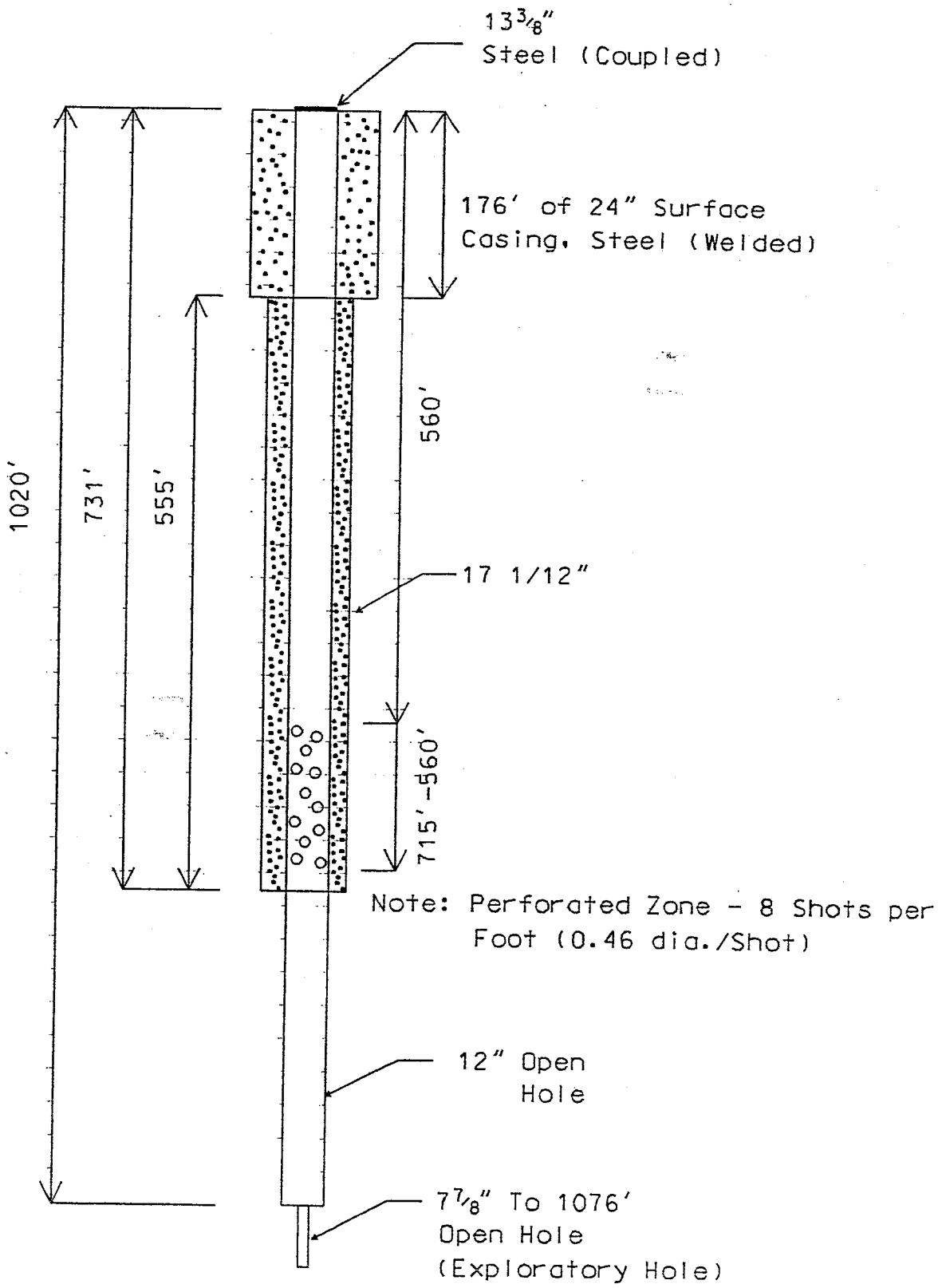
Perforated 13 3/8" casing with 8 shots per foot from 560'-715' to increase production.

1/27/00

Unrestricted flow not measured at the time of this report.

CINIZA REFINERY

COMPLETION DIAGRAM

CINIZA WELL #4

Note: All Elevations From Kelly Bushing